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Information Structure and Coordination in Vegetable Supply Chains

A thesis
submitted in partial fulfilment
of the requirements for the Degree of
Doctor of Philosophy in Agribusiness

at
Lincoln University
by
Mahendra Prasad Khanal

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Abstract

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by

Mahendra Prasad Khanal

The purpose of this study on Nepalese fresh vegetable supply chains is to identify factors that impact on the environment external to these chains, information flows along them, and relationships between actors within them. It identifies the role that information structure plays in chain coordination, and so contributes to the emerging literature on this, while also providing policy insights for the Nepalese government.

A theoretical framework was developed by incorporating principles of coordination theory, transaction cost economics and network theory, to postulate relationships between information structure and coordination in a supply chain. Empirical research on four Nepalese vegetable supply chains was conducted using an embedded multiple case study approach.

It was found that the environment external to the chains had little influence on information structure and chain coordination. Instead, factors internal to the chain were shown to be more important. The results showed that the four chains could be collapsed into two models. The first model exhibited a relatively complete information structure and strong vertical and horizontal coordination. The second model had a relatively asymmetric information structure, along with weak horizontal and vertical coordination. Hence, the completeness of information structure was positively associated with the degree of coordination, both horizontal and vertical.

It was observed that strong horizontal coordination accompanied by complete information structure at the farmers’ level aligns producers in the production and supply of vegetables according to market requirements, assembles vegetables to attract buyers, and disseminates knowledge and experience to increase the efficiency of all members. Similarly, strong vertical
coordination in association with a complete information structure from input suppliers to retailers aligns activities and incentives, leads actors towards achieving the chain goal, and increases efficiency in the delivery of produce.

One insight to emerge is that the observed relationship between information structure and chain coordination result from an underlying factor. This factor was identified as the benefits that chain actors receive or expect to receive from the information they share and the transactions they conduct with other actors. Profits, assurance in buying and selling and strong buyer-supplier relationships are such benefits, which then drive both the completeness of information structure and the degree of coordination, leading to an association between complete information structures and strong coordination and conversely, less complete information structures and weak coordination.

Another insight to emerge is that the completeness of information structure and the degree of coordination in these chains also depends on the role that cooperatives play in sharing information and performing business activities. In particular, the greater is the role of cooperatives in information sharing and in performing business activities, the stronger is the coordination in the chain, and vice versa.

**Keywords**: vegetable supply chain, information structure, horizontal coordination, vertical coordination, embedded multiple case study, benefits, cooperatives
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### Abbreviations

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<tbody>
<tr>
<td>ABPMDD</td>
<td>Agribusiness Promotion and Marketing Development Directorate</td>
</tr>
<tr>
<td>AEC</td>
<td>Agro Enterprise Centre</td>
</tr>
<tr>
<td>AGDP</td>
<td>Agricultural Gross Domestic Product</td>
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<tr>
<td>AICC</td>
<td>Agriculture Information and Communication Centre</td>
</tr>
<tr>
<td>ASC</td>
<td>Agriculture Service Centre</td>
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<tr>
<td>BPR</td>
<td>Business Process Reengineering</td>
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<tr>
<td>CDRC</td>
<td>Community Development Resource Centre</td>
</tr>
<tr>
<td>CPFR</td>
<td>Collaborative Planning Forecasting and Replenishment</td>
</tr>
<tr>
<td>CSCMP</td>
<td>Council of Supply Chain Management Professionals</td>
</tr>
<tr>
<td>DADO</td>
<td>District Agriculture Development Office</td>
</tr>
<tr>
<td>DCO</td>
<td>Division Cooperative Office</td>
</tr>
<tr>
<td>DMMC</td>
<td>District Market Management Committee</td>
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<tr>
<td>DoA</td>
<td>Department of Agriculture</td>
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<tr>
<td>DoC</td>
<td>Department of Cooperatives</td>
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<tr>
<td>ECR</td>
<td>Efficient Consumer Response</td>
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<tr>
<td>EDI</td>
<td>Electronic Data Interchange</td>
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<td>EFT</td>
<td>Electronic Funds Transfer</td>
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<tr>
<td>FM</td>
<td>Frequency Modulation</td>
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<tr>
<td>FNCCI</td>
<td>Federation of Nepalese Chambers of Commerce and Industry</td>
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<tr>
<td>GATT</td>
<td>General Agreement on Tariffs and Trade</td>
</tr>
<tr>
<td>GO</td>
<td>Governmental Organization</td>
</tr>
<tr>
<td>HEC</td>
<td>Human Ethics Committee</td>
</tr>
<tr>
<td>HMGN</td>
<td>His Majesty’s Government of Nepal</td>
</tr>
<tr>
<td>ICT</td>
<td>information and communication technology</td>
</tr>
<tr>
<td>I/NGO</td>
<td>International/Non-governmental Organization</td>
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<tr>
<td>IS</td>
<td>Information Structure</td>
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<tr>
<td>ISM</td>
<td>Institute of Supply Management</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>KFVMDB</td>
<td>Kalimati Fruit and Vegetable Market Development Board</td>
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<tr>
<td>LDO</td>
<td>Local Development Officer</td>
</tr>
<tr>
<td>MMC</td>
<td>Market Management Committee</td>
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<tr>
<td>MoAC</td>
<td>Ministry of Agriculture and Cooperatives</td>
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<tr>
<td>NCDB</td>
<td>National Cooperative Development Board</td>
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<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>SIMI</td>
<td>Nepal Smallholder Irrigation and Market Initiative</td>
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<tr>
<td>QR</td>
<td>Quick Response</td>
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<tr>
<td>RAD</td>
<td>Regional Agricultural Directorate</td>
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<tr>
<td>RD</td>
<td>Regional Director</td>
</tr>
<tr>
<td>RIU</td>
<td>Research into Use</td>
</tr>
<tr>
<td>SADO</td>
<td>Senior Agriculture Development Officer</td>
</tr>
<tr>
<td>SCM</td>
<td>Supply Chain Management</td>
</tr>
<tr>
<td>SFCL</td>
<td>Small Farmers’ Cooperative Limited</td>
</tr>
<tr>
<td>SFDP</td>
<td>Small Farmers’ Development Programme/Project</td>
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<tr>
<td>SMIP</td>
<td>Small Marketing Infrastructure Development Project</td>
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<tr>
<td>TCE</td>
<td>Transaction Cost Economics</td>
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<tr>
<td>TQM</td>
<td>Total Quality Management</td>
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<tr>
<td>VCC</td>
<td>Vegetable Collection Centre</td>
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<tr>
<td>VDC</td>
<td>Village Development Committee</td>
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<tr>
<td>VMI</td>
<td>Vendor Managed Inventory</td>
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<tr>
<td>WTO</td>
<td>World Trade Organization</td>
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Chapter 1
INTRODUCTION

1.1 Background

The agribusiness sector has experienced remarkable changes in its structure worldwide. The changing preferences of consumers, globalization of markets, rapid advances in technologies, and pro-corporate regulations are the major drivers of these changes (Boehlje, Akridge, & Downey, 1995; Dunne, 1999; The University of Queensland, 2001). Such changes have led to a fundamental reorientation of traditional relationships between suppliers and consumers (Thompson, 2001).

A power shift occurred in the business environment during the 1980s and 1990s. Retailers were consolidated and occupied the dominant position previously held by manufacturers in the distribution channel. The consolidation of retailers caused more change and led to a focus on improved logistics systems that could generate more benefits for consumers (Coyle, Bardi, & Langley, 2003). Consumers themselves are now more empowered through higher incomes, better information and communication sources, greater knowledge levels, and availability of food items in diversified and desired forms. Ultimately, these factors cause to change the preferences of consumers (see Figure 1.1).

![Image of factors affecting preferences of fresh produce consumers]

Figure 1.1 Factors affecting preferences of fresh produce consumers

To provide better value to consumers and to increase the effectiveness and efficiency in product delivery and services, actors involved in production and marketing started to work
together utilizing the supply chain concept. The introduction of this chain concept replaces the traditional model of firm versus firm competition with chain versus chain competition (Gifford, Hall, & Ryan, 1998). Suppliers/vendors, manufacturers/producers, distributors, retailers and consumers are all actors in a supply chain that is interconnected in its transportation, information and financial structures (Sahin & Robinson, 2002). As a result, interdependency increases between these actors, particularly for resources and information due to increased pressure created by outsourcing, globalization and rapid innovations in information technologies (Arshinder, Kanda, & Deshmukh, 2011). Increasing interdependence sometimes locks the actors into the chain and may impede them from exploring better opportunities to address the undergoing changes in the markets. To mitigate this risk and to make the right decisions at the right time for the fulfilment of consumer demand, a system is required to be developed inside the chain to disseminate reliable and perfect information about the market situation to all chain actors (Li & Wang, 2007). In the case of agri-food supply chains, the dissemination of information only on the current market situation is insufficient. The actors of these chains require strategic information, such as demand trends, reasons behind demand creation, interest and capacity of competing chains, and production and marketing technologies (Batt, 2006).

Because of the growing attention of consumers towards health and food safety issues, a dramatic increase has been observed in the consumption of fresh produce around the world (Codron, Grunert, Giraud-Heraud, Soler, & Regmi, 2005; Thompson, 2001). This has led to the expansion of global retailers and more institutionalization of fresh produce markets. The demand for fresh produce is widespread and diversified, while the production is diversified but specialized. Therefore, production must be aggregated from several spots, fractionated, and regrouped according to retail segment requirements (Farina & Machado, 2000). However, customers of fresh produce demand consistent quality, varieties of goods in convenience forms, reliable delivery and internationally competitive prices (Batt, 2006). These factors have influenced actors to adopt a consumer focused strategy in the supply chain. To satisfy the needs of consumers, improvements are required in the flow of information and coordination in supply chains (de Moura, 2002).

A summary of factors affecting the coordination between supply chain actors is presented in Figure 1.2. This Figure shows that the coordination between actors is affected by external and internal factors. Factors which are external to the chain are fluctuation in demand and supply situation, nature of goods, and competition in the market. Similarly, internal factors are
maturity of the chain, behaviour of actors, distribution of benefits between these actors, and information flow in the chain.

![Diagram](image)

**Figure 1.2 Factors affecting coordination between supply chain actors**

Unlike manufacturing chains, several primary producers will supply commodities in an agribusiness chain (O'Keefe, 1997). Generally, the involvement of several stakeholders in an agribusiness chain makes it longer than other chains. Because of its perishable nature and the requirement of extra care during transport, storage, and handling, the flow of fresh produce through such a long chain creates complications in the coordination structure. This degree of complexity is greater in developing countries as producers are often unable to manage post harvest requirements of this fresh produce. Thompson (2001) reported that in excess of 25 percent of produce is lost from the farm to the factory in some East Asian nations due to lack of coordination along the chain. There are also concerns about the distribution of benefits that arise from supply chain management (SCM) approaches with observations that the share of benefits is unequally distributed between supply chain actors (Wheatley, Woods, & Setyadjit, 2003). One of the possible reasons for this unequal distribution is that there exists an information gap, which has an impact on relationships between actors (Batt, 2006).

Vertical and horizontal relationships are both important in coordinating agribusiness supply chains. Horizontal coordination is required to create robust interdependent relationships among the large number of small primary producers, which then creates the foundation for the development of effective vertical partnerships between the actors at different levels (O'Keefe, 1997). Smallholders can also be efficient producers of high value crops, such as fruit, vegetables, vegetable seeds, spices, and non timber forest products when supported by strong producer organizations (ANZDEC Limited, ACI, & CMS, 2003; World Bank, 2008). These producer organizations assist smallholders in achieving competitiveness, realizing economies
of scale in market transactions, and gaining market power through a consistent supply of quality produce in required quantity and at the required time.

This review of the agribusiness sector in the current international environment suggests that fluctuations occur in demand and supply of fresh produce due to changing patterns of production, marketing, and consumption. To minimize these fluctuations, actors in fresh produce supply chains may try to coordinate horizontally and vertically, thus synchronizing their production and marketing activities according to market requirements. One of the important factors in strengthening coordination between actors is the flow of information between them (Chambo, 2009; Cheng, 2011). The importance of information flow is arguably higher in fresh produce supply chains; particularly those that have been recently formed, where the actors may be loosely coordinated, and display low levels of trust and commitment. It appears evident that external factors (changes in production, marketing and consumption, and fluctuations in demand and supply) and information flow have an impact on horizontal and vertical coordination, but in-depth study on this phenomenon is lacking. Therefore, interrelationships between external factors, horizontal coordination, vertical coordination, and information flow, need to be better understood, especially in case of fresh produce, such as vegetables, in developing countries like Nepal.

Vegetable crops have been identified as some of the most important high value crops in Nepal (Thapaliya, 2006). Although the production of vegetables has started on a commercial scale by several farmers in the southern plain and middle hill range, many farmers are still in transition from subsistence to commercial. Not surprisingly, the overall vegetable sector has experienced some problems during this transition. These problems are associated with production decisions, information flow, logistics arrangements, the external and internal business environment, and the relationships between supply chain partners.

Despite the occurrence of such transitional problems, remarkable growth has been observed in the cultivated area and production of vegetables in Nepal in the past 30 years (see Figure 1.1). The cultivated area of vegetables doubled, from 96,000 ha in 1979/80 to 235,000 ha in 2009/10. In the same period, annual vegetable production increased by nearly six times and reached 3,003,000 tons in 2009/10 from 528,000 tons in 1979/80 (GON, 2010). The actual vegetable production was well above the projected demand (domestic and export), which was 1,768,000 tons for the year 2009/10. The many-fold increase in production was obtained predominantly from increased yields during that period. The data on area and production
shows that vegetable yield increased from 5.5 tons per hectare in 1979/80 to 12.8 tons per hectare in 2009/10.

![Area and Production of Vegetables in Nepal](image)

**Figure 1.3** Comparison between cultivated area and production of vegetables in Nepal in 1979/80 and 2009/10 (Area in ‘000’ ha. and Production in ‘000’ tons)

Source: GON (2010)

As a result of increasing production, and increasing awareness and purchasing power of consumers, domestic vegetable consumption has increased in Nepal. Republica (2010) reported that per capita annual vegetable consumption reached 105 kg in 2009/10 a significant increase from 60 kg over the past two decades. If this consumption is multiplied by the population of 1990 and 2010, it suggests that total domestic consumption has increased by almost three times.

Notwithstanding this impressive growth of the vegetable sector in Nepal, supply remains fragmented due to the production of vegetables on small pieces of land and unorganized marketing (ANZDEC Limited et al., 2003). The average farm size is 0.80 ha, which is further divided on average into 3.3 parcels (CBS, 2006). This shows that farmers are smallholders and commercial-scale production at individual farm level is not a feature of Nepalese
agriculture. For these reasons, Nepalese farmers are organized into farmers’ groups\(^1\), cooperatives\(^2\) and committees\(^3\) for production and marketing of high value crops, especially vegetables, at commercial scale (GON, 2007).

Prior to the introduction of farmers’ groups or cooperatives, several intermediaries were required between farmers and consumers to assemble and transport produce from production sites to markets. Figure 1.2 shows the vegetable marketing channel that was documented by Kaini and Werner (1998). This channel accommodates several supply chains. In this channel, commission agents, merchants, processors, wholesalers, and retailers are the intermediary agents between farmers and consumers, in the supply of vegetables in fresh or processed form.

![Vegetable marketing channel in Nepal](image)

**Figure 1.4 Vegetable marketing channel in Nepal**

Note: * Often function as collectors who buy from local commission agents

Source: Kaini and Werner (1998)

---

\(^1\) Number of people with common interest comes together to form a group.

\(^2\) A cooperative is an autonomous association of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise (ICA, 2010).

\(^3\) Forming committees is a new concept to consolidate the members of more than one group who are doing similar type of businesses.
Nepalese vegetable supply chains face similar issues to those observed in the international agribusiness environment. Fluctuation occurs in demand and supply due to changes in patterns of production and consumption, and also in the transition in farming from subsistence to commercial. Despite these problems, overall production is increasing at a fast rate. Increasing competition due to the increase in production, and fluctuations in demand and supply, induce actors to strengthen horizontal and vertical coordination in the chain (Thapaliya, 2006). However, due to the variation in chain information structures, (that is, the arrangement and dissemination of information along the chain), transition in farming from subsistence to commercial, and the recent emergence of some new vegetable supply chains, different levels of coordination are observed. Such variations can provide fertile ground for studying why information exchange takes place according to requirements in some chains and why not in others, why the level of coordination is high in some chains and less in others, and how information exchange and coordination are associated with each other.

It is concluded from this discussion that there are key interrelationships between external factors, information structure and chain coordination. Therefore, it is important to focus on these interrelationships to gain greater insight into the association between information structure and coordination in supply chains.

1.2 Research Questions

The linkages between external factors, information structure and coordination in supply chains need to be better understood in the current international environment. In this context, the variation and additional complexities observed in vegetable supply chains in Nepal could yield interesting insights into the relationships between the completeness of information structure and the degree of coordination. The fundamental purpose of this research is, therefore, to identify the underlying factors that impact on the external environment, information flows, and relationships between actors in supply chains, so that the role that information structure plays in coordinating chains can be more fully explored.

In order to attain the purpose of this research, the following specific subsidiary research questions have been posed:

1. What are the attributes of information structures in Nepalese vegetable supply chains?
2. What are the features of horizontal and vertical coordination of vegetable supply chains in Nepal?
3. How do internal and external factors affect information structure and coordination of vegetable supply chains?
4. What is the relationship between information structure and coordination in vegetable supply chains in Nepal?

1.3 Outline of the Study

The study is divided into 10 chapters. Chapter 2 consists of a review of literature. This Chapter considers three relevant theories: coordination theory, transaction cost economics, and network theory followed by a discussion on supply chain management, chain coordination, and information structure. The review of literature provides a base to develop the theoretical framework for this research, which is presented in Chapter 3. In Chapter 4, research methods and design are discussed. A qualitative case study strategy is employed to elicit the role that information structure plays in coordinating vegetable supply chains. The data required for this study were collected from primary and secondary sources in Nepal by conducting fieldwork in four domestic vegetable supply chains, and consulting the actors and agencies associated with these chains. The collected qualitative data are analysed by using the techniques of content analysis. The results derived from the analysis of each individual case are presented in separate chapters; from Chapters 5 to 8. A cross-case analysis and discussion of the results with respect to the literature is presented in Chapter 9. The cross-case analysis consists of a comparison between expected patterns and observed patterns, the development of two models to represent the case results and a discussion of these models, and a higher level synthesis of the analysis. The research is concluded in Chapter 10 by presenting a research summary, contributions, limitations, and suggestions for future research.
Chapter 2
LITERATURE REVIEW

2.1 Introduction

Literature relevant to the research problem and research questions is presented in this chapter. The aim of this review is to identify the research gap, which gives a direction for this research. This review begins by identifying particular theories to discover if the principles of these theories are applicable to this research. This is followed by a discussion on broad aspects of supply chain management. The review is then narrowed to coordination between actors and information structures, which are the key areas of attention. Different aspects of coordination and information structure are discussed in order to detect any associations. This chapter also establishes the context for this research, with a discussion on coordination of vegetable supply chains in Nepal.

2.2 Theoretical Review

For this study of chain coordination and information structure in different structural and behavioural settings, a number of features need to be investigated. These are relationships between different organizations and interdependencies, governance structures, symmetry and asymmetry of information structures and behavioural dimensions of chain actors. Since it is difficult to elicit the principles related to all these facets in a single theory, a review of Coordination Theory, Transaction Cost Economics, and Network Theory has been carried out to provide anchorage for this research.

2.2.1 Coordination Theory

Coordination theory is defined as a body of principles about how the activities of separate actors can be coordinated (Malone, 1988). According to this theory, actors in organizations face coordination problems that arise from interdependencies. Such interdependencies may be inherent in the structure of the coordination problem or may be the result of the disintegration of goals into tasks, and during the assignment of these tasks and resources to the actors (Crowston, 1997). So, attention is paid to the following activities in order to achieve the goals:

- Subdividing overall goals into tasks
- Assigning the tasks to groups or individual actors.
• Allocation of resources to different actors.
• Sharing of information between different actors to help achieve the overall goals.
• Combination of different knowledge and conflicting preferences of different actors to arrive at overall goals (Malone, 1988).

Coordination is the subject matter for research in wide range of disciplines, such as economics, computer science, sociology, psychology, linguistics, organization theory, operations research and management science (Malone & Crowston, 1994). Coordination is the act of managing interdependencies between activities performed to achieve a goal (Malone & Crowston, 1990). According to this definition, a set of two or more interdependent actors, who performs their assigned tasks, are required to be coordinated in order to achieve the goal (Malone, 1988). The tasks, which are assigned to interdependent parties, can be divided into two categories: coordination tasks and production tasks. Coordination tasks are information processing activities undertaken between the parties and production tasks are all other activities, generally undertaken independently, in order to produce outputs.

A coordination mechanism provides necessary tools to manage interdependencies between different people, entities and processes in a supply chain to produce desirable outputs (Xu & Beamon, 2006). A coordination mechanism consists of: an information structure (how members perceive and communicate information) and a decision function (how members decide what actions to take based on the information they receive) (Malone, 1987).

Information structure requires processed information in ready to use form. Information processing maintains the ability to overcome coordination problems that have occurred due to inter-organizational interdependencies. Information processing includes the gathering of data, the transformation of data into information, and the communication and storage of information in the organization (Egelhoff, 1991). The dissemination of processed information facilitates making appropriate decisions to reduce the effects of uncertainty arising from the differences between the amount of information required to perform the task and the amount of information already possessed by the organization.

Although coordination theory suggests various coordination mechanisms, such as incentive alignment, trust, commitment, and transparency to manage different types of interdependencies, there are weaknesses in this theory. Malone and Crowston (1994) termed it as an emerging theory and hoped to refine it by various studies. De Moura (2002) mentioned that the organization of firms into a vertical structure, such as chain, is not the specific focus
of coordination theory. Kaipia (2007) stated that operations management research does not consider this field to be a fully developed theory. Similarly, Xu and Beamon (2006) said that coordination theory does not generally provide guidance for selecting coordination mechanisms, nor does it consider the operating environment of the organization. Therefore, while useful, coordination theory alone is unable to provide a complete framework for current research, which is undertaken in chains with different governance structures (network, hierarchy, or market), diversified behavioural settings, and different operational environments.

2.2.2 Transaction Cost Economics

Another theory that can provide insight into the research problem is transaction cost economics (TCE). The theory behind TCE is as follows. Every business enterprise wants to maximise its profits. One way to do this is to reduce the costs. The total costs of goods and services can be divided into production costs and transaction costs. Production costs are the costs incurred during the transformation of inputs into outputs, while transaction costs are the costs of exchanging goods and services. Williamson (1979) stated that transaction costs are central to the study of economics. He identifies the critical dimensions for characterizing transactions, describes the main governance structures of transactions and indicates how and why transactions can be matched with institutions.

Transaction costs arise in all forms of economic organization, i.e. within a vertically integrated firm, in a market or in a command economy (Hobbs, 1996). Transaction costs are basically coordination costs, which can be categorised into information costs, negotiation costs and monitoring costs (Hobbs, 1996). Based on the original idea of Coase (1937), which stated that the use of market mechanism incurred costs, intensive research on transaction costs was carried out in 1970s and a number of theories emerged. Among them, TCE is important for this research as it relates to cost reduction strategies, an aspect for satisfying customers. According to Williamson (1979), TCE is an interdisciplinary undertaking that joins economics with aspects of organization theory and overlaps extensively with contract law.

There are two basic assumptions in TCE: bounded rationality and opportunism. Bounded rationality refers to the fact that people have limited memories and limited cognitive processing power. Due to this limitation of human beings, managers may not be able to take rational decisions all the times. It is difficult to assimilate all information that are available and then to accurately work out the consequences of such information. Opportunism, as defined by Williamson (1985), is self-interest seeking with guile. It recognizes that businesses
and individuals will sometimes seek to exploit a situation to their own advantage (Hobbs, 1996). Opportunism refers to the incomplete or distorted disclosure of information, especially to calculated efforts to mislead, distort, disguise, obfuscate, or otherwise confuse. It is responsible for real or contrived conditions of information asymmetry (Williamson, 1985).

Uncertainty, frequency of exchange, and the degree to which investments are transaction-specific (asset specificity) are the principal dimensions for describing transactions (Williamson, 1979). These three variables will determine whether the transaction costs will be lowest in a market or in a hierarchy. Similarly, these variables can dictate whether to vertically integrate or not. Uncertainty creates decision problems and causes bounded rationality. Transactions under uncertainty increase costs in a hierarchy, but have little effect in spot markets. Uncertainty may arise due to information asymmetries in the chain. Frequency of exchange is related to vertical integration. An increase in frequency of exchange stimulates vertical integration and vice versa. High frequency of exchange in vertically integrated firms reduces transaction costs. High asset specificity favours vertical integration. Transaction costs are likely to be lower in a hierarchy than in a market when there is high asset specificity.

Information exchange has a vital role in increasing or decreasing transaction costs. Lack of complete information increases uncertainty in all forms of contracts whether they are classical, neoclassical or relational (Macneil, 1978; Paulin, Perrien, & Ferguson, 1997). The classical contract refers to the exchange as being transactional and separate from all past and future relations. The neo-classical contract, on the other hand, is somewhat more relational in nature, and introduces the notion of long-term contractual relations with specific planning and the need for flexibility. However, the structure of both of these contracts is the same and is focussed more on transactions than personal relations. Relational contracts are different to transactional contracts and are characterized by personal relationships, relatively deep and extensive communications, and significant elements of noneconomic personal satisfaction (Williamson, 1979).

As described earlier, opportunism causes asymmetric information to flow in a chain. Therefore, it is necessary to understand the behavioural dimensions of parties in a chain or network to better appreciate how information exchange impacts on coordination. Such behavioural dimensions of network members are described in Network Theory, which is now reviewed.
2.2.3 Network Theory

Production and marketing of goods and services is not possible through the efforts of one firm only. It also relies on the activities and performance of other firms. This reliance is also on the expertise and competence of the firms which are linked with it. Hence, the firm should either make or give resources to other firms, to attain success in business ventures (Batt & Purchase, 2004). The firms which are interlinked with each other develop a relationship network. Håkansson and Ford (2002) define a network as a structure where a number of nodes are related to each other by specific threads. In a complex business market, business units are the nodes and the relationships between them are the threads. Wilkinson (2001) defines business networks as the interdependent systems of organizations and relations that are involved in carrying out all the production and marketing activities involved in creating and delivering value in the form of products and services to consumers. In particular, the network is a source of information, resources, markets and technologies for the firm (Gadde, Huemer, & Håkansson, 2003).

The network relationship depends on economic and social dimensions. The true benefits of a network organization are obtained only when one recognizes the unique managerial and economic benefits that emerge when the network is conceived as a mini-society of interdependent, reciprocal exchange relationships characterized by restraint of power, commitment, trust, solidarity, mutuality, flexibility, role integrity, and harmonization of conflicts (Achrol, 1997). The flow of information is vital to enhance relationships and to strengthen the economic and social ties among the network parties. It also helps the other elements of the networks to function properly. Networks also have a potential dark side and may lock firms into unproductive relationships or preclude partnering with other viable firms (Gulati, Nohria, & Zaheer, 2000).

Achrol (1997) defines four types of organizational networks. They are internal market networks (a firm organized into internal enterprise units that eliminates hierarchical relationships among them), vertical market networks (functional alliance organized around a focal organization), inter-market or concentric networks (institutionalized affiliations among firms characterized by dense interconnections in resource sharing, strategic decision making, culture and identity, and periodic patterns of collective action), and opportunity networks (set of firms specializing in various products, technologies, or services forming temporary alignments around particular projects or problems). The interconnections in agribusiness supply chains resemble inter-market or concentric networks.
It is also argued that a supply chain network is not always linear (Li, Yang, Sun, Ji, & Feng, 2010). Since a supply chain network is formed from a complex interconnection of multiple numbers of autonomous or semiautonomous suppliers, manufacturers, assemblers, distributors, and retailers, it is viewed as a complex adaptive system (Li et al., 2010; Pathak, Day, Nair, Sawaya, & Kristal, 2007). Hearnshaw and Wilson (2012) reported that the structure of efficient supply chains follows a ‘scale-free’ network that is, a network in which some hubs have a seemingly unlimited number of links.

Network theory is opposed to the idea of vertical integration. Achrol (1997) stated that to be successful in present day complex and turbulent markets, organizations should become lean and more specialized, rather than large and vertically integrated. Also, they should become a part of a large network of close-knit alliances and partnerships with other organizations specializing in related technologies and functions. Since the actors in a business network share risks, responsibilities and rewards on an equity, commitment and trust basis (Bititci, Martinez, Albores, & Parung, 2004), the network relationship is highly influenced by their behaviour. Collaborative behaviour increases equity, commitment and trust, while opportunistic behaviour decreases them.

In summary, the theoretical review of the principles of these three theories gives an overview of the broad area of information structures, interdependencies and coordination, governance structures, behaviour of chain actors. To know how these theories may apply in the field of supply chain management, and more specifically, on the contribution of information flow to coordination between actors, previous research undertaken on these topics and their contribution are reviewed in the next sections.

### 2.3 The Supply Chain Concept

The deregulation of transport, communication, energy and financial sectors; the technology revolution; and global sourcing of materials and suppliers during the 1980s favoured the growth of companies working in the production and distribution sector (Coyle et al., 2003). The increasing number of companies working in these sectors created an environment of competition and forced these companies to become more specialized and efficient in offering goods and services (Lummus & Vokurka, 1999). To thrive under such competition, companies of similar nature started giving high emphasis to customer satisfaction while delivering goods and services. The emphasis given to customer satisfaction shifted power from manufacturers/service providers to customers (Coyle et al., 2003). Here, customer satisfaction refers to meeting, and preferably exceeding, customers’ expectation on
availability, reliability and prices of goods and services; time and frequency of supply; availability of information; and loss and damage (Waters, 2009).

Due to competition between producers/manufacturers, production and delivery of goods and services became increasingly difficult for them to achieve without linking their firms closely with suppliers and distributors. This difficulty led to the emergence of the concept of a supply chain (Beamon, 1999). The term “supply chain” encompasses every effort involved in producing and delivering a final product or service, from the supplier’s supplier to the customer’s customer (Supply Chain Council, 1996). This is a very concise definition of a supply chain. Therefore, further definitions, which encompass various aspects of a supply chain, are presented below.

A supply chain has been conceptualized as a process which integrates, coordinates and controls the movement of goods, materials and information from a supplier through a series of customers to the final consumer (Emmett, 2008). The essential point with a supply chain is that it links all the activities between suppliers and end consumers in a timely manner, and bridges the gap between the fundamental core business aspects of supply and demand. Min and Zhou (2002) define a supply chain as an integrated system, which synchronizes a series of inter-related business processes in order to:

- acquire raw materials and parts,
- transform these raw materials and parts into finished products,
- add value to these products,
- distribute and promote these products to either retailers or customers, and
- facilitate information exchange among various business entities (e.g. suppliers, manufacturers, distributors, third-party logistics providers, and retailers).

Hence, there is involvement of various organizations in a supply chain and the performance of this supply chain is influenced to a greater or lesser degree by the actions of all these organizations (Giannakis, Croom, & Slack, 2004). The actions of these organizations also affect the attainment of chain objectives. The main objective of a supply chain is to enhance operational efficiency, profitability and the competitive position of a firm, which delivers goods and services, and its supply chain partners (Min & Zhou, 2002). To achieve a maximum level of efficiency and effectiveness, material flows, money flows and information flows throughout the entire supply chain must be managed in an integrated and holistic manner (Sweeney, 2009). From these discussions, it can be concluded that the flow of
materials, money and information takes place along the chain in such a way that these flows provide maximum satisfaction to end customers and realize benefits to all supply chain actors.

The formation of a chain, involvement of actors and the activities carried out by them vary according to the nature of goods or services that flows across the chain. As a result, the nature of fresh produce supply chains is discussed in next section.

2.3.1 Fresh Produce Supply Chains

Much discussion of the supply chain concept has occurred in the context of the manufacturing sector (Beamon, 1999; Burgess, Singh, & Koroglu, 2006). However, this concept has been adapted, and is gaining popularity in the grocery industry since the early 1990s (Lummus & Vokurka, 1999). A major component of the grocery industry is occupied by fresh agricultural produce, like fruit, vegetables, milk, meat and fish. The adoption of this concept in the grocery sector brings several changes in the production and delivery of fresh agricultural produce and services associated with it.

The changing demand of consumers, increased capacity of producers and the development of the food industry and services, creates competition in food markets, and this competition leads the development of fresh produce supply chains (Boehlje, Hofing, & Schroeder, 1999). The demand for fruit, vegetables, milk, meat and fish has gone up due to the increase in per capita income of consumers (da Silva & Baker, 2009; Wilkinson & Rocha, 2009). To respond to the demand of consumers, producers have increased their capacity by adopting modern production technologies and gaining access to domestic and global markets. This technology adoption and market access helps farmers to utilize the efficiency of their land, machinery, infrastructure and human capital to reduce their production and marketing costs. The increasing demand for processed and ready-to-eat foods favours the development of processing industries, packaging industries, and warehouse, power, and transport sectors (Boehlje et al., 1999).

There are some special characteristics of fresh produce, which place pressure on the flow of produce from one actor to another. Fresh produce is consumed as food, and is often perishable in nature. Due to this reason, food safety and quality concerns are adhered to in their production and delivery (Norina, 2004). The bulk of fresh produce is also supplied to markets as unprocessed commodities. Since the production of much fresh produce is seasonal, their prices are volatile in the markets (O'Keefe, 1997). Fresh produce is also required to be transported and stored in controlled environmental conditions. In addition, special attention is
required in packaging and handling to protect them from quality deterioration; that is, cool chains requiring specialist equipment and expense (Batt, 2006).

Fresh produce supply chains can be divided into two groups (Cadilhon, Andrew, Moustier, & Poole, 2003; Cadilhon, Moustier, Poole, Tam, & Fearne, 2006). In the context of Asian countries, the first and dominating one is the traditional wet markets, retail outlets and moving retailers. The second and rapidly growing one is the supermarkets, department stores and hypermarkets. Actors pay less attention to food safety and product quality in the first type of the chain, but food safety and product quality are highly prioritized before handing over the produce to consumers in the second type of the chain.

The supermarket chain not only focuses on the issues related to food safety and product quality, but also adopts strategies, such as quick response (QR), efficient consumer response (ECR), and collaborative planning forecasting and replenishment (CPFR) to increase efficiency in providing better value to consumers (Sparks & Wagner, 2003). Quick response is a partnership strategy in which suppliers and retailers work together to respond more rapidly to the consumer by sharing point-of-sale scan data, enabling both to forecast replenishment needs. Efficient consumer response deals with the replenishment of goods at retail outlets on the basis of consumer demand and point of sale information. In CPFR, actors collaborate for business planning, sales forecasting, and all operations required to replenish raw materials and finished goods.

The structure of fresh produce supply chains is different from that of other chains. In fresh produce supply chains, there are several producers. The best way to consolidate them in the chain is the formation of some type of producer group, such as a cooperative (Batt, 2006). Such cooperatives can help in arranging production inputs as well as marketing produce. Marketing of the inputs and outputs through cooperatives also helps in reducing the number of tiers between input suppliers and consumers. The number of tiers in chains without producer groups becomes more, due to the involvement of different types of buyers from assembling to retailing of the produce (Poudyal, 2006).

This discussion informs us that the increasing competition between firms and the changing demand of consumers inspires actors to form fresh produce supply chains. The formation of chains changes the nature of competition and it becomes chain versus chain rather than firm versus firm. In such a situation, fulfilling the goal of satisfying consumers and benefitting chain members largely depends on the management of these chains.
2.3.2 Supply Chain Management

The formation of a supply chain brings different organizations together to achieve a common goal. The achievement of this goal depends on Supply Chain Management (SCM) which is basically the intra- and inter-organizational management of purchasing, manufacturing or processing and logistics functions of the supply chain (Burgess et al., 2006). These functions are the prerequisites for the efficient flow of materials, money and information along the chain and coordination between actors.

2.3.2.1 Concept and Definition

Competition between firms has increased and this competition make it difficult for them to work in isolation, particularly after the inception of the General Agreement on Tariffs and Trade (GATT) in 1947 and the replacement of it by the World Trade Organization (WTO) in 1995. However, the concept of managing the supply of goods was advocated long before this (Batt, 2006). The formation of the Institute of Supply Management (ISM) in 1915 with a mission to educate, develop and advance the purchasing and supply management profession is considered by some authors to be the beginning of SCM (Larson & Halldorsson, 2002). The term SCM was introduced by consultants in the early 1980s (Oliver & Webber, 1982). Since then, it is a topic of considerable interest among supply chain practitioners and academicians (Larson & Halldorsson, 2002).

The traditional view of SCM is to leverage the supply chain to achieve the lowest initial purchase prices while assuring supply. This view has been refined and updated in the changed global context. Under the new paradigm, SCM is redefined as a process for designing, developing, optimizing and managing the internal and external components of the supply system, including material supply, transforming materials and distributing finished products or services to customers, that is consistent with overall objectives and strategies (Spekman, Kamauff, & Myhr, 1998). Svensson (2007) defines SCM as a business philosophy that strives to integrate the dependent activities, actors, and resources between the different levels of the points of origin and consumption in channels. A relatively short but comprehensive definition of SCM given by the Global Supply Chain Forum (1996), as cited in Lambert (2008, p. 2) is presented below:

“Supply Chain Management is the integration of key business processes from end-user through original suppliers that provides products, services, and information that add value for customers and other stakeholders.”
A more precise definition of SCM has been given by the Council of Supply Chain Management Professionals (CSCMP). According to CSCMP (2008), SCM encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies.

It can be concluded from this discussion that considerable refinement has been made to the traditional view of SCM to fit it into the changed global context. Still, various authors define SCM in various ways. From their definitions, a common idea emerges that SCM aligns all organizations from input supply to delivery of final products to end customers to enable the efficient flow of materials, money and information. The concept is further elaborated through the discussion on objectives and principles of SCM.

2.3.2.2 Objectives of Supply Chain Management

To attain a common goal, every supply chain develops certain objectives and performs its functions to fulfil them. The specific objectives may differ according to the nature of supply chains but they can be categorized into three broad groups (Tan, 2001)

A. To create value for customer satisfaction: The ability of individual firms to create value (the competitive advantage of the individual supply chain) and the ability of firms to coordinate their value creation activities (the efficiency of the value stream) are enhanced through the alignment between firms in a supply chain (Dunne, 2001). Value creation, which is required to be started from the very beginning stage of the chain, is fundamental to competing in the global markets and satisfying customers. Satisfying end customers is necessary to succeed in competition as they are the ultimate source of money for supply chains (Fawcett, Ellram, & Ogden, 2007).

B. To increase productivity, market share and profits to all supply chain partners: The alignment between supply chain partners not only creates value but also helps to increase the volume of production by making production inputs available at the required time and utilizing all the resources across the chain. The increase in production and value creation helps the chain to attract customers to its products and influence the market. To maintain the influence of a supply chain, it improves logistics operations, lowers material costs, improves manufacturing methods or some combination (Fawcett, Ellram, et al., 2007). From these activities, the chain develops efficiency in production and marketing, and increases market
share\(^4\) as well as profits to all supply chain partners, including the end customers (Lambert & Cooper, 2000).

**C. To reduce risks:** Another important reason for aligning different firms into a supply chain is to mitigate the risks observed in the process from receiving inputs to delivery of final products. Risk is the likelihood of the occurrence of an undesirable event or the negative implications of such event (Tang & Tomlin, 2008). Tang and Tomlin (2008) discussed six major types of supply chain risks, which are related to supply, process, demand, intellectual property, actors’ behaviour and socio-political situation. The likelihood of an undesirable event in a supply chain can be reduced either by following risk avoidance mechanisms (Lee & Wolfe, 2003) or by adopting Total Quality Management (TQM)\(^5\) principles (Carter, Smeltzer, & Narasimhan, 1998; Kanji & Wong, 1999). Another way of reducing the negative implications of an event is to adopt “Triple A” principles (Lee, 2004). The “Triple A” principle suggests that a supply chain needs to be agile (quickly respond the short term changes in the market), adaptable (adjust the design to accommodate market changes) and aligned (develop common interest of all participating firms).

### 2.3.2.3 Principles of Supply Chain Management

Given the above objectives of SCM, a set of principles have emerged that can guide firms which are associated with a supply chain. Such principles provide direction for chain participants and service providers in performing their functions. These prescriptive principles are outlined as follows.

**A. Know the customer requirements:** A clear understanding of customer requirements is necessary to construct a supply chain. Customer requirements can be identified simply by using the classical market research techniques, like interviewing customers, collecting transaction records from the markets, maintaining these data in the records and analysing them (Muckstadt, Murray, Rappold, & Collins, \(n.d.\)). The fulfilment of customer requirements can be done from the delivery of products in the marketplace through logistics synchronisation, which is a coordination arrangement that promotes improvement initiatives in creating value during the acquisition, consumption and disposition of products and services (Simatupang, Wright, & Sridharan, 2002).

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\(^4\) The portion of the overall market demand for a specific product or service which is provided by any single provider (CSCMP, 2008).

\(^5\) A holistic and integrated approach that emphasizes on continuous quality improvement of goods and services to achieve business excellence (Kanji & Wong, 1999).
B. Prepare production plans considering the market demand: The requirement of customers and the size of market gives an idea that how much of which materials to produce. Knowledge of the type and quantity requirement of goods or services and the markets for those goods or services helps actors to prepare a demand-based plan (Anderson, Britt, & Favre, 2007). This type of plan ensures the delivery of the right product at the right time in the right amount (Beamon, 1998). For the efficient and effective implementation of this plan, actors pay attention to capital requirements, input availability, labour charge, production infrastructure and logistics\(^6\) arrangements (Memedovic et al., 2008; Singh, 2002).

C. Adopt lean or agile philosophies: A supply chain is formed by involving different organizations which perform different functions in the course of supplying inputs to delivery of final products to end customers. The involvement of various organizations increases the chance of making supply chain long and complex. Such long and complex chains are often slow to respond to changes required to satisfy consumers and benefit chain actors (Tang & Tomlin, 2008). Therefore, it is necessary to increase the efficiency of supply chain by eliminating the waste of time and other resources and enhancing the flow between suppliers to end users (Emmett, 2008). A supply chain can increase its efficiency by adopting a lean or agile philosophy. Leanness, which is related to reducing all types of waste, is adopted where demand is stable, and agility, which is related to using market knowledge to quickly exploit profitable opportunities, is adopted where demand is volatile (Bhasin & Burcher, 2006; Christopher & Towill, 2001; Mason-Jones, Naylor, & Towill, 2000).

D. Develop a supply chain information network: Information flow facilitates the other functions of a supply chain, such as processing orders, tracking and tracing progress and providing suggestions and feedback timely to improve production and delivery mechanism. Information flow needs to be extended from supply chain actors to external service providers, such as transport agencies and warehouse operators (Lambert & Cooper, 2000) to make the overall supply chain performance efficient and effective. The information network of chain actors and external agencies facilitates the exchange of real-time information, such as data, technology, know-how, designs, specifications, samples, client lists, prices, customer profiles, sales forecasts, and order history (Min & Zhou, 2002). The use of Information Technology (IT) ensures the seamless flow of information and fast exchange of data (Schoenfeldt, 2008).

E. Integrate business processes: Supply chain business processes are the activities that produce a specific output of value to the customer (Lambert, Cooper, & Pagh, 1998). The

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\(^6\) Logistics commonly refers to organising and coordinating the movements of material inputs, final goods and their distribution (Memedovic, Ojala, Rodrigue, & Naula, 2008).
integration of these activities within the firm and across the network of firms that comprise the supply chain is required for successful SCM (Lambert, 2008). The integration of interrelated functions of the network of firms (cross-functional teams) helps to enhance the capabilities of these firms (Muckstadt et al., n.d.) and contribute to enhance efficiency, control, responsiveness and product value-adding by the supply chain (de Moura, 2002).

F. Develop or adopt appropriate technologies: Continuous improvement in supply chain business processes is an approach that is adopted to satisfy customers of the products. Sometimes, continuous improvement may not be sufficient to address customer requirements. In this case, rethinking and radical redesigning of business processes (Business process reengineering) is undertaken (Anderson et al., 2007; Waters, 2009). In business process reengineering (BPR), existing technology is replaced by a new one to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed. For performance improvements supply chain actors either use computer software packages developed by themselves according to their need or use already developed internet based and computer assisted technologies, such as Efficient Consumer Response (ECR), Electronic Data Interchange (EDI), e-procurement, and Electronic Funds Transfer (EFT) (Emmett, 2008; Lancioni, Schau, & Smith, 2003). The use of these technologies is becoming essential to remain competitive in markets (Lancioni et al., 2003; Patterson, Grimm, & Corsi, 2003).

In summary, it can be said that a supply chain links organizations from suppliers’ suppliers to customers’ customers, and supply chain management aligns these organizations to improve materials, information and money flow in the chain. To improve these flows, the actors associated with the chain need to make their functions more effective and efficient. The actors get basic prescriptions for making their functions effective and efficient from SCM objectives and principles. How these functions lead the organizations towards the attainment of a common goal comes under the scope of supply chain coordination which is described in next section.

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7 Connects operations in the supply chain, so that materials are pulled through tiers of suppliers (Waters, 2009).
8 Uses standard formats to allow remote computers to exchange data without going through any intermediaries (Waters, 2009).
9 Acquiring products using the internet (Waters, 2009).
10 Automatically transfers money between bank accounts (Waters, 2009).
2.4 Chain Coordination

Coordination is an effort or measure designed to encourage players within a market system act in a common or complementary way or toward a common goal (Poulton et al., 2004). In the supply chain context, coordination can be viewed as an act of properly combining (relating, harmonising, adjusting, aligning) a number of objects (actions, objectives, decisions, information, knowledge, funds) for the achievement of the chain goal (Simatupang et al., 2002). Within a supply chain, coordination is a strategic response to the problems that arise from inter-organizational dependencies (Xu & Beamon, 2006). Thus, coordination resolves the problem created by the underperformance of interdependent organizations. In essence, supply chain coordination develops and improves linkages or relationships among the members in order to optimize total system performance. On the basis of linkages or relationships, coordination between the members of a supply chain can be described vertically and horizontally.

2.4.1 Vertical Coordination

Vertical coordination refers to the means by which products move through the supply chain from production to consumption (Hobbs & Young, 2000). It is the coordination between actors at different tiers of a supply chain. The price, quantity, quality and terms of exchange are the factors which affect this type of coordination across the chain (Sporleder, 1992). It encompasses a continuum from spot market transactions (loose coordination) in the one end to the vertical integration (tight coordination) in another end (Hobbs & Young, 2000; Peterson & Wysocki, 1998). Specification contracts, strategic alliances and formal cooperation are the intermediate forms between the two ends of the continuum (Peterson & Wysocki, 1998). It has been argued that, the combination of a demand for products of high quality and safety standards and the problems which firms face in supplying such products to processors and traders has led to the growth of vertical coordination in supply chains (Swinnen, 2007).

2.4.2 Horizontal Coordination

Horizontal coordination refers to the coordination between players at a given tier of a marketing chain (Poulton & Lyne, 2009). Conceptually, horizontal coordination can be observed at any stage of the chain, but previous researchers have observed it mainly at the producers’ level in agribusiness supply chains (Poulton & Lyne, 2009). It can range from informal agreements between farmers, to groups that are formally constituted to facilitate collective action (like farmers’ associations) and ultimately to groups that elect or hire managers (like farmers’ cooperatives and investor-owned companies) (Lyne & Martin, 2008).
For successful horizontal coordination in agribusiness supply chains, the group of producer farmers should have a clearly defined purpose, clearly identified sources of competitive advantage, achievable objectives, strong leadership coupled with collective ownership, clear communication, and a cooperative culture (Collins & Dunne, 1996; Murray-Prior, Ducie, Burnside, & Flanagan, 1998).

### 2.4.3 Factors Affecting Chain Coordination

Different factors affect the vertical and horizontal coordination between supply chain actors. A short description of these factors is presented below.

#### 2.4.3.1 Compatible or Common Goal

The entities, such as input suppliers, manufacturers/producers, distributors and retailers, which were working independently before being involved into the supply chain might have separate goals. These goals are required to be compatible to get the same performance outcomes when these entities are involved in the supply chain (Batt, 2006). In the course of working together, these entities are required to modify their goals to form a common goal as the supply chain creates an extended organization (Tan, 2001). Since customers’ expectations are rising and specifications of the goods or services they demand are becoming tighter (de Moura, 2002; Supply Chain Council, 1996), the main challenge of supply chain management is to keep independent players intact to work together as a whole to pursue the common goal of satisfying customers (Simatupang et al., 2002).

#### 2.4.3.2 Efficiency of Chain Actors

Efficiency of chain actors is related to improving the performance of the whole supply chain (Lee, Padmanabhan, & Whang, 1997). Chain actors learn from one another when they work together in the chain. Working together provides opportunity for chain actors to combine fragmented skills and improve the efficiency by acquiring new skills in performing functions, developing trust and commitment between one another, increasing the knowledge about market opportunities, and increasing confidence for further innovation of performance improvement (Simatupang et al., 2002). The improvement in chain efficiency contributes to strengthening the coordination between actors through better flow scheduling and resource use, increasing quality control, and reducing risks (Boehlje, 1999).

#### 2.4.3.3 Incentive Alignment

A supply chain performs well only when the costs, risks and benefits of doing the business are distributed fairly across its members (Narayanan & Raman, 2004). The process of sharing costs, risks and benefits between supply chain members is called incentive alignment.
(Simatupang & Sridharan, 2002). The strength of coordination depends on how fairly the incentive is aligned among chain members. The contribution of incentive alignment to the performance of a supply chain can be judged from compensation fairness and self enforcement. Compensation fairness is the motivation among chain members to share equitably the costs, risks and benefits; and self enforcement is the alignment of individual decisions of chain members towards achieving the overall goal of the supply chain (Simatupang & Sridharan, 2008). Periodic reassessment of incentives and their alignment is necessary as changes in technology and business conditions alter the situation of incentives (Narayanan & Raman, 2004). This can be done by improving the contract made, increasing information exchange and developing trust between chain members (Norrman, 2008).

2.4.3.4 Information Flow
The information that flows across the chain is an enabler if it is shared in transparent manner to supply chain partners and increases their knowledge level, but an inhibitor if it is unable to do so (Storey, Emberson, Godsell, & Harrison, 2006). The exchange of timely information triggers the material flow and money flow in a supply chain (Sweeney, 2009), develops trust and commitment between chain members (Claro, 2004), improves the inter-organizational relationships as well as the efficiency and effectiveness of chain members (Cheng, 2011), and responds to the changing needs of customers more quickly (Li & Lin, 2006). Finally, the outcomes of the timely flow of information are observed in the form of reduced transaction costs of the goods and services and increased competitive advantage of the supply chain as a whole (Cheng, 2011; Li & Lin, 2006).

2.4.3.5 Behaviour of Chain Actors
The alignment of incentives also influences the behaviour of individual chain members (Simatupang & Sridharan, 2002). The behaviour of chain members can be cooperative or opportunistic. The cooperative behaviour of members improves chain performance but opportunistic behaviour causes it to deteriorate (Storey et al., 2006). The cooperative behaviour of chain members also facilitates the physical flow and information flow in the chain (Cigolini, Cozzi, & Perona, 2004). The efficient and effective flow of materials and information in the chain avoids opportunistic behaviour, aligns goals and objectives of chain members and develops a win-win relation between them (Storey et al., 2006). These activities arouse willingness in actors to share information and enable them to develop strategies towards attaining the chain goal. The increased willingness to share information, and enhanced ability to develop strategies, coordinates chain members and so makes the supply chain a competitive force for a business (Lummus & Vokurka, 1999).
2.4.3.6 Chain Structure and External Environment

Supply chain structure deals with the network of firms, and the relationship between them, which are involved in production and delivery of goods or services from the source to consumers (Choi, Dooley, & Rungtusanatham, 2001). Stock, Greis and Kasarda (2000) define supply chain structure in two constructs: geographic dispersion (locations of the suppliers, production facilities, distributors, and customers in the supply chain) and governance structure (network, hierarchy, or market). Thus, the supply chain structure constitutes the number of stages in the chain, number of actors in every stage of the chain, role assigned to these actors and their performance, and the mechanism developed for the delivery of goods and services and receiving feedback.

The internal structure of the supply chain is affected by the external environment in performing its functions. The external environmental factors for agribusiness supply chains are: socio-economic and political factors, and agro-climatic and ecological factors (Batt, 2006), and these factors change the business environment (Yawson & Aguiar, 2006). The structure of supply chain and the external environment affect the coordination between actors. The coordination between these actors is aggravated when demand and supply situation fluctuates due to changes in the external environment (Petrovic, 2001). A study carried out on the relationship between the supply chain structure and external environment showed that the greater the number of firms involved in the chain, the higher the impact of the external environment on chain performance, due to the difficulty in coordination between actors (Sun & Collins, 2009).

2.4.3.7 Level of Interdependency

The actors in a supply chain are interdependent with respect to resource availability and flow, task scheduling and synchronisation, technological 'know-how', and production and customer information (Bankvall, Bygballe, Dubois, & Jahre, 2010; de Moura, 2002). Thompson (1967) describes three types of interdependencies in organizations. They are pooled (each part renders a discrete contribution to the whole and each is supported by the whole), sequential (one entity cannot start producing its output until it has received the output of the other) and reciprocal (output is produced via a collaboration of all entities). Among the three, mainly sequential interdependence coordinates actors in performing supply chain activities (Dubois, Hulthén, & Pedersen, 2004). The degree of interdependence may also vary in different dyads of the same chain (Cheng, 2011). When the degree of interdependence increases between actors, the level of trust, commitment and satisfaction goes up and the occurrence of conflict drops down (Cheng, 2011; Johnson & Sohi, 2001). There are also the cases of asymmetric
interdependence in some dyads in which one actor is highly dependent on another, but the other has low dependence. In this case, the less dependent firm can behave selfishly and pressure the other firm for more benefits (Heide, 1994).

It can be concluded from the discussion that the extent of supply chain coordination is the combined effect of all these factors. Among these factors, the structure of the supply chain, its outside environment, and actors’ behaviour vary according to the goods or services that the chain delivers. In such cases, the intensity of the effect of individual factors on coordination may vary from one chain to another. In order to narrow down the remainder of this literature review, it is necessary to establish the context for this study. Therefore, how these factors might affect the coordination of vegetable supply chains in Nepal is discussed in next section.

### 2.4.4 Coordination of Vegetable Supply Chains in Nepal

The vegetable sub-sector is one of the fastest growing agricultural sectors in Nepal. The share of this sector in Agricultural Gross Domestic Product (AGDP) is increasing (see Figure 2.1). Figure 2.1 compares the proportion of six different sectors (cereals and other crops, vegetables and nursery, fruit and spices, domestic animals and dairy, other animal farming,
and forestry) in the AGDP. The share of vegetables reached 13.53 percent in 2009/10 from 9.71 percent in 2001/02 (ABPSD, 2010). The increase of the share of vegetables is the second highest in percentage increase (39 percent) after fruit (68 percent) in eight years.

Despite this growth, production of vegetables in small pieces of land, transition from subsistence to commercial farming and underdeveloped marketing infrastructure are some of the problems experienced in the vegetable sector. To overcome these problems, the Government, and non-government and private agencies started providing technical and material support to produce vegetables according to market requirements, and to reduce production and marketing costs. To facilitate vegetable marketing, these agencies helped in constructing vegetable collection centres in different production locations. These agencies motivated producer farmers to organize into groups or cooperatives to get such support (Chapagain & Gautam, 2006).

The consolidation of farmers into groups started in 1975/76 with the introduction of the Small Farmers’ Development Programme (SFDP). The main objective of the SFDP was to improve the socio-economic status of the rural poor using a group approach (Pyakuryal, 1997). This was an attempt to coordinate the producer farmers horizontally. The programme was judged to be successful in providing services to the vast majority of small farmers and expanded rapidly during 1980s (Pyakuryal, 1997). The group approach that this programme introduced impacted positively to other sectors. The then His Majesty’s Government of Nepal (HMGN) adopted the group approach as an extension approach in 1988/89, as none of the previous approaches yielded significant results to motivate the vast majority of rural poor to increase agricultural production and productivity (Dongol, 2004). Later, the formation of groups became a common process to deliver services at the producers’ level (Chapagain & Gautam, 2006).

Although group formation was an important step in bringing the scattered farmers into one organization, it did not contribute significantly in reducing the number of steps in supply chain. ANZDEC Limited et al. (2003) reported that farmers’ groups in Nepal are often too small in size to fulfil the vegetable demand of buyers. This situation encouraged farmers as well as service providers to form an organization of large size, such as cooperative, which it was hoped would eventually integrate some of the steps in supply chain. A cooperative is a business operation that pools resources from its members to perform marketing, income or profit distribution, equity investment, and control or governance functions (Coltrain, Barton, & Boland, 1999).
The formation of farmers’ cooperatives by including the members of farmers’ groups was again begun through utilizing the Small Farmers’ Development Projects (SFDP). To facilitate this conversion process, SFDPs established in various parts of the country were converted into a farmer managed Small Farmers’ Cooperative Limited (SFCL) in 1987/88 (Pyakuryal, 1997). The process of converting farmers’ groups into cooperatives is not only limited to the groups formed under the SFDP but also replicated to other farmers’ groups which are involved in various agribusiness activities. The important functions of these cooperative are: transacting consumer goods, production inputs and fresh produce; collecting saving and lending credits; mobilizing resources for community services, such as health, education, drinking water, social empowerment, and science and technology (Chapagain & Gautam, 2006). Although cooperatives are formed by amalgamating group members, these groups still function, but farmers have to rely on cooperatives to get the inputs and to sell their produce (GON, 2010; Sharma & Bhandari, 2005). Therefore, the agriculture extension programmes are delivered to farmers either through groups or through cooperatives.

The formation of groups and cooperatives has allowed the coordination of farmers horizontally at the producers’ level. The coordination of producer farmers further tightened in later years. In addition to horizontal coordination, the groups are gradually moving towards vertical coordination that integrates some of the steps in the supply chain. With the introduction of groups and cooperatives in the chain, and the establishment of collection centres, the role of different types of commission agents and merchants has diminished and their places have been taken by these institutions (Chapagain & Gautam, 2006). Most of the farmers sell their produce to buyers through cooperatives or collection centres. Retailers also have choices to get the produce from cooperatives, collection centres, farmers, wholesalers and haat bazaars. Haat bazaars are farmers’ markets where transactions occur directly between producers and consumers.

Vegetable supply chains in Nepal are gradually moving towards managed coordination from invisible-hand coordination (Thapaliya, 2006). Supply chain actors are building managed vertical coordination based on the mutual interest of the transacting parties who pursue relationships that are more long-term, benefit sharing, transparent in sharing information, stable and interdependent. Invisible-hand coordination, on the other hand, has features, such as self-interest, discrete exchange relationship, opportunistic behaviour, limited information sharing, and independent nature (Peterson, Wysocki, & Harsh, 2001). This progress in coordination is reported to have some positive outcomes in the overall development of vegetable sector. Thapaliya (2006) argued that the development of vegetable sector has been
influenced by strong horizontal coordination between commercial producers and the vertical coordination they have developed with buyers. The strong horizontal and vertical coordination brings dynamic changes in the commercialization of agriculture and leads to the demand-driven growth of agricultural commodities, particularly tea, sugarcane, potato and hybrid vegetables (ANZDEC Limited et al., 2003).

From these discussions, it can be observed that progress has been made in consolidating farmers as well as in bringing other actors together in the supply chain. To keep these participants actively involved requires continuous upstream and downstream flow of information. However, Poudyal (2006) stated that the type of market information collected, compiled, analysed, and disseminated does not serve the purpose of various marketing participants and farmers. This hampers the decision making process in the supply chain and creates coordination problems. There are some other factors, such as involvement of several actors and several stages in the chain, which contributes to create coordination problems. So, there is a need to understand why these problems arise and how the information exchange contributes to mitigate them.

2.4.5 Coordination Problems

The situation in which one does not know which decision aligns best with other decisions in the chain or network is termed as the coordination problem (Hendrikse, 2003). Coordination problems are much more challenging when three or more parties are involved in a chain.

Problems may arise while aligning the objectives and coordinating the activities of individual members for the system as a whole. Bullwhip effect, conflicts of interest, price fluctuation, hidden actions, hidden characteristics, inaccurate forecasts, and poor customer service are some of the common coordination problems observed in supply chains (Forrester 1958 as cited in Fugate, Sahin, & Mentzer, 2006; Hendrikse, 2003; Wong, Johansen, & Hvolby, 2004). Supply and demand uncertainties, limited rationality, information asymmetries, goal conflicts, self interest and opportunism, power dependence, decentralized decision making, economic inefficiency and incentive incompatibility are the major causes of these problems (Wong et al., 2004). Problems, like the large pool of primary producers, involvement of several economic agents in the channel structure, production of commodities, the perishable nature of the produce, volatile prices, lack of trust and commitment, lack of complete chain focus, and lack of information are typical of agribusiness supply chains (Farina & Machado, 2000; O'Keefe, 1997). Coordination problems worsen the relationships across the supply
chain, increase transaction costs, decrease product availability, increase the bullwhip effect and, consequently, reduce profitability (Pearson Education, 2007).

The problems mentioned above can be categorized broadly into behavioural and operational problems. Behavioural problems, like conflicts of interest, hidden actions, and hidden characteristics are directly related to the business culture and attitudes. Lack of trust and commitment, opportunism, goal conflicts, power imbalance are the causes of these problems which are created by the flow of inaccurate, inadequate and hidden information. On the other hand, operational problems, like bullwhip effects, price fluctuation, poor customer service, and inaccurate forecasts are caused by demand and supply uncertainties, which are related to an information gap. Therefore, obstruction in the flow of information has a crucial role in creating coordination problems.

Chain or network parties adopt specific mechanisms to find out the solution of coordination problems. Due to the uniqueness in the nature of each problem, specific mechanisms are required to resolve specific problems (Fugate et al., 2006). One of the important components of such mechanisms is the structure through which information passes from one end to another in the chain. The effectiveness of a coordination mechanism is influenced by a coordination structure, which represents an entire set of interdependencies among all actors in problem domains (Bailetti, Callahan, & DiPietro, 1994).

The resultant effects of coordination problems are multifaceted, and researchers have employed various theories independently or in combination to address them. For example, Farina and Machado (2000) used transaction cost economics (TCE) to identify the coordination issues in the Brazilian fresh fruit and vegetable chain. Similarly, Claro (2004) employed a framework based on a combination of theories, such as business network, SCM, TCE, marketing channels and relational contracting theory, to find out the effects of a firm’s business network on a focal buyer-supplier relationship. Likewise, Batt (2003) used a combination of transaction cost analysis, gap analysis and key dimensions of long-term buyer-supplier relationships to find out how producers and traders determine the prices of potatoes in Red River Delta, Vietnam. O’Keeffe (1998) stated that agency theory complements transaction cost economics by highlighting the importance of uncertainty and information in the context of a principal-agent framework.

On the basis of the discussion in this section, it can be concluded that information exchange is a crucial factor affecting coordination. It is asserted that the causes of most of the coordination problems are generated from the information gap between buyers and suppliers.
This gap affects information flow in the whole chain. To overcome these problems and to fulfill the goal of the supply chain, the flow of required information at the required time from reliable sources is necessary. The next section highlights these aspects of information that flow in a chain.

### 2.5 Information Flow in a Supply Chain

Information is one or more statements or facts that have some form of worth to the recipient (Losee, 1997). Prior literature on information flow asserts that the exchange of reliable and accurate information depends on data availability, collection and processing. Market information is produced by processing data on prices, supplies, demand, quality, grades, circumstances of physical and quality losses, and other market conditions (Kohls & Uhl, 2002). Availability of reliable and accurate data is required to generate accurate, trustworthy, complete and comprehensive information, and efficient procedures need to be developed to collect accurate and reliable data. Since this did not occur when farmers’ institutions were developed in Nepal, the reliability of exchanged information between those supply chain actors becomes questionable (Poudyal, 2006). This creates problems in maintaining trust and commitment between actors, gaining access for the produce in markets, and benefitting the chain actors.

Information flow not only triggers the material and money flow but also helps to implement other activities, plan, coordinate, organize, direct and control in a supply chain (Emmett, 2008). Information flows, therefore, link internal company activities to the external suppliers and customers.

Being an important factor affecting supply chain coordination, different perspectives of information sharing have been captured in previous studies. A chronological summary of important studies related to information sharing with their focus and principal findings is presented in Table 2.1.

These findings highlight the reasons for the exchange of low quality information (Fawcett, Osterhaus, et al., 2007; Fawcett et al., 2009; Omar et al., 2010; Simatupang & Sridharan, 2001), importance of information sharing in supply chains (Bauer et al., 2002; Raghu et al., 2004; Williams & Moore, 2007), and factors influencing information sharing (Cheng, 2011; Li & Lin, 2006). While the findings presented in Table 2.1 are important in giving insights on different arrays of information sharing, the listing in such a concise form is insufficient to
elaborate on the impact of information sharing on organizational capacity and behaviour of chain actors.

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Focus of the Study</th>
<th>Findings / Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simatupang and Sridharan (2001)</td>
<td>Study the characterisation of information sharing and incentive mechanisms for chain members to share relevant private information</td>
<td>Inequitable distribution of benefits and burdens motivates chain members to distort shared information that reduces the overall performance, and thereby both parties cannot capture the potential mutual benefits.</td>
</tr>
<tr>
<td>Bauer, Grether, and Leach (2002)</td>
<td>How constant availability of information in the World Wide Web on the internet influences key variables of relationship marketing that is, commitment, trust and satisfaction</td>
<td>If a corporation can manage to increase its customers’ satisfaction from information flow, this will at the same time enhance trust and commitment.</td>
</tr>
<tr>
<td>Raghu, Jayaraman, and Rao (2004)</td>
<td>How introduction of sophisticated information structures affects transactional aspects of human behaviours in an organizational process</td>
<td>In an outcome based scheme, incentive mechanisms are required to be altered to take advantage of changed information structures in an organizational process to derive any improvement in performance.</td>
</tr>
<tr>
<td>Li and Lin (2006)</td>
<td>Factors impacting information sharing and information quality</td>
<td>Information sharing and information quality are influenced positively by trust and shared vision between supply chain partners, but negatively by supplier uncertainty.</td>
</tr>
<tr>
<td>Fawcett, Osterhaus, Magnan, Brau, and McCarter (2007)</td>
<td>The effects of connectivity and willingness on operational performance of supply chains</td>
<td>Connectivity and willingness both are found to impact operational performance, but many companies are found to have placed more emphasis on connectivity than the willingness, and result into the exchange of inadequate information.</td>
</tr>
<tr>
<td>Williams and Moore (2007)</td>
<td>Examine the role of information integration on supply chain relationships through power</td>
<td>Organizations build power by harnessing the information, which have an impact on organizational acquisition and behaviours and fosters the relationships between organizations.</td>
</tr>
<tr>
<td>Fawcett, Wallin, Allred, and Magnan (2009)</td>
<td>Examine the development and competitive influence of a supply chain information-sharing capability (connectivity and willingness) over time</td>
<td>The greatest performance improvements in a supply chain occur when companies develop both connectivity and willingness dimensions of an information sharing capability.</td>
</tr>
<tr>
<td>Omar, Ramayah, Lo, Sang, and Siron (2010)</td>
<td>The level of information sharing, information quality and usage of information technology (IT) tools</td>
<td>Accuracy of information was found more important than credibility, adequacy, timeliness and completeness (least important) to improve the quality of information. Internet, Vendor Managed Inventory (VMI) and EDI were the IT tools used by these firms.</td>
</tr>
<tr>
<td>Cheng (2011)</td>
<td>Factors influencing information sharing and implementation in inter-organizational relationships</td>
<td>The role played by relational benefits is critical in ensuring the information sharing as it reinforces the connectedness between supply chain members and mitigates the dysfunctional conflicts in the process.</td>
</tr>
</tbody>
</table>
The act of receiving and disseminating information in a timely manner increases the overall performance of organizations (Sari, 2007). Such organizations enrich their capacity to influence other organizations. The advancement of information and communication technology (ICT) has facilitated the management and sharing of a huge amount of data effectively and efficiently. Organizations use ICT in processing orders, tracking and tracing their progress, and providing timely and real-time visibility (Emmett, 2008). Information can enable the capacity of organizations, and create information power (Williams & Moore, 2007).

Information power is the ability of organizations to create or gather valuable market and supply chain data and use it in interactions with other organizations in such a manner that they gain a benefit (Williams & Moore, 2007). The initial definition of power has five bases or sources, namely reward, coercive, expert, referent and legitimate (French & Raven, 1959). These bases can be further grouped into coercive and non-coercive (reward, expert, referent and legitimate). Information is a primary attribute that leads to the development of other power bases. Despite the common focus on firm-to-firm relationships in modern supply chains, power derived from information still serves as a critical success factor, and firms who have it or are able to obtain it, are well positioned for competitive advantage (Williams & Moore, 2007).

Since information is considered power in today’s business world, many individuals have a belief that the sharing of information is like power sharing and leads to a competitive disadvantage for their organizations (Li & Lin, 2006). They want to maintain supremacy in the chain by not sharing the information. Company culture also influences how willing its people are to share information (Fawcett, Ellram, et al., 2007). The behaviour of people also affects information sharing, as it is people that gather, process, share, and interpret the information; write and uphold alliance guidelines; and determine and adhere to the goals of their operations. In the current competitive environment, many business enterprises have invested a large amount of money in information technologies for information collection and dissemination. Therefore, one of the main reasons for inadequate information is not that companies lack ability, but they lack the desire and willingness to share it (Fawcett, Magnan, & McCarter, 2008). Such actions can lead opportunism and impede the actors in making rational decisions. As a result, the relationship among actors worsens, coordination becomes weak and the whole chain will suffer.
Due to these reasons, communication and information flow is considered as one of the key management components for successful SCM. Information flow becomes efficient, when information is organized as per the requirement of supply chains. The discussion on information structure highlights the matters to be taken into consideration while organizing information in a supply chain.

2.5.1 Information Structure

Information structure (IS) is the organization of information and ideas for a certain purpose. The IS gives precise meaning to the intuitive idea of imperfect or incomplete or imprecise information (Phlips, 1988). Although the definition of IS given by various authors conveys similar meanings, they define it in different ways. Raghu, Jayaraman and Rao (2004) define IS as who supplies what information to which decision maker. Arrow (1985) defines IS as the assignment of signals to agents; where agents are the elements of a firm among whom both decision making and knowledge are dispersed, and signal is the random variable which an agent observes. Malone (1987) says that IS guides actors on how to share, perceive and communicate information. A further notion is that information structure enables a manager to observe an outcome at the end of each period (Raghu, Chaudhury, & Rao, 1998). It follows that organizational decision makers will face problems in decision making when the information structure is not appropriate. Availability of information facilitates and the lack of it impedes the decision function (how members decide what actions to take).

2.5.2 Types of Information Structure

There are different basis for categorizing information structure into various types. On the basis of direction of flow, Aoki (1986) envisaged two types of IS in a firm. The first one is hierarchical, in which management possesses a perfect a priori knowledge of the technological possibilities of shops (interrelated units), but is incapable of perfect monitoring of emerging events affecting these technologies, and/or having rapid corrective actions implemented at shops. The second one is horizontal, in which production decisions are coordinated among semi autonomous shops that have only incomplete knowledge of technology at the outset, but gradually become capable of responding to emerging events more quickly by better uses of on-the-spot knowledge. In addition to hierarchical and horizontal information structures, Patel (2001) also proposed a web-like information structure. In this type, every organization is linked with an organization at the centre to exchange information, despite its linkages with other organizations.
Availability of information is another basis for categorizing information structure. Milgrom and Roberts (1987) suggests that there are three different types of information structures: one with complete information, one with incomplete information but no asymmetry, and one with asymmetric information. When the information structure is complete, everyone involved in a transaction knows everything (Milgrom & Roberts, 1987; Philip, 1988). The chances of an information structure being complete is most unlikely in a real situation as it is affected by several other factors, which are not under consideration, including the knowledge level of people. The information structure becomes incomplete but with no asymmetry when the actors do not know some of the information which others know but whatever they know is accurate and undistorted (Philip, 1988). The information structure becomes asymmetric when one side of the transaction has better information (complete, accurate and undistorted) than the other side (Swann & McEachern, 2006).

2.5.3 Relationship between Information Structure and Chain Coordination

Information exchange facilitates coordination and has been seen as the glue that holds organizations included in the chain together (Claro, 2004; Clements, Lazo, & Martin, 2008; Emshwiller, 1991; Jacobides, 2000; Kaipia, 2007; Magnet, 1994; Mohr & Nevin, 1990; Surti, 2003). The timely flow of relevant, reliable, accurate, consistent and adequate information increases its quality by increasing perfectness as well as its symmetry (Miller, 2005). The exchange of such information reinforces interdependency between chain members (Dubois et al., 2004; Johnson & Sohi, 2001), enhances the knowledge level of these members (Alter, 1999; Duhan, Levy, & Powell, 2001), develops trust and commitment between them (Babbar, Addae, Gosen, & Prasad, 2008), increases reliability and transparency in transactions (Poudyal, 2006) and develops collaborative behaviour between the members (Cheng, 2011). All these factors improve the relationship between organizations and strengthen the coordination between them.

The detailed findings of some of the more relevant studies conducted to identify the association between different components of information structure and chain coordination is presented in Table 2.2.

The findings presented in Table 2.2 shows the relationships between quality of information and inventory level (Ding et al., 2011; Rossin, 2007), divergence in information sharing and coordination problems (Babbar et al., 2008), and quality of information and response time (Arshinder et al., 2011). These aspects of information structure not only impact directly on the operational part of supply chain but also impact on actors’ behaviour, which ultimately
Table 2.2  Findings of Relevant Studies on the Relationship between Information Structure and Chain Coordination

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Focus of the Study</th>
<th>Findings / Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rossin (2007)</td>
<td>The impact of various levels of poor information quality on the performance characteristics of efficient supply chains and responsive supply chains</td>
<td>In efficient supply chains, poor information quality results in a change in inventory mix but no change in the total system inventory, and in responsive supply chains, poor information quality results in an increase in total cost and degrading of customer service.</td>
</tr>
<tr>
<td>Babbar, Addae, Gosen, and Prasad (2008)</td>
<td>Develop a framework for investigating and effectively managing organizational factors and supply-chain networks for developing countries</td>
<td>Decentralization, which is an organizational factor, diverge the flow of information along the chain and increases the possibility of bullwhip effect.</td>
</tr>
<tr>
<td>Ding, Guo, and Liu (2011)</td>
<td>Analyze the value created by information sharing on decreasing inventory level and investigate the collaborative mechanism for providing incentive to retailer</td>
<td>Retailers could not receive extra profit from information sharing, however, can possibly make contribution to lowering bullwhip effect of market demand and subsequently reducing stock holdings of distributors and manufacturer in supply chains.</td>
</tr>
<tr>
<td>Arshinder, Kanda and Deshmukh (2011)</td>
<td>Identify the coordination mechanisms, which help in addressing the uncertainty in supply chain and achieving supply chain coordination</td>
<td>Information sharing being an important coordination mechanism, the use of information technology in handling transactions online between supply chain members reduces the response time.</td>
</tr>
</tbody>
</table>

influences the level of coordination. The behaviour of supply chain actors is generally assessed from their willingness to share information (Fawcett, Osterhaus, et al., 2007). Willingness is the openness in sharing information that strengthens the ties between supply chain actors and helps them to get full advantage of the benefits of information sharing (Swaminathan, Smith, & Sadeh, 1998).

Information requirements of supply chain actors differ according to their purpose (ANZDEC Limited et al., 2003) and an appropriate information structure ensures the fulfilment of this requirement. To fulfil the information requirement, accurate and timely flow of required information is necessary. Such information enables actors to take appropriate marketing decisions, regulates the competitive market processes, and lubricates the marketing machinery (Kohls & Uhl, 2002).

Acquiring reliable information is a cost bearing activity and the marginal benefit from acquiring additional information is gradually reduced. Therefore, organizations try to optimize payoff through the right choice of action without excessive informational and computational costs (Moore, Rao, Whinston, Nam, & Raghu, 1997). Otherwise, the flow of
unnecessary information increases transaction costs and consumers have to pay more for the produce.

The discussion suggests that the exchange of more complete information contributes to strengthen supply chain coordination in various ways. The impact of information structure on coordination is manifested in the performance of the supply chain.

2.6 Conclusion

From the review of literature, it became evident that the use of multiple theories is essential for this research, whereby several topics encompassing a broad area have to be covered. Since the purpose of this research is to explore the association between information structure and chain coordination within the framework of supply chain management in a particular operational environment, coordination theory, transaction cost economics, and network theory have been employed. Principles of supply chain management are there to support these theories wherever required.

This research has to address interdependence between supply chain members, coordination problems, geographic dispersion, governance structures, symmetry and asymmetry of information and behavioural aspects of chain members. Among these, interdependence and coordination problems can be dealt by the principles of coordination theory. Two types of governance structures: market and hierarchy can be dealt with transaction cost economics. Geographic dispersion, network structure and behavioural aspects of chain members come under the scope of network theory. Symmetry and asymmetry of exchanged information come under the scope of all three theories.

This review reveals that the concept of a supply chain became solidified among companies involved in the production and distribution sector as a result of increased competition caused by global marketing of goods and services. This competition changes the nature of business from supply driven to demand driven. To fulfil customer demand, manufacturing companies closely link their activities with suppliers, distributors and logistics service providers forming a supply chain.

The supply chain concept was introduced later in the fresh produce sector. Since food quality and food safety are prime concerns of consumers, supply chain actors are required to pay special attention to production, storage and delivery of fresh produce. The involvement of several actors from production to delivery of such produce and the alignment of all these actors in fulfilling the interest of consumers is a difficult task in the operation of fresh produce
supply chains. Researchers argued that the formation of cooperatives can help, both in supplying the produce as per the requirement of consumers, and in reducing the number of steps in the supply chains and so reduce transaction costs. However, research is lacking on how the formation of cooperatives as well as other forms of horizontal coordination at the producers’ level can enable better vertical coordination with other actors, particularly in the Nepalese context. Similarly, the contribution of information shared by horizontal organizations of farmers in coordinating chain members both horizontally and vertically warrants greater investigation.

Supply chain management is considered a philosophy that aims to create value for customers, increase benefits to all supply chain partners and reduce risks. For the attainment of these objectives, all the actors in a supply chain are required to perform their functions according to SCM principles. Researchers have a common view that the adoption of these principles leads actors towards the attainment of the chain goal and helps in developing strong inter-organizational relationships. The exchange of information plays a crucial role in broadening the knowledge and skills of chain members. This issue has not been well-addressed in research undertaken in the past. Even though some research work has been undertaken on this aspect in the manufacturing and service sectors, it appears to be lacking in the fresh produce sector.

To improve the overall performance of a supply chain, coordination that aligns the objectives, activities, decisions, knowledge, information and funds of the organizations is required both horizontally and vertically. Both types of coordination are affected by factors, such as goal compatibility, actors’ efficiency, incentive alignment, information flow, actors’ behaviour, the level of interdependency, chain structure, and external environment. Although research work has touched on how these factors, including information flow, affects the strength of chain coordination around the world, the majority of such studies are in developed countries. The context of developing countries like Nepal is different; for example, the communication system is not well developed, infrastructure is poorly developed, farm size is small and people have less commercial motivation. Hence, research is lacking on the effects of information structure on coordination between actors in developing countries where the socio-economic context is similar to that in Nepal. Therefore, this research aims to fill this gap.

An information structure guides actors to share, perceive and communicate information, and to observe the outcome if the information is arranged according to the requirements of organizations. On the basis of arrangement of information, information structure is divided
into three types: more complete, incomplete but no asymmetry and asymmetric. The association between these three types of information structures and horizontal and vertical coordination is sketchy in the literature. This research attempts to identify the association between different types of information structures and different types of coordination.
Chapter 3
TOWARDS A THEORETICAL FRAMEWORK

3.1 Introduction

The review of coordination theory, transaction cost economics, network theory, supply chain management, information structure and chain coordination in Chapter 2 gives an overview of the theoretical basis for this research. In this chapter, conclusions of the literature review and the arguments developed from this review are linked with the purpose of developing the theoretical framework for this study. Information structure and chain coordination are the core constructs of this framework but these two constructs remain under the influence of the external environment. This framework devises the ways of identifying the influence of the external environment on information structure and chain coordination. The framework provides the theoretical basis for analysing information structures and chain coordination so that the association between these two constructs can be identified in different stages of vegetable supply chains in Nepal.

3.2 The External Environment

The external environment affects different aspects of a supply chain, including its information structure and the coordination between its actors. In the context of this research, these external environmental factors are changing consumer preferences and regional competition, and demand and supply uncertainties.

A. Changing consumer preferences and regional competition: A supply chain is formed to satisfy end customers in a better way through the production and delivery of goods and services (Batt, 2006). Since the perception of consumers on foods is gradually changing from serving basic needs to maintaining lifestyles, their priority is changing from products with different taste and appearance (sensory attributes) to the consumption of fresh fruit and vegetables (health attributes), organic products (process attributes), and products that are easy to prepare and dispose (convenience attributes) (Codron et al., 2005). In this context, consumers do not rely only on domestic produce if they can source the food items of their preference from global producers or retailers. Access to these domestic markets becomes easy for these global producers and retailers as a result of trade liberalization (Hartmann, Frohberg, & Fischer, 2010). Due to easy access and low non-tariff barriers (especially on phyto-sanitary measures), seasonal imports and exports of vegetables takes place between Nepal and India
on a regular basis (Singh, 2005). This has an impact on domestic supply chains in Nepal in terms of the production and delivery of vegetables. To become successful in this more competitive environment, it is necessary for producers to be better informed about the preferences of consumers (Albisu, Henchion, Leat, & Blandford, 2010).

**B. Demand and supply uncertainties:** Due to their specific climatic requirements, most vegetable crops are produced in specific seasons. This seasonal pattern of production is a common problem in the agriculture sector as it does not coincide with market demand (Batt, 2010). Awasthi (2007) reported that, in Nepal, vegetable demand is relatively stable but supply is volatile, due to seasonal and weather dependent production. This fluctuation in supply has an impact on market demand. The imports and exports of vegetables between India and Nepal sometimes disrupt the usual trend, which also impacts on the demand and supply. Any fluctuation in the demand and supply situation changes the information flow, which has an impact on the relationship between producers and buyers (Batt, 2010). Stable relationships between producers, suppliers and distributors are thought to overcome the difficulties created by demand and supply uncertainty.

In summary, the discussion suggests that consumer preferences are changing towards food items which maintain good health and are convenient to use. To draw the attention of food producers and global suppliers to these changing interests of consumers, information needs to be disseminated frequently and precisely. The flow of information on this manner facilitates an environment of global competition. This competition among producers and suppliers can create uncertainty in the demand and supply situation. In the Nepalese context, the uncertainty in the demand and supply situation is caused by seasonal and weather dependent production, and imports and exports between India and Nepal. To overcome the difficulties caused by demand and supply uncertainty, producers and suppliers may try to develop a stable relationship with distributors to continue their business during adverse times.

### 3.3 Information Structure

Various definitions of information structures given by different authors were presented in Section 2.5.1. These definitions can be integrated to develop a single comprehensive definition of information structure, which can be stated as:

Information structure is a framework within which information and ideas are organized to make it easy for the actors to communicate in a timely and frequent manner, and decision makers to take appropriate decisions for the attainment of certain purposes.
From this definition, we can determine the components of an information structure. These components are: a framework, organization of information and ideas, sender and receiver, ease of communication, exchange of timely and frequent information, decision-makers, decision making, and attaining a purpose. These components include the operational aspects of organization and communication of information, and behavioural aspects of the people taking part in information exchange and decision making. It is considered in this research that operational aspects help to improve (or hinder) the quality of information and behavioural aspects help to increase (or decrease) willingness on actors to exchange information. These two aspects are the key attributes of information structure and these attributes have various features. The attributes of information structure and features of each attribute are summarised in Figure 3.1.

![Figure 3.1](image)

**Figure 3.1**  Figure showing the attributes of information structure and features of each attribute

### 3.3.1 Information Quality

Information quality refers to the degree to which the information exchanged between parties, individuals, or organizations meets their needs (Petersen, 1999; Wang & Strong, 1996).
Whether the exchanged information fulfils the needs of the exchanging parties or not in a supply chain, is measured by what information is shared, when and how it is shared, and with whom. These questions are linked with the quality parameters of information. Some of the important quality parameters that were pointed out in the literature are: consistency, accuracy, adequacy, reliability, perfectness, timeliness, accessibility, credibility, relevancy, objectivity and ease of use (Omar et al., 2010). Since the consideration of all these parameters is not possible or necessary for every research endeavour, Wang and Strong (1996) suggested choosing the relevant parameters according to the purpose of research, and analysing them to find out the quality of information. Therefore, in this research, information quality will be assessed in terms of its consistency, reliability and perfectness (accuracy), contribution in developing operational efficiency, and frequency of exchange (required/ adequate), as the information to be exchanged changes frequently and it needs to be communicated to improve the knowledge and skills of several actors organized in five to six stages of supply chains.

A. Consistency of information: To perform various activities in supply chains, actors receive the same information from various sources. This information is then passed to other actors in different directions in different ways. To become consistent, the information received from various sources and passed from one actor to another is required to agree (Mercer, 2006). The exchange of consistent information helps to increase information quality but the exchange of inconsistent information reduces it (Miller, 2005). The exchange of consistent or inconsistent information also has an impact on the behaviour of people. The exchange of consistent information increases optimism of actors by giving clarity on the matters they need to know about. On the other hand, the exchange of inconsistent information increases frustration by creating confusion (Miranda & Tarapanoff, 2008).

B. Reliability and perfectness: The information exchanged between parties is required to be unambiguous and trustworthy if it is to increase the quality of information. Information becomes reliable when it is accurate, disseminated in a timely way and as per the requirement of actors (Gustin, Daugherty, & Stank, 1995; Monczka, Petersen, Handfield, & Ragatz, 1998). Reliability is measured from the contribution of information in making better decisions and improving performance (Omar et al., 2010). Reliable information has some features of perfectness but for the information to become perfect, actors would need to have complete information about all aspects of business, such as profits and consumption utility, market opportunities, available technologies, resources, prices, quality of produced goods, and the intentions of fellow actors (Kirsten, Karaan, & Dorward, 2009). So, it is difficult for
information to become absolutely perfect, and for the purpose of this research, information is considered perfect if it can fulfil the information requirement of recipients.

C. Enabling operational efficiency: The purpose of information sharing is to help actors make better decisions and to improve their performance (Omar et al., 2010). So, the quality of information is considered high if it improves the effectiveness of decisions made by the actors, as well as improving their performance efficiency, but is considered low if it does not improve such effectiveness and efficiency. The use of information technology (IT) further enhances the information quality by making it available frequently, quickly and at low cost, and increases the performance efficiency of actors (Lin & Tseng, 2006). Operational efficiency of actors is also measured from the level of inventory in supply chains. The level of inventory mix is found to be high in commodity supply chains, in which information quality is thought to be poor (Rossin, 2007).

D. Frequency of exchange: Frequency of information exchange is required to be adequate to perform activities or as per the need to improve the quality of information. However, supply chains generally suffer from the delay or distortion of information when it moves from one actor to another. Quite often, such delaying or distortion is done intentionally by the actors involved in the supply chain (Li & Lin, 2006). Frequency of exchange more than required and the flow of too much information are also undesirable as this creates ambiguity and confusion for information recipients (Day, Junglas, & Silva, 2009; Eggert & Helm, 2003; Stvilia, Gasser, Twidale, & Smith, 2007).

The discussion implies that these quality parameters are interrelated. In most cases, they complement each other. For example, timely flow of information does not have any meaning if it is not reliable and perfect. Similarly, the flow of accurate information on time does not have any meaning if it is difficult to understand and does not help in performing activities (Omar et al., 2010). So, for the information to be of high quality, high scores on all these parameters, independently or in combination, are required to help actors in fulfilling their needs.

3.3.2 Willingness to Exchange Information

As stated in the previous section, the quality of information also depends on the behaviour of information exchanging parties. The behaviour of people manifests in their willingness to exchange information with others. Willingness is defined as the openness of actors to exchange relevant information honestly and frequently (Fawcett, Osterhaus, et al., 2007).
Willingness of actors develops trust\textsuperscript{11} and commitment\textsuperscript{12} between them (Bauer et al., 2002; Fawcett, Osterhaus, et al., 2007), enriches information power so that they can communicate high quality information to others (Williams & Moore, 2007), enhances collaboration\textsuperscript{13} (Fawcett et al., 2009), strengthens the relationship (Cheng, 2011), and establishes a suitable environment to receive and share private or sensitive information necessary for making good decisions (Simatupang & Sridharan, 2001).

From the above discussion, we can develop criteria for measuring the willingness of actors to exchange information. On this basis, information power built between chain actors, their behaviour, and transparency are used in this research as the principal criteria for assessing the willingness of actors to exchange information.

\textit{A. Information power built between chain actors:} Information enables the capacity of supply chain actors to perform their functions more efficiently and effectively. Therefore, information is considered a source of power in the business world (Fawcett, Osterhaus, et al., 2007). Power is the ability to influence others to do the work, which they might not have done otherwise (Emerson, 1962). Information power is defined as the ability of organizations or the actors involved in these organizations to produce or gather valuable market and supply chain information and use it in interactions with other actors in such a manner that they gain benefit from it (Williams & Moore, 2007). So, supply chain actors broaden their understanding and knowledge level from the information they have received or generated, and communicate reliable and accurate information to others so that the whole chain will benefit. On the other hand, there is a traditional belief by some actors that information sharing is power sharing. In such a case, these actors are reluctant to share information in order to maintain supremacy in the chain (Fawcett, Osterhaus, et al., 2007).

\textit{B. Actors’ behaviour:} Behaviour, as defined by Ajzen and Fishbein (1977), is the aggregate of observable actions performed by an individual. The behaviour of people also affects information sharing as it is people that gather, process, share, and interpret the information; write and uphold any alliance guidelines; and determine and adhere to the goals of their operations. In the present competitive environment, every business enterprise has invested a large amount of money in information technologies for information collection and dissemination. Therefore, one of the main reasons for inadequate information is not that a

\textsuperscript{11} The willingness to rely on an exchange partner in whom one has confidence (Moorman, Zaltman, & Deshpande, 1992).

\textsuperscript{12} An enduring desire to maintain a valued relationship (Moorman et al., 1992).

\textsuperscript{13} Joint work and communication among people and systems – including business partners, suppliers, and customers – to achieve a common business goal (CSCMP, 2008).
company lacks ability, but that its people lack desire and willingness (Fawcett et al., 2008). Since company culture influences the behaviour of people, organizations associated with supply chains are required to invest in developing a company culture that is conducive to information sharing (Fawcett, Osterhaus, et al., 2007).

C. Information transparency: Willingness of actors is also measured by how transparent they are in sharing information. Information transparency is the subjective perception of an individual of the relevant actions and properties communicated by another party (Eggert & Helm, 2003). Information transparency minimizes the perceived need to constantly search for information, reduces uncertainty, increases the level of trust, and changes behavioural intentions of supply chain actors towards improving the performance and benefitting all involved in the chain (Botden & Terhörne, 2006; Cadilhon et al., 2006; Eggert & Helm, 2003). However, due to lack of sufficient means and inaccessibility to sophisticated technologies that allows efficient and transparent information flow, an information gap is experienced quite often in agribusiness supply chains (Folinas, Manikas, & Manos, 2006).

The discussion suggests that actors need to have a thorough understanding of a matter to be able to communicate required information to others. The knowledge level of actors is supported by their behaviour. If the actors are cooperative, they will share required as well as associated information, which makes it easy for other actors to perform their functions. Cooperative behaviour also develops transparency between actors. Transparency in sharing information makes the actors trusted by information recipients. Therefore, in this research, willingness is the combination of ability, intention and nature of information exchanging parties.

3.4 Chain Coordination

The views of different authors regarding the definition of coordination were presented in Section 2.4. It is concluded from those views that coordination is an act which links activities of various organizations together for the achievement of a common goal. According to this definition, there are two main components in coordination. They are: linking activities of various organizations, and achievement of a common goal. The common goal is the chain goal, and for the achievement of this goal, organizations develop linkages in two ways: horizontally (organizations working at the same level performing similar function) and vertically (organizations working at different levels performing various functions). The horizontal and vertical coordination are the attributes of coordination, and they are presented in Figure 3.2 along with their features.
3.4.1 Horizontal Coordination

Horizontal coordination of some form is required in agribusiness supply chains to consolidate several primary producers (O'Keefe, 1997). This type of coordination is considered to be relevant in this research as the smallholder producers are organized into groups or cooperatives for the production and delivery of vegetables as per the requirement of customers. So, how tightly these producers are aligned to each other to fulfil the requirements of customers is a criterion for assessing the degree of horizontal coordination between them.

A. Horizontal alignment within groups: Collective action, which is an action taken by a group of people for the fulfilment of a common interest, is the basis of horizontal coordination between farmers (Poulton & Lyne, 2009). Collective action is guided by the decisions of farmers’ groups or cooperatives. These decisions align the production and marketing activities carried out by farmers towards the goal of satisfying customers. The alignment of production and marketing activities enables farmers to produce the types of crops which have high market demand, assemble vegetables in a place to fulfil the quantity requirement of buyers, improve packaging and handling practices to increase quality, supply vegetables at appropriate times, and hire vehicles to transport the collected vegetables from the production area to the market (Poulton & Lyne, 2009). Production and collection of similar vegetables helps to increase economies of scale. Similarly, quality improvement, timely supply and reduced transaction costs from joint transport of vegetables in a hired vehicle adds value for customers. The added value increases the demand for these vegetables and this demand increases the market power of producer farmers.
3.4.2 Vertical Coordination

Horizontal coordination between farmers prepares a base for vertical coordination (Poulton & Lyne, 2009). Cooperation (joint operation), collaboration (working jointly) and integration (combining to an integral whole) are different forms of coordination and can be observed at dyadic, chain and network level (Arshinder et al., 2011). Arshinder et al. (2011) also pointed out that the study of coordination in the whole supply chain from a holistic perspective is a big challenge. In this research, different forms of coordination vertically in dyads and at the chain level will be studied. To assess the degree of vertical coordination at these levels, the focus of chain activities towards fulfilling the interest of consumers and the alignment of activities and incentives between chain members will be assessed.

A. End customer focus: Supply chain business processes are carried out to satisfy (create value for) end customers (Lambert & Cooper, 2000) and different types of coordination arrangements, such as interdependence, and the existence of an environment for sharing resources and information technology, are required between chain actors to satisfy customers (Xu & Beamon, 2006). De Moura (2002) pointed out that the strength of these coordination arrangements depends on the kind of end-product or end-service the chains deliver and how difficult it is to meet customer expectations. In addition to fulfilling the requirements of type, quantity, specification and delivery time of goods or services, reduction in transaction costs is another important means of satisfying customers of goods or services (Hobbs & Young, 2000). The reduced transaction costs will contribute to lower the price for end consumers.

B. Vertical alignment: Alignment of chain activities, incentives and information vertically between actors is required to coordinate them for efficient and effective performance and so to achieve their supply chain goals (Piplani & Fu, 2005). The degree to which these three factors are aligned depends on congruency in their goals (Power, 2005), mutual contribution of the activities performed by actors in making decisions at different levels (Kim & Oh, 2005), interdependencies (Simatupang, Sandroto, & Lubis, 2004), and contribution in improving the knowledge level and mutual respect through information sharing (Gittell & Weiss, 2004). The contribution of information sharing in changing the knowledge and attitude of actors was dealt in Section 3.3.1, so the level of goal congruence, enabling each other in making decisions, and interdependencies are assessed to find out the degree of vertical alignment between actors in dyads or chains.

The discussion on coordination suggests that producers of vegetable supply chains can be aligned in groups or cooperatives to fulfil the requirements of buyers and ultimately of
consumers. This prepares a good base for vertical coordination. The strength of vertical coordination in dyads is assessed by observing the efforts of dyadic partners to satisfy consumers and the alignment between them in activities, incentive and information.

### 3.5 Theoretical Propositions

From the discussion on theoretical underpinnings of the external environment, information structure and chain coordination, we can now develop a general theoretical framework for this research (see Figure 3.3).

In this framework, the relationship between specific external environmental factors, and between the external environmental factors and information structure and chain coordination can be observed. Likewise, relationships between information structure and chain coordination can be portrayed. These proposed relations are expressed as theoretical propositions.

The relationship between external environmental factors is expressed as:

**Theoretical proposition 1:** Changing consumer preferences and regional competition create difficulties in making forecasts, increasing demand and supply uncertainties.

Changing consumer preferences and regional competition have a direct effect on information structure and chain coordination, and indirectly on these factors by creating demand and supply uncertainties. So, both of the external environmental factors affect information structures and chain coordination, and the relationships between them can be expressed by the following four propositions:

**Theoretical proposition 2:** Changing consumer preferences and regional competition increases risk and uncertainties, creating difficulties in accessing high quality information.

From this proposition, the risk of disseminating misleading information and uncertainty of getting right information created by changing consumer preferences and import-export fluctuations, and the effects of these risk and uncertainties in accessing information will be explored.
Theoretical proposition 3: Changing consumer preferences and regional competition increases risk, leading towards stronger horizontal and vertical coordination in order to adapt to these changing preferences.

This proposition intends to study the increasing risk of selling produce in the market as a result of changing consumer preferences and import-export fluctuations, and the impact of this risk in strengthening coordination between actors.
**Theoretical proposition 4:** Demand and supply uncertainties increase risk, creating difficulties in accessing high quality information.

Demand and supply uncertainties produce similar type of risk for supply chain actors as changing consumer preferences and regional competition. This proposition intends to study the risk of disseminating misleading information and uncertainty of getting right information through demand and supply uncertainties and the difficulties created by this risk in getting high quality information.

**Theoretical proposition 5:** Demand and supply uncertainties increase risk, leading to a strengthening of horizontal and vertical coordination to manage this risk.

Demand and supply uncertainties affect horizontal and vertical coordination between actors in the similar manner as changing consumer preferences and regional competition. To minimize the risk of marketing the produce through uncertain demand and supply situation and the effects of this risk in coordinating actors are intended to be studied from this proposition.

The relationship between information structure and chain coordination can be traced out as a whole and between the features of information structure and horizontal and vertical coordination. These relationships can be expressed as:

**Theoretical proposition 6:** A complete information structure increases trust, leading towards strong horizontal and vertical coordination.

This proposition intends to study the three-way relationship between complete information structure, increasing trust between actors as a result of this information structure, and the overall impact of these two in coordination between actors.

**Theoretical proposition 7:** The flow of high quality information from various sources to chain actors increases cooperative behaviour and enables their capacity, and so strengthens horizontal and vertical coordination in the chain.

In this proposition, the intention is to study the influence of the collection of high quality information from different sources and its dissemination in the chain on behaviour and capacity of actors, and ultimately on horizontal and vertical coordination.
Theoretical proposition 8: The flow of high quality information from one actor to another in the chain tightens alignment between parties, and so strengthening the horizontal and vertical coordination.

The effects of the exchange of high quality information on the alignment between actors and ultimately on horizontal and vertical coordination are intended to be studied from this proposition.

Theoretical proposition 9: High willingness of actors to exchange information develops trust and commitment, and so strengthens the horizontal and vertical coordination.

The effects of the willingness of actors to exchange information on trust and commitment through the exchange of required information in a timely manner, and finally on horizontal and vertical coordination in the chain will be studied from this proposition.

3.6 Conclusion

A general theoretical framework (see Figure 3.3) has been developed for this research after the discussion on the constituents of the external environment, attributes of information structure, and chain coordination and the features of each attribute. There are three basic components in this framework: the external environment, information structure and chain coordination. The elements of these basic components have been discussed in three steps to make it easy to analyse the empirical data and derive the results from this research. Firstly, the discussion established the components of these elements and established their relevancy for this research. Secondly, the use of these elements in similar research works carried out in the past was explored through literature. Finally, propositions were developed to link these elements, thus establishing a framework that can be used to analyse the external environment, information structure and coordination of vegetable supply chains in Nepal.

The use of this framework guides the choice of a research method, which is the next step. The selection of an appropriate research method is important so that the empirical work can be carried out well, thus developing a foundation to answer the principal and specific research questions posed in Chapter 1.
Chapter 4
RESEARCH METHODS AND DESIGN

4.1 Introduction
The research method and design adopted for this research is described in this chapter. The employment of an appropriate research method is guided by the review of the literature in Chapter 2 and the theoretical framework developed in Chapter 3. The discussion starts from the rationale for the choice of a qualitative research method, followed by the selection of case study strategy and its design, which includes the data collection procedure and analysis. The aim of the empirical research guided by the research method is to answer the research questions asked in Section 1.2.

4.2 Qualitative Research
When undertaking empirical research, researchers employ quantitative, qualitative or a mix of these two research methods (Walliman, 2006). Each of these methods has its own strengths and logic. A deductive approach is followed in quantitative research, whereas the strengths of qualitative research derive primarily from its inductive approach. In a deductive approach, the research work moves from the general to specific for confirming a theory, but in an inductive approach the research moves from specific observation to broader generalization for building a theory (Burney, 2008). The focus of qualitative research is on specific situations or people, and its emphasis is on words rather than numbers as in quantitative research (Weiss, 1994).

The aim of this research is to find out the types of information structures and their association with the degree of coordination in various stages of vegetable supply chains. For this, the operational and behavioural aspects of information sharing between supply chain actors are required to be studied. In depth study of situation, incidents, events, behaviour or experiences of people in order to make sense of, or interpret phenomena in their natural settings, is one of the important features of qualitative research and one of its strength (Denzin & Lincoln, 1994; Lavrakas, 2008). In qualitative method, researchers often make knowledge claims based primarily on constructivist perspectives (i.e., the multiple meanings of individual experiences, meanings socially and historically constructed, with an intent of developing a theory or pattern) or advocacy/participatory perspectives (i.e., political, issue-oriented, collaborative, or change oriented) or both. The goal of qualitative research is to discover patterns which emerge after close observation, careful documentation, and thoughtful analysis of the research.
topic (Ruskin, 2001). Since in depth study of whole vegetable supply chains is required to explore issues and understand the phenomena of information and material flow to answer the research questions, a qualitative approach is considered the most appropriate for this research.

With qualitative research, many strategies have been suggested by different authors. However, five strategies of inquiry: narrative, phenomenology, ethnography, grounded theory, and case study as suggested by Creswell (2003) are in most common use. In general, the study of individuals is associated with narrative and phenomenology; learning about broad culture-sharing behaviour of individuals or groups is often studied using ethnography; and exploring processes, activities, and events is well-suited to grounded theory and case study.

4.3 Case Study

A case study is an “empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (Yin, 2009, p. 18). Therefore, it is recommended to be used in research when a researcher has to answer ‘how’ and ‘why’ questions, the researcher does not have control over the behavioural events, and the focus of research is on contemporary events (Yin, 2009). Meredith (1998) added that a case study is appropriate for exploratory investigation of a new phenomenon that may be related to a person, a family, a situation, an institution, a cultural group or even the entire community. The case study deals with the processes, and places more emphasis on detailed contextual analysis of a limited number of events or conditions and their interrelations (Dooley, 2002; Kothari, 1990). VanWynsberghe and Khan (2007) further state that case study is trans-disciplinary. Therefore, it does not have a disciplinary orientation and can be used in social science, applied science, business, fine arts, and humanities.

Considering the nature of this research, which requires a thorough investigation of processes, activities and events to answer how and why questions in order to ascertain the subtle connections between information flow and coordination between actors, a case study strategy is followed. The appropriateness of the use of case study is further justified by the conduct of the research in an existing environment in which the chains are operating, and so the behaviour of chain actors is beyond the researcher’s control.

In a case study, special attention is given to completeness in observation, reconstruction and analysis (Tellis, 1997). Therefore, the object of case study is understood phenomena using a wealth of empirical materials, such as interviews, focus group discussions, questionnaires, observations, reports, archives and physical artefacts (Hamel, Dufour, & Fortin, 1993).
However, caution is required since there is a possibility that the use of variety of empirical materials may create analytical challenges.

**4.3.1 Case Study Design**

First, it is required to define a ‘case’ to make it easy to understand the case study design. The term ‘case’ in a case study is an empirical unit, theoretical construct (Ragin, 1992), and subject to evaluation, because scientific and practical interests are tied to it (Scholz & Tietje, 2002). Technically, a case can be defined as a phenomenon for which we report and interpret only a single measure on any pertinent variable (Platt, 2007). The case could be an account of an activity, event or problem (Dooley, 2002). This could also be an individual, unit of a society, organization or group (Scholz & Tietje, 2002). Vegetable supply chains are the cases for this research, as they are the empirical units of analysis, which are required to be evaluated to find out the answers of research questions asked in Section 1.2.

The design of a research endeavour consists of a detailed plan of work from its beginning to its end (Flick, 2007). Yin (2009) stated that research design is the logical sequence that connects the empirical data to a study’s initial research questions and, ultimately, to its conclusions. So, the initial focus is on the research questions, and the research design facilitates data collection and analysis to derive results and conclusions. Taking these features of research into consideration, a case study is designed. The design itself can be holistic or embedded on the basis of unit of analysis, and also single or multiple on the basis of scope of inquiry (Scholz & Tietje, 2002). Therefore, four types of case study designs are possible: holistic single, embedded single, holistic multiple and embedded multiple.

A single case-design is selected in a situation when the case to be studied is unique (another similar case is not available for research), prototypical (representative), critical (in testing a well-formulated theory), revelatory (opportunity of observing and analysing a phenomenon previously inaccessible) or longitudinal (studying the same single case in at two or more different points in time) (Scholz & Tietje, 2002; Yin, 2009). Choosing a single case design is considered vulnerable as a case may later turn out not to be the case it was thought to be at the outset. Therefore, Yin (2009) suggested selecting more than one case for a research endeavour, the results of which are considered more compelling and the overall study is more robust. In comparison to a single case study, multiple case studies require more extensive resources and time. Multiple cases are not like the selection of multiple respondents in a survey, but are akin to the replication of an experiment (Ellram, 1996). So, multiple cases are selected using replication logic not sampling logic. This study on information and
coordination of vegetable supply chains does not have features, which suggest a single case study design, and the aim is to derive robust conclusion to give credibility to the findings, which have an implication to supply chain actors and policy makers. Therefore, a multiple case design is chosen for this research.

These single or multiple case studies can be grouped further into holistic or embedded cases. A holistic design covers all aspects of the case or phenomenon under study. In an embedded design, a case is divided into parts or sub-units and an analysis of these sub-units is undertaken (Yin, 2009). The selection of holistic or embedded design depends on the type of problem treated and the nature of case(s) to be studied (Scholz & Tietje, 2002). In vegetable supply chains, the exchange of goods and information takes place vertically between actors in dyads from one end of the chain to another and horizontally between farmers at their level and others directly or through organizations, such as cooperatives, plus Non Governmental Organizations (NGO). To determine the completeness of information structure and the degree of coordination of the whole chain, the information structure and coordination between actors in different stages of the chain are required to be analysed and aggregated. Therefore, the multiple case design chosen for this research is an embedded one.

4.3.2 Quality of Case Study Design

Case study research has its own strengths and weaknesses. The strengths of case study are realised from the use of a wealth of empirical materials, which make it possible to carry out an in-depth investigation of an object (Hamel et al., 1993) and uncovers the reality of a relatively complex and contextualised problem (Scholz & Tietje, 2002). Despite these strengths, case studies are often criticized for a lack of perceived rigour and scientific basis, excess of bias, the danger of ad hoc theorizing and use of subjective judgements (Amaratunga & Baldry, 2001). To utilize the strengths and to minimize the weaknesses, quality is required to be maintained during a case study design. To maintain quality, attention is required to be paid to construct validity, internal validity, external validity, and reliability of the research (Yin, 2009).

Construct validity refers to establishing correct operational measures for the concepts being studied (Amaratunga & Baldry, 2001). The use of multiple sources of evidence, establishment of a chain of events, and the review of draft case study report by key informants establishes construct validity (Yin, 2009), and reduces the potential subjectivity of researchers (Tellis, 1997). Internal validity relates to making proper inferences from data (Ellram, 1996). The tactics of pattern matching, explanation building and time-series analysis increases the
internal validity of the research (Amaratunga & Baldry, 2001). External validity refers how accurately the results represent the phenomenon studied, and how generalizable are the findings beyond the immediate case (Ellram, 1996). Yin (2009) suggested using theory in single case studies and replication logic in multiple case studies to increase the external validity. Reliability refers to the stability, accuracy and precision of measurement, and whether replication will achieve the same results or not (Ellram, 1996). The use of case study protocol and the development of case study database increase the reliability of the research (Yin, 2009).

### 4.3.3 Case Selection

The selection of the number of cases depends on the purpose of study and the focus of the research questions (Darke, Shanks, & Broadbent, 1998). Yin (2009) suggested that the study of multiple cases (replications) provides greater certainty in the results but the number of cases to be studied should not be too many, as this can create a mess for the researcher when analysing the data. There are some other benefits of conducting multiple case studies. The study of multiple cases allows comparison and facilitates cross-case analysis (Darke et al., 1998), and the study of each case either predicts similar results (a literal replication) or predicts contrasting results but for anticipatable reasons (a theoretical replication) (Yin, 2009).

Using these suggestions from the literature as guidelines, the desired research context was analysed for case selection. This was done by consulting the Government officials working in the Agribusiness Promotion and Marketing Development Directorate (ABPMDD) of the Department of Agriculture (DoA). The purpose of the research was explained to these officials. They then shared their knowledge of possible supply chains with respect to information richness, management and communication of information, volume of transactions, relationships among chain actors, and finally, the likely behaviour of chain actors in providing information to the researcher.

On the basis of this guidance, suggested by the literature and the experiences of local officials, four domestic vegetable supply chains were selected purposively from the middle hill range of Nepal (see Figure 4.1). Purposive (judgement) sampling is a technique, whereby a researcher actively selects the most productive samples to answer the research questions (Marshall, 1996). The cases selected for this research are: the Panchkhal vegetable and potato supply chains originating in Kavre District, the Charaudi vegetable supply chain originating in Dhading District, the Sarketari vegetable supply chain, which originates in Syangja District and the Harthok vegetable supply chain, which originates in Palpa District. Although these
chains extend from production sites to markets, the majority of their activities take place in the areas shown in Figure 4.1.

![Figure 4.1 Map showing the location of four case study sites in Nepal](image)

It was anticipated that results of the analysis of these four cases would agree with some of the expected patterns, but contradict with the remaining ones, and that information received from these cases would reach an acceptable degree of saturation. In the view of Marshall (1996), the data for qualitative research reaches the level of saturation when new categories, themes or explanations stop emerging from the study of additional cases. Ideally, cases are not predetermined, and additional cases are carefully chosen to derive both agreed and contradictory results until saturation is reached. However, this ideal approach was not logistically possible in this study, but it was expected that the careful selection of predetermined cases would yield acceptable results.

### 4.4 Ethical Considerations

The data required for this research are collected by interviewing key informants at every level of each supply chain, such as farmers, assemblers, wholesalers, retailers, cooperative staff, transport operator, cold storage owner, and Governmental Organization (GO) and Non-Governmental Organization (NGO) officials, and by observing these participants and chain activities. These data are related to the business activities of these chains, and services
provided to support in undertaking those activities. The principles and guidelines of Lincoln University Human Ethics Committee (HEC) states that interviews with professional persons in the areas of their duties and competence and non-interactive observation of these people in the course of everyday life do not come under the scope of HEC review. Therefore, HEC approval was not sought to carry out this research. However, in the beginning of interview, every participant was clearly explained that the interview was voluntary and they were free not to answer any of the questions, in the course of interview. To maintain the privacy of these interviewees, their actual names have not been revealed anywhere in this thesis.

4.5 Data Collection

The data for case studies can be collected from various sources. Yin (2009) mentioned documents, archival records, physical artefacts interviews, direct observation, and participant-observation as the six important sources of evidence for case studies. These data sources can be divided into primary (interviews, direct observation, participant-observation and physical artefacts) and secondary (documents and archival records) (Hedrick, Bickman, & Rog, 1993). Among them, the primary data for this research were collected from interviews, direct observation (production farms, markets, marketing practices), and participant observation. Similarly, secondary data were collected from documents (study or evaluation reports, progress reports and transaction records) and archival records. Cross-sectional data were collected from April to June 2009 from selected respondents, cooperatives, GO, NGO and private agencies. Cross-sectional data are the data collected in given point in time (Darity, 2008). Abundant help and support was received from different organizations, people affiliated with those organizations and friends during data collection.

4.5.1 Preparation

Preparatory works for data collection was begun after the selection of cases. These works can be divided into two parts: central level preparation and District level preparation.

4.5.1.1 Central Level Preparation

After the selection of cases, a letter was received from the Ministry of Agriculture and Cooperatives (MoAC) requesting District Agriculture Development Offices (DADO) of Kavre, Dhading, Syangja and Palpa Districts; Regional Agricultural Directorates (RAD) of Lalitpur and Pokhara; Agribusiness Promotion and Marketing Development Directorate (ABPMDD) of the Department of Agriculture (DoA) for providing necessary helps in data collection. Since the vegetable supply chains selected for this research have direct and indirect
links with these GOs, the request from the ministry to these organizations was helpful to collect primary and secondary data from different sources.

The ABPMDD officials provided basic information about the supply of vegetables from these chains to markets, operation of collection centres in production sites, the involvement of cooperatives in production and marketing of vegetables and the contact person of the cooperatives. They also provided information about the involvement of GOs, NGOs and private sector in the activities of selected chains. They suggested starting field work from the cooperatives associated with the chains.

Contact details of DADO and RAD officials were received from the ministry. In the organizational structure, the DADO Kavre and Dhading are under the RAD Lalitpur and the DADO Syangja and Palpa are under the RAD Pokhara. The Directors of these RADs were contacted by phone to obtain their consent to get helps from DADO officials in data collection. DADO officials were contacted by phone to fix the field programme and to receive the contact details of the chairmen of producers’ cooperatives and groups, and Agriculture Service Centre (ASC) officials. After these preparatory works, the researcher moved to the districts, from where supply chains are originated, with necessary stationery and other materials.

4.5.1.2 District Level Preparation
Being a local level Government organization, DADOs are working closely with farmers, farmers’ groups or cooperatives, different levels of buyers, NGOs and private agencies working in the vegetable sector. Due to this reason, DADO officials were consulted in person or by phone to prepare the field programme. Two levels of meeting were organized at the District level: one with DADO officials and another with the cooperative members and staff. In case of the Panchkhal and Charaudi chains, meetings were organized with DADO officials before the meetings with the cooperative members and staff. In the case of Sarketari and Harthok chains, meetings with the cooperative members and staff were organized before the meetings with DADO officials for logistical reasons.

During the meetings with DADO officials or cooperative members and staff, the purpose of the research, methods of data collection, nature of questions going to be asked to the respondents, approximate time required completing the interviews, and the help expected from the meeting participants were explained. The meetings with DADO officials were used in getting more information about the groups or cooperatives and other organizations associated with the chains. The help of DADO officials was also received in setting the
environment for data collection, such as finding accommodation, local transport and facilities, such as internet access.

Since the chairmen of the cooperatives associated with all four chains were key informants and were busier than other farmers, appointments were fixed with them at a suitable time and place for the interview almost a week before visiting the cooperatives. Considering the time requirement for the interview and the nature of local farmers and vegetable buyers, a collaborative approach was adopted to decide who to interview next in the meetings with the cooperative members and staff.

### 4.5.2 Selection of Respondents

The chairmen of producers’ cooperatives associated with the chains were selected automatically for interviews when these chains were selected as the cases. The selection of other farmers, different levels of buyers and service providers followed a snowball technique. In this technique, other potential respondents are selected as per the recommendation of the maximum number of people consulted (Marshall, 1996; Patton, 2002). This type of sampling is also called chain sampling as it forms a chain while selecting successive farmers and buyers. Among the service providers, the cooperative managers or staff, GO and NGO officials, transport operator, and cold storage owner associated with the chain were selected for interviews. The selection of the next respondent depends on the richness of data received from completed interviews so far (Liamputtong & Ezzy, 2005). Therefore, the number of respondents selected for interviews varied in each chain. The number of interviewees selected in different vegetable supply chains is presented in Table 4.1.

### 4.5.3 Semi-structured and In-depth Interviews

Interviews are the main sources of evidence for this research. Yin (2009) suggested three forms of interviews: in-depth, focussed, and structured. The in-depth interviews are open-ended interviews, in which open-ended questions of about certain facts or matters are asked. These open-ended questions are chosen carefully and phrased so that respondents can put their opinion on the matter from different perspectives in detail. The focussed interviews are also open-ended but the questions asked to the respondents are semi-structured. In this type of interview, there is a certain set of questions, which lead the interviews towards conversational style but with the focus on a particular subject that has been predetermined. In structured interviews, researchers ask the same set of closed-ended questions, in the same order, using the same words to different interviewees (Babbie, 2010; Fontana & Frey, 2008; Patton, 2002; Yin, 2009).
Table 4.1  Table Showing the Number of Actors Interviewed in Four Vegetable Supply Chains

<table>
<thead>
<tr>
<th>Vegetable Supply Chain</th>
<th>Panchkhal</th>
<th>Charaudi</th>
<th>Sarketari</th>
<th>Harthok</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumers</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Retailers</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Wholesalers</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Assemblers</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Farmers</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Input suppliers</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Service Providers</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>18</td>
<td>12</td>
<td>11</td>
</tr>
</tbody>
</table>

Note: 1. Interviews were not completed with one assembler in Charaudi because of unfavourable weather condition, and one retailer in Sarketari because of poor health condition of the respondent.
2. The cooperative is both the input supplier and vegetable assembler in the Sarketari and Harthok chain.
3. Interviews with the officials of ABPMDD of the DoA and Kalimati Wholesale Market Board are shown in Charaudi, but these interviews with policymakers are reference materials for all four chains.

Considering the scope of this research, three sets of questions were prepared for interviews. The first set of semi-structured questions was prepared for farmers. The second set was also semi-structured questions and was prepared for different levels of buyers. Considering the similar nature of buying and selling, the same set of questions was prepared for assemblers,
wholesalers and retailers. The third set consists of open-ended questions (check-list) and was prepared for service providers.

4.5.4 Collection of Primary Data

Interviews are the main source of primary data. Semi-structured interviews were conducted with farmers, assemblers, wholesalers and retailers, but open-ended interviews were taken with cooperative managers (input suppliers), GO and NGO officials, transport operator and cold-storage owner. Since the information provided by farmers and buyers are the main source of data for this research, the interviews taken with them were comparatively longer than the interviews taken with service providers although farmers and buyers were asked semi-structured questions and service providers were asked open-ended questions. Collecting primary data was begun from Panchkhal and moved to Charaudi, Sarketari and Harthok chains in succession.

4.5.4.1 Panchkhal Chain

In the Panchkhal vegetable and potato supply chains, vegetables and potatoes produced in the Panchkhal Valley of Kavre District are supplied mainly to the capital city Kathmandu. Therefore, data for this chain were collected locally from the Panchkhal Valley and Kavre District Headquarters Dhulikhel, and also from Kathmandu. Data collection was done for more than a week in Panchkhal and Dhulikhel by making three visits from Kathmandu to different parts of Kavre.

Primary data were gathered from formal interviews (see Table 4.1 for total number of interviews taken in this chain) and informal meetings and discussions. Since an actual pilot case study was not conducted in this research for logistics and resource reasons, the sets of questions prepared for farmers and traders were revised from the experience of Panchkhal chain before using them in other chains.

Conducting interviews was begun with farmers. Time and venue for these interviews were fixed by telephone. One farmer associated with the cooperative and one farmer associated with a farmers’ group were interviewed separately. A joint interview was taken with three farmers associated with the cooperative. Assemblers were met personally and asked for an interview. They were interviewed at their workplaces. The Chairman of the Vegetable Collection Centre (VCC) and the staff of Agriculture Service Centre (ASC) were interviewed in Dhulikhel. Interviews were also taken with the DADO officials and the proprietor of Palanchowk Bhagawati Cold Storage P. Ltd. Altogether nine interviews were taken in Kavre District.
The rest of the interviews with wholesalers and retailers were undertaken in Kathmandu. A potato wholesaler and a vegetable wholesaler connected to this chain were separately interviewed in Kalimati Wholesale Market, Kathmandu. A buyer who purchases vegetables directly from farmers in Panchkhal, and does both wholesaling and retailing in Tukucha Market, Kathmandu was interviewed at his own shop.

Observation of participating chain actors, farmers’ field and market places and marketing processes was another important tool employed to collect primary data. These observations were done while visiting the actors for interview. A short visit was made to Banepa Vegetable Market (at a distance of around 10 km from Panchkhal) to observe the transaction since some of the farmers from Panchkhal bring their vegetables to sell to assemblers in this market. Information was also gathered by visiting Khopasi, Nala and some other important vegetable production sites of Kavre District. Such information helps in comparing the situation of Panchkhal with these places.

### 4.5.4.2 Charaudi Chain

In the Charaudi vegetable supply chain, vegetables produced in Charaudi and the surrounding area are collected in the Farmers Improvement Fruit and Vegetable Producers Cooperative Ltd located in Charaudi, and then supplied mainly to Pokhara, Kathmandu, Narayangadh and Butwal markets. Therefore, primary data for this chain were collected from the Charaudi area of Dhading District, Dhading District headquarters at Dhadingbesi and the Wholesale Markets in Pokhara and Kathmandu.

Two visits each were made to Dhading and Pokhara mainly to collect the primary data from interviews (see Table 4.1 for total number of interviews taken in this chain), observation and participation in a discussion programme. The sets of questions revised from the experience of Panchkhal were used for interviewing farmers, assemblers, wholesalers and retailers of this chain.

As per the recommendation of the meeting conducted in DADO Dhading, two farmers supplying vegetables to the collection centres established by the Charaudi cooperative and one farmer supplying vegetables to the collection centre established by the Bishaltar cooperative were interviewed. Farmers supplying vegetables to the collection centre established by the Bishaltar cooperative are not associated with this chain. However, the meeting participants suggested interviewing a farmer from this cooperative to compare the situation of Charaudi with the nearby area. Similarly, three assemblers, one Cooperative Manager and one transport operator were interviewed at the premises of the Charaudi
cooperative. Interview with one assembler could not be completed due to very high wind and rain. The Planning Officer of the DADO was interviewed at Dhadingbesi.

The rest of the interviews were undertaken with wholesalers, retailers and service providers in Pokhara and Kathmandu. Two wholesalers and one wholesaler cum retailer from Pokhara and one wholesaler from Kathmandu, all associated with this chain, were interviewed at their workplaces. The Market Manager of Pokhara Wholesale Market was interviewed in Pokhara. The Senior Agriculture Development Officer (SADO) of Dhading, the Deputy Director of Kalimati Wholesale Market, and an Official from the ABPMDD were interviewed in Kathmandu later on.

Besides formal meetings and interviews, informal discussions were held with the Government officials, vegetable buyers (assemblers, wholesalers and retailers) and other chain participants in all those places. The Local Development Officer (LDO) of Dhading was personally met and the chief of the Division Cooperative Office (DCO), Dhading was contacted by telephone. The purpose of both these interviews was to get their views on the situation of vegetable production and marketing, and the support they are providing to vegetable producers and buyers. The discussion programme organized by New Lucky Enterprises, a supplier of organic fertilizers, was attended at Charaudi to collect primary data. The discussion programme was helpful in getting the views of cooperative members in the use of organic fertilizers for vegetable production. The observation of chain participants' activities, farmers' fields, buying and selling of vegetables in the collection centres as well as the markets, and the situation of market places was another method employed to collect primary data.

4.5.4.3 Sarketari Chain

The field programme for collecting data from the Sarketari vegetable supply chain was fixed by consulting the SADO of Syangja and the Regional Director (RD) of the Regional Agricultural Directorate (RAD), Pokhara by phone. For data collection, more than a week was spent in Syangja District by making two visits. Data collection was completed in these two visits since the chain both originates and ends in Syangja District.

Respondents for interviews were selected as per the recommendation of meetings held in the Agricultural Produce Market Management Cooperative Ltd, Sarketari and the DADO, Syangja (see Table 4.1 for total number of interviews taken in this chain). Four farmers and one Cooperative Manager were interviewed at the cooperative office. One wholesaler and three retailers transacting vegetables with the cooperative were interviewed at their shops but
the interview with one retailer was terminated as it was very difficult to get answers from him. Three DADO officials working in the vegetable production and marketing sector were interviewed jointly. The SADO was interviewed separately in his official residence. Finally, the Field Officer of the Nepal Smallholder Irrigation Market Initiative (Nepal SIMI) Syangja was interviewed in her office.

The data were also collected through informal interactions with the people visiting the cooperative and the DADO. An informal discussion was held with the DCO staff to collect their views on the operation of this chain. The observation of the local situation, activities of chain participants and the transaction of vegetables in wholesale and retail stores was another method employed to collect primary data.

4.5.4.4 Harthok Chain

The DADO officials of Palpa District were contacted several times by phone from Kathmandu, Pokhara and Syangja to fix the data collection programme for the Harthok Chain. This chain originates in the Harthok area of Palpa and ends at the Palpa District Headquarters, Tansen and the Regional Market, Butwal. Therefore, a field programme of approximately three weeks was prepared in consultation with DADO officials to collect data from these places.

Data collection for this chain was begun from observation of the Harthok area where vegetables are produced and assembled by the Harthok Agricultural Multipurpose Cooperative Ltd. This visit was helpful in finding some key cooperative members and staff who explained the current production situation in the area, and the operation of the rural information centre and the marketing of vegetables by the cooperative. The observation of chain participants, service providers, production farms, market places and marketing processes continued during the interviews with supply chain actors and service providers. In the course of data collection, the DCO, Horticulture Centre and the Vegetable Wholesale Market, located in Tansen, were also visited to find out how these agencies support the production and marketing activities of this chain. To compare the chain activities of Harthok with nearby other chains, the process of supplying organic ginger from Bhairabsthan to international markets and fresh vegetables from Madanpokhara to Tansen and Butwal were also studied.

At the time that the interviewing for this study was being conducted, two meetings were being held in Harthok: one between vegetable producers and buyers, and another between the
cooperative members (producers) and a visiting Bangladeshi team. Both of these meetings were attended to collect primary data for this research.

Interviewing the respondents was begun from the third day of the visit to Palpa (see Table 4.1 for total number of interviews taken in this chain). In consultation with the Planning Officer of DADO Palpa, three producers, one each from Bhairabsthan, Khashauli and Deurali Village Development Committees (VDC), who supply vegetables to the Harthok cooperative, were selected for interview. All of them were met personally to fix the appointment for interviews. Two of them were interviewed on their farms and the other one was interviewed in Harthok town. Later on, one of the ASC staff and the Cooperative Manager were met personally and interviewed in their offices. All other actors and service providers were contacted by phone to fix the appointments for interviews. A wholesaler cum retailer who was receiving vegetables from the cooperative was interviewed at his shop in Tansen. The Chairman of the Apex Body of the market management committees of vegetable collection centres operated in Palpa District was interviewed at his home in Madanpokhara. The District Manager of the Nepal SIMI and the District Marketing Manager of Research into Use (RIU) were jointly interviewed in Tansen. A joint interview was also undertaken with the SADO and the Planning Officer of the DADO, Palpa. Upon completing most of the work in Palpa, five days were spent in Butwal to contact, find and interview two wholesalers referred from the Harthok cooperative.

4.5.5 Collection of Secondary Data

In the course of interviewing respondents, secondary data were collected from cooperatives, GOs, NGOs and private organizations. Annual reports of vegetable transactions, audit reports and constitutions were collected from the cooperatives associated with all vegetable supply chains, except Panchkhal. Hard and soft copies of relevant documents related to vegetable production and marketing, study reports, and progress reports were received from the DADOs and DCOs of Kavre, Dhading, Syangja and Palpa Districts. Other important sources of secondary data are statistical publications and other publications received from the regional and central level organizations, such as RAD Pokhara, ABPMDD, Department of Cooperatives (DoC), National Cooperative Development Board (NCDB), Kalimati Fruit and Vegetable Market Development Board (KFVMDB), Agriculture Information and Communication Centre (AICC), and MOAC. Secondary data related to vegetable production and marketing, and fresh produce supply chains were received from Nepal SIMI field offices located in Syangja and Palpa, the regional office located in Pokhara and the country office located in Lalitpur. Vegetable marketing and value chain data were collected not only from
GOs and NGOs, but also from private organizations, such as Shree Complex (a fruit and vegetable wholesale market), Pokhara, and Agro Enterprise Centre (AEC), Kathmandu.

4.5.6 Data Triangulation

Collecting data from observation and secondary sources supplements the primary data collected from interviews, and is an important basis for data triangulation in this research. Stake (1994) defines triangulation as a process of using multiple perceptions to clarify meaning and verifying the repeatability of an observation or interpretation. Thus, data triangulation increases the reliability of findings, addresses construct validity problem, and can be a major strength when conducting case studies.

4.6 Data Analysis

Data analysis consists of summarising the mass of data collected and presenting the results in a way that communicates the most important features (Hancock, Windridge, & Ockleford, 2009). Analysis helps researchers to find out the patterns in data and to develop ideas to explain why those patterns are there (Bernard & Ryan, 2010). The analysis of qualitative data is carried out in two levels: descriptive and interpretive (Hancock et al., 2009). The descriptive level of analysis starts right from the beginning of the data collection phase. In this phase, what was actually said, documented or observed during data collection are presented. Documents prepared from descriptive analysis are collated to undertake interpretive analysis. In interpretive analysis, what is meant, inferred or implied by the response of a person, contents of the documents, or observation of objects, are presented.

4.6.1 Content Analysis

A particular approach known as content analysis is used in this research. Content analysis refers to any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings (Patton, 2002). This is a set of methods for systematically coding and categorizing a large amount of textual information in order to ascertain the trends and patterns of words used, their frequency, their relationships, and the structures and discourses of communication (Bernard & Ryan, 2010; Grbich, 2007). Although content analysis was conceptualised solely in terms of counting the frequency of data in the past, this concept has become wider in recent years (Joffe & Yardley, 2004). Such analysis is now currently used across social sciences to explore manifest and latent content (Bernard & Ryan, 2010; Graneheim & Lundman, 2004). Manifest content describes the visible and obvious components, such as counting of textual elements and
rankings while the latent content describes the underlying meaning or inferences of the textual elements, such as main idea and theme. Hence, content analysis uses a variety of approaches from enumerative to thematic as well as various combinations of these two approaches (Grbich, 2007).

In this research, analysis of the data was begun from descriptive analysis by transcribing the interviews, preparing notes from observation and collecting archival documents. Undertaking such activities familiarizes the researcher with the data (Taylor-Powell & Renner, 2003), and the use of data from multiple sources increases the construct validity of the research (Voss, Tsikriktsis, & Frohlich, 2002). The data at this stage of the research were raw relatively unstructured, and somewhat unwieldy. These data were collated, and coded and grouped according to the components of the theoretical framework (themes). The processes adopted for further analysis of the data were data reduction, pattern matching and cross-case analysis. The data were reduced while writing descriptions of individual cases, pattern matching was done during the synthesis of individual case study results, and cross-case analysis was done by comparing the results of highly coordinated chains and less coordinated chains, and also the results from these two groups.

4.6.2 Case Description

Case description is within-case analysis that typically involves detailed case study write-ups for each site. These write-ups are pure descriptions, which makes it easy for researchers to understand the cases (Babbie, 2010; Eisenhardt, 1989; Huberman & Miles, 1994). Case descriptions pulled together and the data organized into a comprehensive, primary resource package. This then becomes the resource materials to carry out the interpretive analysis in the next phase (Patton, 2002). Considering the importance of case descriptions for further analysis, sufficient time was allocated to include the comprehensive details of all four cases in their case study write-ups (see Appendix A – D). The comprehensive description of the cases gives the researcher the depth of understanding that is needed for cross-case analysis (Voss et al., 2002).

4.6.3 Pattern Matching

Pattern matching is an analytic technique, on which the expected pattern is compared with the observed pattern to find out whether they match or do not match (Hak & Dul, 2009; Yin, 2009). Expected patterns in qualitative research are hypotheses or propositions, and they are compared with the patterns obtained from the collected data. Pattern matching is useful for linking data to the propositions (Campbell, 1975) and this is the core procedure of theory-
testing with cases (Hak & Dul, 2009). The adoption of this technique in case studies increases the internal validity of the research (Voss et al., 2002). How the observed patterns coincide with the initial propositions is evaluated in the synthesis of case study results presented in Section 9.2.

### 4.6.4 Constructing Models

Models are simplifications of complicated, real things. Therefore, models are built to better understand these complexities and to help others understand them as well (Bernard & Ryan, 2010). As an analytic technique, the use of case study models consists of matching empirically observed events to theoretically predicted events, and is very similar to pattern matching. However, because of their sequential stages, case study models deserved to be distinguished as a separate analytic technique from pattern matching (Yin, 2009). Considering the similarities between cases, two models, the first one for highly coordinated chains and the second one for less coordinated chains, are constructed in Section 9.3.

### 4.6.5 Cross-case Analysis

Cross-case analysis is an important analytic technique for research in which multiple cases are studied (Yin, 2009). According to the purpose of the research, cross-case analysis can be done in a variable-oriented or a case-oriented manner (Babbie, 2010). The simplest and most effective method of doing a cross-case analysis is to construct an array of data according to variables in pairs of cases and search for similarities and differences in those pairs (Voss et al., 2002). Under this principle, the four cases, which are studied in this research, are grouped into highly coordinated chains and less coordinated chains according to the degree of coordination, and the similarities and differences in each group and the commonality of two groups are presented in Section 9.3. Cross-case analysis seeks to increase the internal validity of the findings and reliability of results (Yin, 2009). Voss et al. (2002) argued that cross-case analysis is essential for enhancing the generalisability of conclusions drawn from the research thereby increasing its external validity.

### 4.7 Conclusion

The need to adopt a qualitative case study strategy, and the design and methods guided by this strategy has been discussed on this chapter. The research design emerged from the research questions and theoretical framework, and the first step in the analysis procedure is to identify the features of the information structure and coordination between actors and the association between these two factors in the vegetable supply chains study. This analysis of qualitative
data and the results derived from this analysis is presented in Chapter 5, 6, 7, and 8. The association between information structure and chain coordination is explored from these results and presented in Chapter 9.
Chapter 5
CHAIN ANALYSIS AND RESULTS, PANCHKHAL

5.1 Introduction

The Panchkhal vegetable supply chain originates in the Panchkhal Valley of Kavre District and ends in Kathmandu. The transaction of green vegetables and potatoes takes place in this chain. Out of the four cases selected for this research, this is the only supply chain in which potatoes are commercially produced and marketed. The Panchkhal potato supply chain has been in operation since the late 1980s and the Panchkhal vegetable supply chain has been in operation since the early 1990s. The production area of this chain lies in the area surrounding a vegetable collection centre established in the Panchkhal Village Development Committee (VDC), which is situated at the centre of the valley (see Figure A.1, Appendix A).

The production area of the Panchkhal chain extends from the flat Panchkhal Valley to surrounding hills. Farmers of this area are organized into groups or cooperatives to carry out production operations. On the basis of their own experiences and information received from GOs and NGOs, group or cooperative members decide which crops or varieties to produce on their farms. Production of vegetables and potatoes is done in different seasons by the same farmers, but their marketing process and the involvement of actors in marketing are slightly different for the two products.

In the vegetable supply chain, product flows from input suppliers to consumers via producers, assemblers, wholesalers, and retailers (see Figure 5.1). In this chain, producers arrange inputs mainly from private input dealers. Producers have been facing difficulty in getting fertilizers every year due to their scarcity in the markets. As a result of this difficulty, cooperatives sometimes supply fertilizers to their members. When vegetables become ready, farmers harvest the crops and sell them, generally to assemblers, either in the collection centre operated by the Progressive Multipurpose Cooperative Ltd. or in Tamaghat (a local market) or Banepa (a market located at a distance of 18 km from Tamaghat). All of these assemblers supply vegetables to wholesalers in different markets (but mainly Kalimati Wholesale Market) in the Kathmandu Valley. These vegetables are then supplied to retailers from different parts of the Kathmandu Valley, and consumers purchase them from the retail outlets.
Figure 5.1  Product flow in fresh vegetable supply chain originating from Panchkhal

In the case of the potato supply chain, product flows from input suppliers to consumers via wholesalers and retailers (see Figure 5.2). Because of the involvement of the same actors as in the vegetable supply chain, similar activities are undertaken between input suppliers and producers. Since assemblers are normally absent in this chain, farmers harvest and sell potatoes to wholesalers, mostly from their farms. A similar process, as followed for vegetables, is adopted in selling potatoes in the Kathmandu Valley, but wholesalers supply some of the potatoes to markets outside Kathmandu.

Vegetables are supplied from this chain everyday throughout the year, but there is large difference in the volume supplied in the main and lean season. However, potatoes are supplied only in the main season (February – March). Prices of vegetables and potatoes are determined at every step when they are transferred from one actor to another. Almost 90 percent of the vegetables and potatoes produced in this chain are supplied to Kathmandu, and the remaining 10 percent are supplied to other small markets including Khasa, a border town in China.
To fulfil the quality concerns of consumers, improvements are made in harvesting, packaging, post harvest handling, and transporting vegetables from farmers’ fields to retail outlets. Potatoes are separated into two grades manually if required. Grading is not done for vegetables and buyers do not accept any sorting which is done at the farmers’ level. Normally, the demand for potatoes produced in Panchkhal is high in the markets but the import of cheap Indian potatoes sometimes affects it. However, imports and exports do not have a significant effect on the supply of vegetables from this chain. Vegetables are transported from Panchkhal to assembly or wholesale markets in hired trucks or pick up vans. The supply of vegetables from Panchkhal to these markets is obstructed sometimes due to road strikes.

The above description of chain activities prepares a basis to analyse the external environment, information structure, and horizontal and vertical coordination in the Panchkhal vegetable and potato supply chains. For further reference, a more detailed description of this case is given in Appendix A. In this chapter, aspects of these two chains are analysed and the results derived from these analyses are presented. Since it was proposed that the information structure and chain coordination are interrelated and are affected by the external environment and their own internal attributes, the factors that make up the external environment and the attributes of information structure, horizontal coordination and vertical coordination have been identified. The features of each attribute of information structure, and horizontal and vertical

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**Figure 5.2  Product flow in the potato supply chain originating from Panchkhal**

Consumers

Retailers

Wholesalers

Producer Farmers

Input Dealers/Cooperatives
coordination, have been defined. These features are then analysed to determine how they affect the attributes, and how these attributes impact on information structure, horizontal coordination and vertical coordination.

5.2 The External Environment

Changing consumer preferences and regional competition, and demand and supply uncertainties, are the factors that make up the external environment for the vegetable and potato supply chains. The impact of these factors on chain activities, and the efforts of supply chain actors to minimize it are discussed in this section.

5.2.1 Changing Consumer Preferences and Regional Competition

The Panchkhal vegetable and potato chains arose in their present form after the opening of vegetable collection centres in Panchkhal Valley in early 2000. Since then, the chain actors have been observing the changes in the preferences of consumers. These changes are:

a. Consumers consume more vegetables in diversified forms (raw, cooked and processed) and prefer to take more than one vegetable dish with meals.

b. Consumers want continuous supply of tomatoes, cucumber, cabbages and potatoes throughout the year.

c. Most of the consumers want vegetables and potatoes that are produced by using low or no pesticides and fertilizers, fresh, harvested at the appropriate stage, clean and free from marks and bruises.

d. Consumers prefer the vegetables and potatoes produced in the hilly region, like Panchkhal, over the vegetables and potatoes produced in the tropical (terai) region.

Diversified and increased consumption, increasing awareness of consumers towards safety products, and tastes of vegetables are the principal reasons behind these changes. Vegetable consumption pattern has been drastically changed in comparison to the past. The consumption is increased due to the intake of two to three vegetable items, in place of one vegetable curry, in every meal. Also, the consumption is diversified. Besides making curry, vegetables are also used in preparing salad (tomatoes, cucumber, cabbages) all the year round, mixed with noodles and dumplings (tomatoes, cabbages), processed (tomatoes), mixed as condiments (potatoes and tomatoes). In addition, consumers are attracted towards organic vegetables due to safety reason. Taste of vegetables is another priority of these consumers. Chain actors said
that the vegetables and potatoes produced in the subtropical or temperate region (hills and high hills) are tastier than those items produced in tropical plains.

In the course of fulfilling these changing needs of consumers, the actors of Panchkhali supply chain has to compete with the actors of other supply chains, including importers from India.

Imports and exports between Nepal and India are largely driven by differences in production seasons, prices and quality. Imports and exports take place normally in main production seasons which differ between the hilly regions of Nepal and border side of India and do not have a great impact on the demand and supply situation in domestic markets. However, bumper production seasons or crop failure on one side of the border leads to increased or reduced imports and exports, which creates uncertainty in demand and supply. This uncertainty leads to price fluctuation. For example, oversupply of imported Indian potatoes reduced demand for Nepalese potatoes and dropped the price from NPR 27.00 to NPR 17.00 per dharni in 2008. There are a few vegetables, which are imported or exported due to quality reasons. For example, large (salad) tomatoes imported from India are considered superior to Nepalese ones. Similarly, red potatoes produced in Panchkhali and other hilly regions of Nepal are considered superior to Indian ones, and are exported. The export of such potatoes from Nepal sometimes reduced supply to domestic markets.

5.2.2 Demand and Supply Uncertainties

Demand and supply uncertainties are common in the markets where vegetables and potatoes are supplied from Panchkhali. The chain actors said that changing consumer preferences and excessive imports and exports make vegetable and potato demand uncertain in the market. They said that there is significant increase in the quantity of tomato, cabbage, cucumber, and potato demand due to changing patterns of consumers. Because of gradual increase in vegetable consumption, the quantity of other vegetables’ demand is also going up in the similar manner. However, changing consumption patterns do not reduce the demanded quantity of any item. Vegetable items, such as capsicums, cauliflowers, carrots, tomatoes, and potatoes have export demand and are exported regularly to border markets of India and China. If vegetables are scarce in those markets, particularly in Indian markets, excessive export takes place from Nepal. Such export creates scarcity of those items in domestic markets and increases their demand. A wholesaler said that potato demand went up sharply in 2009 due to its low production and export to India. Occasionaly, excessive import of cheap Indian vegetables reduces the demand for domestic produce.
Vegetable supply from Panchkhal fluctuates almost every year due to weather dependent production, production decisions based on last year’s demand, and strikes. Vegetable production, in this area, depends on the distribution of rainfall from February to May due to irrigation difficulty in most of the farms. Since this is not the rainy season, the rainfall may or may not occur in these months. If rainfall occurs according to the requirement, there will be bumper harvest and oversupply in the market. If these months remain dry, production will be reduced and the supply will remain quite low. Another factor causing oversupply of some of the items in the domestic market is the production of same vegetables by several farmers on the basis of last years’ demand. Increased supply of these items causes reduced supply of rest of the items. Frequent strikes and roadblocks are the other factors, which cause uncertainty in supply for few days. Due to the political instability, frequency of such strikes and roadblocks has increased in Nepal in recent years. These problems affect the distribution system and obstruct the vegetable and potato supply generally from production sites to markets.

To minimize the effect of these external environmental factors, farmers have made some changes in production activities like increasing the production of crops which have high market demand, introducing appropriate varieties and expanding the area towards the surrounding hills. However, very few changes have been done in performing marketing activities, except transacting vegetables and potatoes with the same parties.

### 5.3 Information Structure

The information structures of the Panchkhal vegetable and potato supply chains are analyzed in a two-step process. The first step identifies the degree of information quality and willingness of actors to exchange information. The second step identifies the positioning of chain actors and external agencies (service providers) in the structure according to their involvement in information sharing. The first step – the analysis of the degree of information quality and willingness of actors to exchange information – is used as input into the second step; that is, to prepare the structure in which the position of chain actors and external agencies can be displayed with linkages to each other.

#### 5.3.1 Types of Information Exchanged between Actors

The interviews with chain actors and service providers showed that information exchange takes place horizontally between farmers, vertically between actors in dyads, and in the networks of cooperatives and wholesalers. Information on input management and production operations is exchanged between farmers horizontally in groups or cooperatives. Market related information (basically demand, supply and price) is exchanged vertically between the
actors in dyads. Information on the issues related to availability and use of inputs is exchanged between the cooperatives in cooperatives’ network at the district level. Similarly, wholesalers share information with a view to resolving problems related to transport and waste disposal in their wholesalers’ network at the national level.

The information on demand, supply and price exchanged vertically between actors of this chain influences the types of information exchanged horizontally between farmers and in the networks of cooperatives and wholesalers. The flow of these three different types of information between the chain actors, and between chain actors and service providers of the fresh vegetable supply chain, is presented in Figure 5.3.

The first type of information that flows across the chain is the price. The wholesalers based in Kalimati Wholesale Market are the main source of prices of vegetables. Within the chain, wholesalers disseminate this information to farmers via assemblers and consumers via retailers. The second type of information comprises demand side information, which includes the types of vegetables preferred by consumers and the quantity demanded at a particular time period. The demand side information flows downward from consumers to producers. Producers also receive information about broad market demand from input suppliers while purchasing seeds. The third type of information comprises supply, which includes the types of vegetables, their attributes (variety, grade, size, shape, colour, taste, and shelf life), and the quantity and time of availability. The supply side information flows upward from producers to consumers in the chain.

Information exchange also takes place between the actors and other agencies, mainly service providers. Wholesalers share the price, demand and supply to the Kalimati Wholesale Market Board. This Board disseminates price information to Radio Nepal for broadcast. The Board also disseminates price, demand and supply to GOs, NGOs and cooperatives. These GOs, NGOs and cooperatives disseminate the information to farmers. The exchange of information between chain actors and service providers allows these actors to know the overall situation of the Kalimati Wholesale Market, and the service providers to know the situation of this chain.
Since the structure of the potato supply chain (Figure 5.2) is slightly different from the fresh vegetable supply chain (Figure 5.1), there is a slight difference in how the information flows along that chain. The difference in the flow of information in the potato supply chain is presented in Figure 5.4.

**Figure 5.3  Information flow in the Panchkhal vegetable supply chain**
Assemblers are usually absent in this chain, and transactions take place directly between farmers and wholesalers. Due to this reason, farmers share supply side information with wholesalers, and wholesalers share price and demand side information with farmers during transactions. The flow of information between other actors and between the actors and service providers is same as in the vegetable supply chain.
5.3.2 Horizontal Information Structure

The information structure exists horizontally at the farmers’ level in the vegetable and potato supply chains. The two attributes of information structure: information quality and willingness to exchange information are observed from their features. On the basis of these observations, the strength of these two attributes are determined and depicted in the horizontal continua at the end of this section.

Farmers said that they meet almost every month for the group meetings or Ward Assemblies\(^{14}\) of the cooperative. Since the two cooperatives associated with this chain have 1700 and 464 general members respectively, it is difficult for all members to gather in one place frequently for meetings. Therefore, the assembly of cooperative members is conducted every month at the Ward level. These Ward Assemblies forward their meeting minutes to the Cooperative Board for further action and implement the decisions of this Board.

Farmers said that they exchange information mainly during group meetings or Ward Assemblies. Some of these meetings/assemblies are also attended by GO and NGO officials but Ward Assemblies are always attended by Cooperative Board Members. The information on the existing demand and price trends for different crops or varieties is exchanged during these meetings/assemblies. On the basis of this information, the groups or cooperatives select the most beneficial crops or varieties to grow in the next season. Information on techniques for increasing production, extending the duration of production, managing seeds and other inputs, and introducing recently developed technologies (such as the construction of plastic tunnels and drip irrigation), is also exchanged in these meetings or assemblies. Of the information shared in meetings or assemblies, only the existing demand and price trend are related to marketing and all other information is related to production.

Farmers said that the production and market related information exchanged between them, and received from GO and NGO officials and Cooperative Board Members, is consistent. However, these farmers exchange partial information between themselves. For example, farmers are adopting various techniques to increase profits from vegetable and potato production. These farmers said that they do not share such information with others. Groups or cooperatives rely more on GOs and NGOs than on their own members for knowledge on techniques for increasing production and extending production duration. This exchange of consistent, but imperfect, information does not enable farmers to implement production

\(^{14}\) Ward Assemblies are the lower units of the cooperatives which are formed by including the cooperative members of each Ward of the VDC. A Village Development Committee (VDC) is divided into nine wards. There are 9 – 35 wards in a municipality (www.moha.gov.np/abtnepal.php).
programmes in the best manner. As a result, progress in reducing the use of pesticides and developing irrigation facilities (two major production problems in the Panchkhal Valley) are not judged to be satisfactory. The frequency of information exchange is also not helping in achieving such progress. Farmers said that the duration of one month for scheduled meeting is insufficient to exchange all information. Also, the tendency to exchange imperfect information makes farmers reluctant to meet other farmers informally to share information.

This exchange of imperfect information means that the knowledge of farmers is not as broad as it could be. Further, the exchange at inadequate frequency hinders information updating by farmers. As a result, the exchange of information does not build information power for farmers. The sharing of imperfect information also indicates that these farmers are not fully cooperative in outlook. The farmers who share only imperfect information, and so behave opportunistically, do not maintain transparency in communicating with other farmers.

In summary, although the information exchanged at the farmers’ level is consistent, it is imperfect, does not fully enable the operational efficiency of farmers, and the frequency of exchange is inadequate. As a result, the quality of information exchanged between farmers is low and the degree of information quality is depicted towards lower end but close to the midpoint of the continuum. Similarly, the lack of information power, opportunistic behaviour, and lack of transparency suggests that farmers have a relatively low willingness to exchange information. Hence, the degree of willingness to exchange information is also depicted towards the lower end - between the lowest end and midpoint - of the continuum.

This discussion on the degree of information quality and willingness of farmers to exchange information horizontally at the farmers’ level is summarized in Figure 5.5. In this Figure, the degree of information quality moves from low to high and the degree of willingness to exchange information moves from unwillingness to willingness, moving from left to right.

![Figure 5.5](image-url)

**Figure 5.5** The degree of information quality and willingness to exchange information at the farmers' level in the Panchkhal vegetable and potato supply chains
The depiction of both attributes towards lower end of the continua suggests that there is a relatively asymmetric information structure at the farmers’ level both in the vegetable and potato supply chains.

5.3.3 Vertical Information Structure

The overall vertical information structure of the vegetable supply chain is the aggregation of the information structure in each of the sequential dyads. These are input suppliers – producers, producers – assemblers, assemblers – wholesalers and wholesalers – retailers dyads. Likewise, the overall vertical information structure of the potato supply chain is the aggregation of information structure in the input suppliers – producers, producers – wholesalers and wholesalers – retailers dyads. Aside from the absence of assemblers and the presence of different wholesalers in the potato supply chain, all other actors are same in both chains, and they follow the same procedures to exchange the information. As a result, the attributes: degree of information quality and actors’ willingness for both chains are analysed together using continua in different dyads. After completing the dyadic analysis, these two attributes are summarized separately for the vegetable and potato supply chains in horizontal continua at the end (Section 5.3.3.6).

5.3.3.1 Input Suppliers – Producers

Private input dealers are the main input suppliers for farmers in Panchkhal, but they also receive inputs from fertilizer dealers and cooperatives some of the time. The cooperatives associated with this chain are basically saving and credit cooperatives, and supply fertilizers once or twice a year when they are unavailable from other suppliers. Farmers said that they receive information related to the attributes of inputs (type, nutrient content if it is a fertilizer, when to use, and how to use) and broad market demand for a particular variety or crop from private input dealers and sole fertilizer dealers during transactions. The cooperative staff or members provide information to farmers on product attributes during transactions and broad market demand for a crop or variety during Ward Assemblies. Farmers receive information on the demand for a crop or variety from DADO and ASC staff as well.

Farmers said that they do not know whether the attributes of inputs provided by the input suppliers is consistent or not, as they receive the information only from one source. However, the information they received on broad market demand from input suppliers, DADO and ASC staff is consistent. These suppliers usually do not tell farmers about the associated risks of using inputs and problems that may occur in future, but farmers want to know these things in advance. Therefore, the information disseminated by input suppliers does not fulfil the
farmers’ needs, and so is imperfect. The purpose of disseminating information on attributes of inputs and market demand for vegetables and potatoes is to bring about change in production operations, so that more can be produced. Because of the dissemination of partly consistent and imperfect information farmers cannot conduct their operations in the most efficient manner. The frequency of information exchange is also important for operational efficiency, but the dissemination of information only during transactions and scheduled assemblies is not frequent enough for this to occur.

The flow of partly consistent and imperfect information from input suppliers does not build information power for farmers. As a result, these farmers cannot share consistent and perfect information with assemblers and other farmers. The behaviour of input suppliers is not fully cooperative, as they share the information only during transactions or assemblies, and do not provide any help thereafter. To resolve any problems that might occur after the use of inputs, farmers usually consult the DADO or ASC. Farmers buy inputs from different suppliers on different occasions, and these suppliers only share information necessary to make the transaction, and this is not transparent.

Therefore, the exchange of information between input suppliers and farmers lacks most of the features of high quality information except for the sharing of consistent information on broad market demand. Therefore, the degree of information quality is depicted towards lower end but near midpoint of the continuum (see Figure 5.6). Similarly, the discussion suggests that the input suppliers show low willingness to exchange information with farmers. Therefore, the degree of willingness to exchange information is depicted towards the lower end of the continuum (see Figure 5.6). Hence, the exchange of information with low quality coupled with unwillingness of actors to exchange information suggests an asymmetric information structure.

5.3.3.2 Producers – Assemblers
Farmers and assemblers generally exchange information during transactions. Farmers share information on how much of which vegetables they can supply in that season, and assemblers share information on price and the demand and supply situation of vegetables in the market. Farmers also receive price information from GOs, NGOs, the cooperative and radio. Since these agencies generally do not disseminate information other than prices, farmers rely heavily on assemblers for the other information they require. Farmers said that the wholesale prices of vegetables at Kalimati Wholesale Market are the most important information that
they receive from all these sources. However, they find that the information received from assemblers and other sources is inconsistent.

Farmers said that the main reason behind this inconsistency is the flow of imperfect information from assemblers. Therefore, they try to verify the information from various sources before making a transaction. This makes it difficult for farmers to decide whether to sell their produce to the same assemblers or to find other buyers, although most of the farmers and assemblers generally do transact with the same parties. The frequency of information exchanged between producers and assemblers is adequate, as they interact regularly during transactions, and make phone conversations when required.

Farmers said that assemblers sometime intentionally manipulate the information on quantity demanded and prevailing prices. Any such manipulation reduces the ability of farmers to share consistent and perfect information to other chain actors. It is possible that such manipulation could be greater if farmers did not verify their information from other sources. Farmers argued that the intention behind disguising or distorting information is to increase profit for assemblers by reducing purchase prices and increasing margins to cover future loss. Hence, the dissemination of such information is for the benefit of assemblers and not both parties in the dyad. Since assemblers do not share information transparently, the information is not fully trusted by farmers.

This discussion suggests that farmers and assemblers exchange inconsistent and imperfect information, which reduces the ability of farmers to make good decisions, although the frequency of information exchange between them appears to be adequate. Therefore, the exchange of information with low quality takes place in this dyad and the degree of information quality is depicted towards the lower end of the continuum but towards the midpoint (see Figure 5.6). Similarly, information exchange between these two actors does not build information power for farmers, assemblers appear to focus on their own personal benefits, and there is low trust and transparency. These features signify that the actors are unwilling to exchange information, and so the degree of willingness to exchange information is depicted towards the lower end of the continuum (see Figure 5.6). This exchange of information with low quality and low willingness of actors to exchange information leads to an asymmetric information structure.

5.3.3.3 Assemblers – Wholesalers
Assemblers said that they transact regularly with the same wholesalers, and they inform them how much of which vegetables they can supply every day. They get the information on price,
demand, market arrivals and stock from wholesalers. They rely on the information supplied by wholesalers, and do not attach importance to the information disseminated by institutional sources like the cooperative, DADO and radio. Therefore, assemblers are not concerned about the consistency of information supplied by wholesalers and other sources, although on very few occasions, the information supplied by wholesalers becomes inconsistent due to a rapidly changing demand and supply situation in the market.

Assemblers and wholesalers exchange information through face-to-face or phone conversations. This two-way communication means that the actors have an opportunity to clarify matters of concern during these conversations. This increases the reliability and perfectness of information. The exchange of consistent and perfect information enables both the assemblers and wholesalers to conduct transactions more efficiently. As a result, most of the transactions and payments are made on the basis of information provided by phones. Assemblers said that the exchange of information by phone normally takes place two or more times a day. This occurs generally before 2.00 pm (before the beginning of transaction) and in the evening (after completing the transaction). The frequency of communication at least twice a day by phone or through face-to-face conversation is adequate for them to exchange the required information.

Assemblers and wholesalers said that the exchange of more consistent and perfect information helps to build information power between them, and makes both sides knowledgeable. This power enables them to transfer more consistent and perfect information to other chain actors who come in contact with them in dyads.

Transacting vegetables is a major business for assemblers, and is the sole business of wholesalers. Their business becomes more stable if these assemblers and wholesalers proportionately align benefits received from vegetable transaction. This motivates them to become transparent in information sharing, and facilitates the building of mutual trust.

Similar features of information quality and willingness to exchange information are observed in the assemblers – retailers’ dyad if assemblers are transacting directly with retailers. In the potato supply chain, producers act as assemblers and the same features of information quality and willingness to exchange information are observed in the producers – wholesalers’ dyad.

The discussion suggests that there is exchange of high quality information between the actors in this dyad, although the flow of inconsistent information by wholesalers does occur on rare occasions. Therefore, the degree of information quality is depicted towards the higher end,
between the midpoint and highest end of the continuum (see Figure 5.6). Assemblers and wholesalers also have a high willingness to exchange information. So, the degree of willingness to exchange information is depicted at the highest end of the continuum (see Figure 5.6). The exchange of high quality information followed by high willingness of actors depicts a more complete information structure in this dyad.

5.3.3.4 **Wholesalers – Retailers**

A wholesaler said that he supplies vegetables to several retailers every day and exchanges information during these transactions. Wholesalers share the information on price, overall demand, supply and stock with retailers, and retailers share the type, attributes and quantity of vegetables they want to buy with wholesalers. Wholesalers find consistency in the information supplied by retailers at a specific time. On this basis, wholesalers prepare their buying plans to give them the best return. On the other hand, retailers said that they occasionally need to visit other wholesalers to find certain vegetables which are required to fulfil their customers’ demand, but not available from their regular wholesaler. Retailers utilize this opportunity to enquire about the price, demand and supply situation of vegetables in the market. Retailers find consistency in the information they get from both their regular and occasional wholesalers.

Normally, retailers meet wholesalers once a day and exchange information. In addition, retailers contact wholesalers by phone to get more information when required. This two-way communication and the exchange of information face-to-face and by phone makes the information more reliable and perfect. The exchange of more consistent and perfect information enables both wholesalers and retailers to implement their buying and selling plans of vegetables. To make their buying and selling plans successful, both of them continue conversation or increase the frequency of phone talks until any matters of concern are resolved on both sides. Therefore, the frequency of information exchange is adequate to fulfil their information needs.

The exchange of consistent and perfect information increases the information power of both wholesalers and retailers. In turn, this facilitates the flow of consistent and perfect information to the dyads where wholesalers and retailers are associated with other actors. The exchange of more consistent and perfect information impacts on their behaviour as well. Wholesalers and retailers both said that they share information, not only for their individual benefits, but also for the benefits of the other actors. In addition, they are transparent in sharing information.
This relatively chain focussed behaviour of wholesalers and transparency in sharing information helps to keep actors committed to chain activities.

The discussion suggests that the exchange of high quality information takes place between wholesalers and retailers. Therefore, the degree of information quality is depicted towards the highest end of the continuum (see Figure 5.6). Similarly, the discussion suggests that wholesalers and retailers have a high willingness to exchange information. As a result, the willingness to exchange information is depicted towards the higher side of the continuum but it lies close to the midpoint as the retailers want to get more information from wholesalers than to share their information (see Figure 5.6). The flow of high quality information accompanied by high willingness of actors leads to a more complete information structure between wholesalers and retailers.

5.3.3.5 Retailers – Consumers

The primary data required to analyse this dyad was obtained only from a retailer. As a result, it is not possible to draw conclusions on the degree of information quality and willingness of actors to exchange information from data obtained from only one side of the dyad. So, the features of information quality and willingness to exchange information are reported from the experience of the retailer are described in brief, but will not be used for further analysis.

A wholesaler-cum-retailer associated with this chain said that retailers and consumers are his customers. He has to deal with several customers every day. In his observation, the main characteristics of consumers are that they buy small volume and do not purchase regularly from the same retailer. Most of these consumers observe vegetables, ask about the price and other attributes of interest to them, and then say the quantity that they require. The wholesaler-cum-retailer said that he provides consumers the information that he received from his vegetable suppliers, but it is not possible for him to explain matters to every consumer in detail, and he just responds to consumers' curiosity. This indicates that retailers share consistent but imperfect information to consumers. The wholesaler-cum-retailer further said that the exchange of information between him and consumers enables him to better identify consumer preferences and predict demand. This demand is the basis for him to buy vegetables from wholesalers to run his business.

Retailers and consumers exchange information by face-to-face conversation during transactions. Since they exchange information only during transactions, the frequency of exchange is considered inadequate.
5.3.3.6 Summary of Vertical Information Structure

The degree of information quality and willingness to exchange information in different dyads of the Panchkhal vegetable supply chain is presented in Figure 5.6 in two continua. In this Figure, the degree of information quality moves from low quality on the left of the continuum to high quality on the right, and unwillingness on the left to willingness on the right of that continuum. The depiction of both of these attributes towards the lower end of each continuum results in an asymmetric information structure in the input suppliers – producers and producers – assemblers, dyads. However, the information structure is complete in the assemblers – wholesalers, and wholesalers – retailers, dyads due to the depiction of these two attributes at the higher side of the continua. The asymmetric information structure in the producers – assemblers dyad creates difficulty in the flow of reliable and accurate information about market demand from retailers to farmers, and supply information from farmers to retailers. For this reason, the overall vertical information structure is considered asymmetric in the Panchkhal vegetable supply chain.

Figure 5.6 The degree of information quality and willingness to exchange information vertically in different dyads of the Panchkhal vegetable supply chain
Three dyads are formed from input suppliers to retailers in the potato supply chain with assemblers being absent. The degree of information quality and willingness of actors to exchange information in these three dyads is presented in Figure 5.7. The depiction of the degree of information quality and willingness to exchange information towards the lower end suggests that the information structure is asymmetric in the input suppliers – producers’ dyad. The information structure is complete in producers – wholesalers, and wholesalers – retailers, dyads due to the depiction of both of these attributes towards higher side of the continua.

Since the information structure is complete from producers to retailers’ level, the flow of high quality information takes place from retailers to farmers and farmers to retailers. This assists farmers to produce and supply potatoes as per the market demand, and wholesalers and retailers to develop strategies to receive potatoes from different sources to fulfil the needs of consumers. Since the asymmetric information structure between input suppliers and producers does not have a significant effect in fulfilling market demand, the complete information structure in the other two dyads determine the overall vertical information structure of this chain. Therefore, the overall vertical information structure is more complete in the Panchkhal potato supply chain.
5.3.4 Information Structure of the Whole Chain

On the basis of the analysis of horizontal and vertical information structure, the information structure of the whole Panchkhal vegetable supply chain is prepared and presented in Figure 5.8. This Figure consists of the involvement of actors in exchanging information, the direction of information flow and types of information structure in different stages of the chain.

The actors involved in sharing information in this chain can be broadly categorized into chain actors and service providers. Among the chain actors, farmers share the information horizontally between them and vertically with other chain actors but all other actors share the information vertically with one another. The information flows outside the chain originate from wholesalers, and enters the chain flowing to producers and input suppliers. In particular, Kalimati Wholesale Market Board receives information from wholesalers and passes this to GOs, NGOs and cooperatives, and radio. The GOs, NGOs and cooperatives disseminate the information to producers and input suppliers. Anyone in the chain can benefit from the information broadcast by radio, but farmers put special attention on it.

The information flow is two-way vertically between chain actors in all four dyads and horizontally at the producers’ level. The flow is one-way from chain actors to service providers and from service providers to chain actors. Figure 5.8 shows that wholesalers are the sources of information for service providers, and the main target group of these service providers are producers, although they also supply information to input suppliers. For information to flow from wholesalers to producers, it needs to pass through one further stage (assemblers) within the chain, but through two stages (Kalimati Wholesale Market Board and GOs/NGOs/ cooperatives or radio) via service providers.

Figure 5.8 shows that the vertical information structure is more complete at the top end of the chain (wholesalers – retailers, and assemblers – wholesalers, dyads), and asymmetric at the bottom end (input suppliers – producers, and producers – assemblers, dyads). Thus, the vertical information structure is asymmetric in the whole chain (see Section 5.3.3.6) as a result of the asymmetric information structures in the dyads at the bottom end of the chain. The information structure is also asymmetric horizontally at the farmers’ level (see Section 5.3.2). As a result of the asymmetric vertical and horizontal information structure, the information structure of the whole chain is also asymmetric.
Vertical information exchange:
- Exchange of more complete information
- Exchange of asymmetric information

Horizontal information exchange:
- Exchange of asymmetric information

Information exchange between service providers and chain actors
- One-way exchange

**Figure 5.8  Information structure of the Panchkhal vegetable supply chain**

Figure 5.8 also shows that producers receive information from four different sources and disseminate to two chain actors. Other than producers, all other actors have information links with only one or two actors. Therefore, this is not a web-shaped structure. Instead, a horizontal structure is observed only at the farmers’ level, and a hierarchical structure is observed from input suppliers to retailers, and so is predominant in the chain. Hence, the information structure of the Panchkhal vegetable supply chain is *hierarchical* in shape.

Similarly, the information structure of the whole Panchkhal potato supply chain is presented in Figure 5.9. Except for the absence of assemblers, all other actors involved in exchanging information in the vegetable and potato supply chains are same. Due to the absence of
assemblers, producers form a dyad with wholesalers, and exchange information directly with them. Except for this difference, the direction of information flow is also similar to the vegetable supply chain. However, the absence of assemblers produces some differences in the information structure.

Vertical information exchange:
- Exchange of complete information
- Exchange of asymmetric information

Horizontal information exchange:
- Exchange of asymmetric information
- Information exchange between service providers and chain actors
  - One-way exchange

Figure 5.9 Information structure of the Panchkhal potato supply chain

Figure 5.9 shows that the vertical information structure is more complete in the top two dyads of this chain (wholesalers – retailers and producers – wholesalers) and asymmetric in the bottom one dyad (input suppliers – producers). Due to the exchange of more symmetric information and the high willingness of actors to share the information from producers to retailers, the overall vertical information structure is complete (see Section 5.3.3.6). However, the horizontal information structure is asymmetric in this chain (see Section 5.3.2). Although producers receive relatively complete information from wholesalers, there is difficulty in
realizing the benefits of this information as the horizontal information structure at this level is asymmetric. As a result, the information structure of the whole potato supply chain is asymmetric. Since the potato supply chain has similar structure to the vegetable supply chain, the information structure of the Panchkhal potato supply chain is also hierarchical in shape.

5.4 Chain Coordination

Both horizontal and vertical coordination are observed in the Panchkhal vegetable and potato supply chains. The horizontal coordination is observed at the producers’ level of both chains. In these chains, the vertical coordination is observed between the actors in different sequential dyads from input suppliers to retailers.

5.4.1 Horizontal Coordination

Vegetable and potato producers in Panchkhal are smallholder farmers. These farmers formed producers’ groups and cooperatives, which are the means to coordinate them horizontally. The strength of horizontal coordination at the farmers’ level is measured by the horizontal alignment of farmers in these groups or cooperatives. An analysis of production and marketing activities is carried out to establish the horizontal alignment between farmers, and a judgement is made on the degree of horizontal alignment. This degree of horizontal alignment is then depicted as a horizontal continuum with an associated summary.

The involvement of farmers formally in groups or cooperatives provides them with a forum to share ideas and so get more benefits from vegetable and potato production. Farmers said that one of the important matters on which farmers share ideas in group meetings or ward assemblies of the cooperative is the selection of appropriate crops or varieties to grow in the next season. Such meetings also explore the sources of inputs required to grow the crops or varieties, and suggestions are made to farmers on contacting identified input suppliers. This process helps to introduce seeds and technologies that are highly beneficial for the farmers in Panchkhal. However, the implementation of group or cooperative decisions is sometimes affected by the capacity of farmers to manage inputs and resources. Despite the possibilities of such problems, farmers are increasing the area under crops or varieties, like red potatoes, which have continuous high demand in the market.

Although farmers have to arrange inputs and resources from various sources individually, most of them are producing the same crops or varieties. This increases production and influence markets. Hence, the production operations discussed in groups or cooperatives contribute partially to tightening the degree of alignment between farmers.
The involvement of farmers in groups or cooperatives also makes it easy for them to get support from GOs and NGOs to introduce new technologies, resolve field problems and increase production. Government officials said that the GOs and NGOs prefer to provide technical, financial and material support to farmers through groups or cooperatives rather than to individual farmers. Their support improves the capacity of farmers to increase production.

Although most of the farmers carry out production operations as per the decision of groups or cooperatives, they undertake marketing operations independently, except for the transport of vegetables in trucks or pick-up vans from Panchkhal to Banepa. The reason behind the group transport of vegetables is to reduce cost. Farmers said that Banepa is 18 km away from Panchkhal and transporting small volume of vegetables independently to this market is costly. In addition to selling in Banepa, farmers also sell their vegetables independently to assemblers in the VCC or Tamaghat. The supply of vegetables to assemblers in three different places can reduce the risk of dependence by an individual producer on any one market. However, it also reduces the ability of farmers to gain market power. Thus, the marketing operation conducted by farmers loosens the degree of horizontal alignment between them.

On the basis of this discussion, the degree of horizontal alignment between farmers is presented in Figure 5.10. The partial contribution of production operations in tightening horizontal alignment, combined with the contribution of marketing operations in loosening horizontal alignment means that it is depicted towards the lower end of the continuum, but close to the midpoint. The depiction of this alignment towards lower side of the continuum suggests that horizontal coordination is slightly weak at the farmers’ level in the Panchkhal vegetable and potato supply chains.

| Not aligned | | Fully aligned |
|-------------|--------------------------|
| Position of alignment |

**Figure 5.10 Position of horizontal alignment between farmers in the Panchkhal vegetable and potato supply chains**

### 5.4.2 Vertical Coordination

As stated in Section 5.3.3, the actors, from input suppliers to retailers, form four dyads in the vegetable supply chain and three dyads in the potato supply chain. Input suppliers, producers
and retailers are the same in both the vegetable and potato supply chains. The wholesalers in the vegetable and potato supply chains are different, but they perform similar functions. Assemblers are absent in the potato supply chain and producers transact directly with wholesalers. Therefore, the vertical coordination between the dyadic partners in both the vegetable and potato supply chains are analysed together in four dyads: input suppliers – producers, producers – assemblers, assemblers – wholesalers and wholesalers – retailers. Out of these, the producers – assemblers’ dyad is observed only in vegetable supply chain and in place of the assemblers – wholesalers’ dyad in the vegetable supply chain there is a producers – wholesalers’ dyad in the potato supply chain.

The strength of vertical coordination is measured on a dyad by dyad basis by considering the degree to which activities are focussed on satisfying end customers (consumers), and the alignment between actors up and down the chain. Vertical coordination is considered strong if the activities of dyadic partners are focussed towards end customers and these partners are tightly aligned to each other, and it is considered weak if these two features are negative. In this section, these two features are discussed in detail for each dyad. After this discussion, the position of the degree of consumer focus and vertical alignment is presented on a continuum for each dyad, in order to illustrate the strength of vertical coordination. The strength (or degree) of vertical coordination in different dyads is determined separately, and then they are considered together to determine the strength of the overall vertical coordination in the vegetable and potato supply chains.

5.4.2.1 Input Suppliers – Producers

Farmers reported that fertilizer dealers and cooperatives supply only fertilizers, but private input dealers supply almost all types of inputs. Farmers generally prefer to buy fertilizers from fertilizer dealers or the cooperatives, and the rest of their inputs from private input dealers. However, they need to buy fertilizers from these input dealers when they are not available from other suppliers. Therefore, private input dealers are the principal input suppliers for farmers.

Farmers said that they consider the group or cooperative’s recommendation when deciding to grow types of vegetables or potatoes on their farms. These groups or cooperatives recommend growing particular types of vegetables or potatoes on the basis of their market demand. Input suppliers also consider the broad market demand when arranging the supply of seeds of vegetables and potatoes. Hence, the transaction between input suppliers and farmers is
focussed on fulfilling the types and quantity requirements of final consumers. However, this does not ensure quality, time of availability and lowest possible prices for consumers.

Farmers said that they frequently change their input suppliers, and at any one time, they buy from the place where they are most satisfied with the quality and prices of inputs. Although both of these actors want to increase their personal benefits, they appear to have inconsistent goals. Input suppliers want to increase profit from the transaction, and do not pay much attention to the quality of inputs, and their effect on production. On the contrary, farmers want to increase profit from production and are concerned about the quality of inputs. Their search for good quality inputs means that farmers frequently change their suppliers. These suppliers generally motivate farmers to buy what they have and farmers want to be assured on the quality what they are going to buy. This type of uncertainty reduces the ability of input suppliers and farmers to make appropriate transacting decisions. Since they frequently change transacting parties to achieve their goals, they are not interdependent.

Input suppliers and farmers want to satisfy consumers through supply of the types and quantity of vegetables and potatoes that consumers’ desire, but they pay less attention to other consumer requirements. This indicates that their activities are less focussed towards consumers. Therefore, the degree of consumer focus is depicted towards the lower side of the continuum, somewhere between the midpoint and lowest end (see Figure 5.11). Similarly, inconsistent goals, an inability to make appropriate decisions, and the independent nature of doing business, suggest that these two actors are loosely aligned with each other. Thus, the degree of vertical alignment is depicted towards the lowest end of the continuum (see Figure 5.11). Less focus of activities towards consumer satisfaction, and loose vertical alignment, weaken vertical coordination between input suppliers and farmers.

5.4.2.2 Producers – Assemblers
Farmers generally supply their vegetables to the market through assemblers. Assemblers collect different types of vegetables from several farmers of the area. This assists in fulfilling the types and quantity requirements of the market, and ultimately, of consumers. Farmers said that they harvest the vegetables at the appropriate stage to bring to the collection centres. They develop a schedule of harvesting, post harvesting and transporting operations so that they do not need to hold the vegetables for long duration and can supply them fresh to the market. The purpose of conducting all these activities to a set schedule is to supply good quality vegetables to consumers. However, farmers are discouraged from sorting out their
vegetables properly, due to the fact that assemblers automatically deduct a quantity margin to compensate themselves for future volume loss.

Selling vegetables without proper sorting can reduce the quality for consumers. It can also increase transaction costs. Assemblers said that the chance of spoiling good items is high when damaged and decayed items are not removed from containers. So, sorting is required at different stages before the vegetables are finally sold to consumers. Transporting these unwanted items from one stage to another also increases transport cost. Therefore, the activities performed by farmers and assemblers contribute to satisfying consumers through the supply of required types and quantity, but they are unable to guarantee the supply of good quality vegetables or reduce the transaction costs associated with this.

Farmers said that assemblers try to exploit them by reducing the price and increasing the margin for future loss. Assemblers said that they are not assured of the quality of vegetables that farmers supply. Since farmers want to increase profits by increasing the volume, they do not remove bad quality items from good ones, and want to sell all of them at the same price. Therefore, their goals are to increase individual profits at the expense of the other instead of satisfying one another. This is not consistent with a chain goal focus of satisfying consumers.

As both parties want to squeeze the other to enhance their own profit, there is lack of trust between farmers and assemblers. Farmers generally verify the price information that they receive from assemblers with the cooperative, GOs and NGOs. Assemblers also check the quality of supplied vegetables carefully before buying. Verifying the prices by farmers and quality by assemblers takes time, and impedes the ability to make a good decision on both sides.

Even though farmers and assemblers work in this environment of apparent mistrust, they are still interdependent to some extent, and prefer to transact with the same partner. Regular transaction between the same farmers and assemblers assures farmers of selling their produce during the flush season and assemblers of buying produce during times of scarcity.

This discussion suggests that the activities undertaken by farmers and assemblers are partly aimed at satisfying consumers, but their activities do not reduce transaction costs and so the final price for consumers. Hence, their activities are focussed less towards consumers, and so the degree of consumer focus is depicted towards the lower end of the continuum, somewhere between the midpoint and the lowest end (see Figure 5.11). Although farmers and assemblers are interdependent with respect to vegetable transactions, their goals are inconsistent and not
chain focused, and do not contribute to align decisions. Therefore, the degree of vertical alignment is depicted towards the lower end of the continuum, somewhere between the midpoint and the lowest end (see Figure 5.11). With activities focussed less towards consumers and loose vertical alignment between farmers and assemblers, vertical coordination in this dyad is weakened.

5.4.2.3 Assemblers – Wholesalers

Assemblers and wholesalers transact vegetables regularly with the same parties and their target is to satisfy each other, and ultimately, consumers. Assemblers follow the procedure that is asked by wholesalers in vegetable transaction, handling and transport. This begins from vegetable collection in Panchkhal or Banepa. Assemblers collect the types and quantity of vegetables from farmers as per the demand of wholesalers. The demand is generally flexible and matches with the production season. To maintain the quality, assemblers buy vegetables, pack them in appropriate containers, and load them in vehicles to dispatch to the market. They do not hold and store the vegetables for long duration. These vegetables are transported to the market at night. Transport of vegetables at this time helps to reduce the percentage loss, due to low atmospheric temperature at this time, and it makes them available to consumers next morning. The whole process of packing, handling and transporting is focussed on maintaining quality, reducing wastage, delivering vegetables at an appropriate time and reducing transport costs. Therefore, the performance of all these activities is focussed towards satisfying consumers with the type, quantity, quality, time of availability and prices of vegetables that they require.

The ultimate goal of both the assemblers and wholesalers is to get the highest return possible by satisfying consumers. To attain this goal, they transact vegetables in the environment of mutual trust and transparency. Some of the assemblers supply vegetables to wholesalers without pricing, and wholesalers sell those vegetables on commission. Apparently, they also integrate some of the business processes. Collecting vegetables from farmers and supplying these regularly to wholesalers develops trust and enables assemblers and wholesalers both to make appropriate buying and selling decisions. Since they do not change transacting parties, they are interdependent. However, assemblers need to find a few more wholesalers during the main season in order to sell all the collected vegetables. Sometimes, their regular wholesalers will help assemblers in finding other wholesalers at this time.

This discussion suggests that the activities of assemblers and wholesalers are focussed on satisfying consumers by supplying the required amount of good quality vegetables at an
appropriate time. Their efforts to reduce price by reducing transaction costs can also be considered a consumer focussed strategy. Therefore, the degree of consumer focus is depicted towards the far end of the higher side of the continuum (see Figure 5.11). Similarly, the vertical alignment between these two actors is considered tight due to consistent goals of increasing benefits by satisfying consumers, the ability to make jointly aligned buying and selling decisions, and interdependency in transactions for most of the time. As a result, the degree of vertical alignment is depicted towards the higher end of the continuum, but slightly less than that depicted for the degree of consumer focus (see Figure 5.11). The consumer focussed strategy of assemblers and wholesalers, and tight vertical alignment between them, helps to strengthen the vertical coordination in this dyad.

5.4.2.4 Wholesalers – Retailers

The activities of wholesalers and retailers are focussed towards satisfying consumers for types, quantity, quality and prices of vegetables and potatoes. Retailers need not worry much about availability of type and quantity, as wholesalers estimate their demand from everyday transactions, and buy the required quantity of most of the vegetables and potatoes from assemblers and the remaining from importers. Wholesalers’ demand is the aggregation of retailers’ demand, which is predicted from everyday transactions with consumers. Wholesalers arrange to receive vegetables before 5.00 am and sell them to retailers before 6.00 am in order to fulfil consumers’ demand for fresh vegetables everyday in the morning. Being comparatively less perishable, both wholesalers and retailers do not follow this schedule for potatoes. Retailers purchase potatoes that are sufficient to sell for about a week at a convenient time of the day from wholesalers. Wholesalers sell vegetables and potatoes to retailers in the same pack in which assemblers send them. This reduces the potential damage from transferring vegetables from one container to another. The reduction in damage and transfer of vegetables quickly from wholesalers to retailers by using the same container reduces, the costs incurred in wastage, storing and repacking. This reduction in these costs helps to reduce prices for consumers.

Wholesalers and retailers said that their goal of conducting marketing activities is to increase their own benefits by fulfilling the requirements of consumers. The consistent goal and the activities wholesalers and retailers perform in this dyad help them to develop efficiency in vegetable marketing. As a result, almost all wholesalers, and most of the retailers, associated with this chain have undertaken this business for more than five years. These two actors generally do not change their transacting parties, but some of the retailers associated with this chain purchase directly from assemblers. The transaction between wholesalers and retailers
takes place mostly on credit, which they settle at periodic intervals (in a week or fortnight). Regular transaction between the same actors for a long time, and conducting the transaction on credit, makes them interdependent.

The transaction of required type and quantity of vegetables every morning and potatoes at a convenient time, maintaining quality from marketing activities and the reduction in transaction costs suggest that wholesalers and retailers follow a consumer focussed strategy. For these reasons, the degree of consumer focus is depicted towards the higher end, somewhere between the midpoint and the highest end of the continuum (see Figure 5.11). Similarly, the consistent goals of increasing benefits by satisfying consumers, enabling the ability of each other in making their vegetable marketing decisions, and interdependency in transactions, helps to tighten the vertical alignment between wholesalers and retailers. Therefore, the degree of vertical alignment is depicted towards the higher end, close to the far end of this continuum (see Figure 5.11). The higher degree of consumer focus and tight vertical alignment helps to strengthen vertical coordination between wholesalers and retailers.

**5.4.2.5 Retailers – Consumers**

The data for this dyad was collected only from a wholesaler-cum-retailer and the consumers’ view is absent. So only the perception of this wholesaler-cum-retailer with regard to the coordination between him and consumers is reported. He said that around half of his customers, mostly consumers and few retailers, are regular, and the remaining ones are irregular, but he wants to satisfy all of them with the supply of fresh vegetables at lowest possible prices. To do so, he receives most of his vegetables directly from assemblers in Panchkhal and the rest from wholesalers at the Kalimati Wholesale Market. He receives vegetables from Panchkhal early in the morning, but he needs to open the packs to allow consumers to select from the container. In this process, the consumers who visit first get good quality vegetables, but the consumers who visit later have to buy what is left over, and the quality of such vegetables is poor. However, he does not have to pay a wholesalers’ commission on the vegetables that he receives directly from Panchkhal. He can supply these vegetables to consumers at relatively low prices. He is unable to fulfil the type and quantity demand of all of his customers as these customers are changing frequently and the demand of these frequently changing customers varies.

The goal of this retailer is to get maximum return by satisfying consumers from the quality and prices of vegetables, but the consumers’ view is absent here, and so the retailer’s claim is
unsupported. Because of the availability of several other retailers in the market, the customers of this retailer are changing and not dependent to him.

The discussion suggests that the retailer is unable to satisfy some of his customers who do not purchase vegetables regularly from him. Therefore, he is unable to fulfil his expressed goal. In addition, retailers and consumers are not interdependent. Hence, there appears to be loose vertical alignment between retailers and consumers.

5.4.2.6 Summary of Vertical Coordination

The degree of consumer focus and the alignment between actors in all different dyads of the Panchkhal vegetable supply chain is shown in Figure 5.11. When viewed in its entirety, the Figure shows that the degree of consumer focus and vertical alignment are depicted towards the higher end in the assemblers – wholesalers’ and wholesalers – retailers’ dyads. Although these two features are located in different positions in the continua, their depiction towards higher side suggests that these two dyads are contributing to strengthening the vertical coordination of the vegetable supply chain. However, these two features are depicted towards

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<tr>
<td>Producers – Input Suppliers</td>
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Figure 5.11 Position of consumer focus and vertical alignment between actors in different dyads of the Panchkhal vegetable supply chain
the lower end in input suppliers – producers’ and producers – assemblers’ dyads, indicating that these two dyads are contributing to weakening the vertical coordination of this chain. The activities conducted and the alignment between actors in input suppliers – producers’ and producers – assemblers’ dyads not only weaken the vertical coordination in these dyads, but also in the whole chain. Even though the volume of production is increasing in the Panchhkhal area, farmers are unable to supply good quality produce and reduce transaction costs. This affects the quality and prices of the vegetables until they reach consumers, even though there is strong coordination between the actors in assemblers – wholesalers’ and wholesalers – retailers’ dyads. As a result, consumers will receive inferior quality vegetables at higher prices than might be otherwise possible. This ultimately weakens the overall vertical coordination in the Panchkhal vegetable supply chain.

The degree of consumer focus and the alignment between actors in different dyads of the Panchkhal potato supply chain is presented in Figure 5.12. The activities performed and the alignment between actors in the input suppliers – producers and wholesalers – retailers’ dyads are similar to those in the vegetable supply chain. Therefore, the positions of the degree of consumer focus and the alignment between actors in these dyads are depicted at the same point in the continua as they were in the vegetable supply chain. Since producers perform the role of assemblers in this chain, the positions of the degree of consumer focus and alignment between actors in the producers – wholesalers’ dyad are depicted in the same place as they were in the assemblers – wholesalers’ dyad of the vegetable supply chain.

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<td><strong>Wholesalers – Producers</strong></td>
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<td><strong>Producers – Input Suppliers</strong></td>
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**Figure 5.12 Position of consumer focus and vertical alignment between actors in different dyads of the Panchkhal potato supply chain**
The depiction of the degree of consumer focus and vertical alignment at higher end of these continua suggests that the vertical coordination is strong in the producers – wholesalers, and wholesalers – retailers, dyads. The depiction of these two features at the lower end of the continua suggests that the vertical coordination is weak in the input suppliers – producers dyad.

The weak vertical coordination in the input suppliers – producers dyad has very less effect on the overall vertical coordination in the potato supply chain. Consumers prefer the variety of potatoes produced in Panchkhal, and the seed of such varieties is managed by farmers themselves. Therefore, farmers rely on input suppliers only for fertilizers and pesticides, and the use of these inputs has a negligible effect in consumer satisfaction. Also, the weak coordination between input suppliers and farmers does not affect production and marketing operations from farmers to retailers. Since producers, wholesalers and retailers supply potatoes which satisfy consumers the best, and they have tight vertical alignment, the overall vertical coordination in the potato supply chain is strong.

5.5 Conclusion

The results of the analysis of factors that constitute the external environment and the attributes of information structure and chain coordination are presented in this chapter. The results show that the changes in the preferences of consumers and imports or exports of vegetables create uncertainty in market demand. Supply becomes uncertain due to weather dependent production and disturbances on road transport.

The analysis of horizontal information structure at the farmers’ level and vertical information structure on sequential dyads from input suppliers to retailers has been carried out by evaluating the credibility of information that flows across the chain and willingness of actors to share the information. The results show that the horizontal information structures in both the vegetable and potato supply chains are asymmetric but the vertical information structure is asymmetric in the vegetable supply chain and more complete in the potato supply chain. Information structures of the whole vegetable and potato supply chains are found asymmetric, and hierarchical in shape while integrating the horizontal and vertical information structures in different stages of these chains.

The degree of alignment between farmers has been analysed to find out the strength of horizontal coordination at the farmers’ level. Similarly, the degree of end customer focus and
vertical alignment between the partners of sequential dyads have been analysed from input suppliers to retailers. The results show that the horizontal coordination is weak in both the vegetable and potato supply chains but the vertical coordination is weak in the vegetable supply chain and strong in the potato supply chain.

Similar pattern is observed between information structure and chain coordination in these results. Coordination is found strong in the stages where information structure is more complete and weak in the stages where information structure is asymmetric. These case results will be synthesized and then compared to other chains in the cross case analysis in Chapter 9.
Chapter 6
CHAIN ANALYSIS AND RESULTS, CHARAUDI

6.1 Introduction

The vegetable supply chain originating in Charaudi is well-known for producing fresh vegetables for supply to domestic markets. This chain can be considered a mature chain, as vegetables have been supplied to markets from the Charaudi area since the late 1980s. This supply chain originates in the catchment of the Farmers Improvement Fruit and Vegetable Producers Cooperative Ltd., Charaudi. Vegetables produced in the area surrounding this cooperative are collected in the main and satellite collection centres of the cooperative, and supplied mostly to the wholesale markets of Pokhara Sub Metropolitan City, Kathmandu Metropolitan City, Narayangadh Township and Butwal Municipality. The location of main collection centre in the map of Dhading District is presented in Figure B.1, Appendix B.

The production area of this chain extends from the tropical river basin to the high hills. For this reason, different types of vegetables are produced in different altitudes at the same time, and the same vegetables are produced for an extended period of time from the bottom to the top of the hills. These different types of vegetables are produced in this area as per the suggestions of the cooperative.

The vegetables produced in the Charaudi area are transferred to consumers via assemblers, wholesalers, and retailers (see Figure 6.1). Most of the farmers get required inputs from the cooperative to produce vegetables according to market demand. Some of the farmers also get inputs from the private input dealers who supply inputs from different locations. The majority of the vegetables produced by these farmers are sold to assemblers in the collection centre or satellite centres and a small proportion is sold directly to retailers in these centres or indirectly in Kathmandu via the cooperative. Farmers also sell some bulky vegetables directly from farms. Assemblers supply the vegetables to wholesalers of Pokhara, Kathmandu, Narayangadh and Butwal. These wholesalers sell the vegetables generally to local retailers and the retailers sell vegetables to consumers from their outlets. Price setting is done between actors in every step of the chain when vegetables are transferred from one actor to another except between farmers and the cooperative. Farmers just handover vegetables to the cooperative and their prices are determined when the cooperative sells such vegetables to retailers from its outlet in the Kalimati Wholesale Market, Kathmandu.
Figure 6.1  Product flow in the fresh vegetable supply chain originating from Charaudi

Although the quantity of vegetables supplied from this chain varies in different seasons, the collection and supply of vegetables takes place every day from Mid April to Mid February. Out of the total vegetables supplied from this chain, around 40 percent goes to Pokhara, 30 percent to Kathmandu, 15 percent to Narayangadh, five percent to Butwal and the remaining 10 percent to different small markets. The cooperative has contracted a transport operator to transport vegetables to Kathmandu. Transport of vegetables to other markets is carried out either in wholesalers’ trucks or in empty returning trucks, or on the roofs of vehicles carrying passengers.

The secondary data received from the cooperative show that the supply of vegetables from this chain is increasing. The high demand for vegetables produced in the Charaudi area, improvements in post harvest operations, transportation and handling, and the insignificant impact of vegetable imports has resulted in farmers increasing production in the Charaudi area. However, road blocks due to excessive rain during summer and occasional strikes affect vegetable supply from this chain.
A detailed description of the activities undertaken in the Charaudi vegetable supply chain is presented in Appendix B. On the basis of this description, an analysis of the external environment, information structure and chain coordination is carried out and the results derived from this analysis are presented in this chapter. The external environment is analysed by evaluating the factors that constitute it. The information structure and chain coordination are analysed both horizontally and vertically with the aid of defined attributes and features of these attributes.

6.2 The External Environment

The changing preferences of consumers as observed by the actors of the Charaudi vegetable supply chain and the reasons of these changes, imports and exports situation and their effects on domestic production and supply, factors causing demand and supply uncertainties and the activities undertaken to mitigate them are discussed in this section.

6.2.1 Changing Consumer Preferences and Regional Competition

Changing consumer preferences as identified by retailers through conversation or observation of buying behaviour of consumers are transmitted to other chain actors till they reach vegetable producers. Producers and assemblers said that the choices of consumers are different in different markets. The general preferences of consumers observed by the actors of Panchkhal vegetable supply chain on diversified and increased consumption, continuity of supply, and their interest of consuming hill grown vegetables are also observed by the actors of this chain. The reasons of these changes are also similar as they are described in Chapter 5. Therefore, the preferences of consumers which are specific to the Charaudi vegetable supply chain and the reasons of these changes are described below:

a. The demand for organic vegetables or the vegetables produced from low use of chemical fertilizers and pesticides is increasing in Kathmandu but the demand for such vegetables is insignificant in other markets. This is due to the differences in awareness level of consumers. Being a big city, the number of health conscious people, who demand organic vegetables, is high in Kathmandu. However, the majority of consumers in all these markets, including Kathmandu, emphasize more on physical appearance than on credence attributes.

b. The bottle gourds, bitter gourds and hybrid okra produced in the Charaudi area are highly preferred by consumers since these vegetables are considered tastier than those produced in the tropical plain.
c. Consumers prefer black seeded beans over the brown seeded ones, and thick shelled tomatoes over the thin shelled ones due to their better keeping quality.

Wholesalers receive vegetables from several other domestic sources and sometimes import from India to fulfil the preferences of consumers. These wholesalers also export when vegetable demand is high in India. Since these imports and exports are of regular nature, they do not significantly affect the production and supply from Charaudi.

6.2.2 Demand and Supply Uncertainties

Although the actors of this supply chain focus their attention in fulfilling consumer preferences and market demand by improving production and marketing operations, they are unable to do it fully due to the uncertainties in demand and supply situation. Changing consumer preferences affect the demand for certain types, and big festivals, the marriage season and tourist season (especially in Pokhara) affect the seasonal demand for vegetables. Farmers and assemblers said that changing consumer preferences significantly increased the demand for tomatoes, cabbages, bottle gourds, bitter gourds and okra, and reduce the demand for egg plants produced in Charaudi. Similarly, vegetable demand is high from October to November during the festive season, from December to February and from April to May during the marriage season and from September to February during the tourist season.

On the other hand, seasonal and weather dependent production, and strikes and roadblocks create uncertainties in vegetable supply. Normally, vegetable production is highest from May to August (during the rainy season), lowest from January to April and average in other months in the Charaudi area. Also, in the main season, the volume of production depends on the distribution of rainfall. If the distribution of rainfall is favourable for standing crops, there will be over production and vice versa. Marketing of vegetables becomes difficult sometimes due to strikes and roadblocks. Actors are unable to transport vegetables from production sites to markets during strikes which are called on frequently by different groups in Nepal. They also have difficulty to transport vegetables towards Pokhara, Narayangadh, Butwal and other markets in western side during the rainy season as the landslide occasionally blocks the road in Krishnabhir on the Prithvi Highway.

The discussion suggests that except on the month of May none of the high consuming seasons match with the duration when the production is highest. So, the supply exceeds demand in the highest producing seasons and demand exceeds supply in highest consuming seasons. The
actors try to minimize the effects of demand and supply uncertainties by linking the production site to different markets, wholesaling directly by the cooperative in Kathmandu and exchanging information as per their requirements.

In summary, the discussion on external environment implies that changing consumer preferences, festive season, marriage season and tourist season increases the overall vegetable demand, which guides production and marketing activities. The increasing demand motivates actors towards increasing the supply. The supply is constrained by seasonal production and disruption in the road transport. The factors bringing fluctuations in demand and supply make them uncertain.

6.3 Information Structure

The analysis of information structure of the Charaudi vegetable supply chain is undertaken horizontally at the farmers’ and assemblers’ level and vertically between actors in different dyads. The analysis aims to find out: (i) the degree of information quality and willingness of actors to exchange information in those levels and different dyads of the chain, and (ii) the positioning of actors and external agencies on the structure and the strength of exchanged information.

6.3.1 Types of Information Exchanged between Actors

The actors said that the types of information that flows across the whole chain are important to carry out chain activities and can be broadly categorized into price, demand and supply. The flow of these three types of information in the Charaudi vegetable supply chain is presented in Figure 6.2. The flow of these three types of information takes place horizontally between farmers and assemblers, vertically between actors from consumers to input suppliers, and sideways between chain actors and external agencies (service providers). The information flows horizontally between the members in groups or the cooperative but the information passes on through various stages in vertical flow and side flow, and is described below.

Out of these three types of information, price of vegetables is the most widely distributed information since this is directly related to the profit or loss from the business. Price information flows both ways from wholesalers to retailers and assemblers. Assemblers share the prices with farmers, and retailers share them with consumers. The wholesale prices disseminated by wholesalers are the most important references for setting prices between farmers and assemblers, and retailers and consumers.
Demand Side Information
Supply Side Information
Price

**Figure 6.2** Information flow in the fresh vegetable supply chain originating from Charaudi

The demand side information flows downwards from consumers to other actors and consists of the type and quantity required. Wholesalers predict demand by collecting the information from retailers on the basis of consumer preferences and by evaluating the recent sale trend from his/her own outlet.
The supply side information flows upwards from farmers to the cooperative and assemblers from where it is disseminated to other actors in the chain. The information related to supply are basically product attributes (type, variety, grade, shape and colour), quantity and time of availability.

The information flows sideways outside the chain mainly through the cooperative and wholesalers. The cooperative is functioning as an input supplier, assembler, wholesaler and service provider and exchanges information with chain actors and service providers who come in contact with it. The cooperative maintains its own record on the type, quantity and prices of vegetables from everyday transaction. It receives information on demand, supply and prices of vegetables from the Wholesale Market Boards and the GOs and NGOs. It also collects vegetable prices from nearby collection centres. The cooperative officials disseminate the information generated from its own transaction and collected from various sources to the actors up and down in the chain, Wholesale Market Boards, GOs and NGOs, and other collection centres through face-to-face communication, bulletin board and telephone. The GOs and NGOs associated with this chain collect demand, supply and price information from the cooperative and Wholesale Market Boards, and disseminate mainly to farmers and input suppliers. There are two local frequency modulation (FM) radios in Dhading District which broadcast the prices of vegetables obtained from different collection centres including the ones operated by the Charaudi cooperative and wholesale markets.

The information disseminated by external agencies support the information flow between the actors within the chain. So, the degree of information quality and willingness to exchange information is discussed horizontally on a level by level basis and vertically on a dyad by dyad basis.

### 6.3.2 Horizontal Information Structure

The horizontal information structure at the farmers’ and assemblers’ levels are analysed by evaluating the two attributes: degree of information quality and willingness to exchange information. These attributes are discussed, and a judgement is made on where they are positioned on the continua. The continua are visually presented in Figure 6.3 in Section 6.3.2.3.

#### 6.3.2.1 Farmers’ Level

Farmers said that they exchange the information related to production and marketing operations in group meetings or in ward assemblies organized by the cooperative. They also share the information informally at any time in the community. Under production operations,
they share their own experiences and the information they received from the cooperative, GOs and NGOs on which crop or variety is beneficial to grow, from where they can get the seeds and other inputs, problems that may occur in producing the crop and the ways to resolve them. Under marketing operations, they exchange information to bring improvements in harvesting, cleaning, sorting, grading, storing, packing and transporting the vegetables. The final decision on production and marketing issues is taken at the cooperative board meetings that are held 12 - 15 times a year. In group meetings or ward assemblies, farmers share the decisions made by previous board meeting and provide issues to be discussed at next meeting.

The cooperative is the main source of information for farmers. They get information from the cooperative during their visit to the office or in the community from the Cooperative Board Member representing their area. They also receive information by participating in meetings, trainings, workshops or similar programmes organized by the GOs, NGOs and seeds and fertilizer distributors. Farmers said that they find consistency in the information received from various sources. Farmers try their best to exchange not only the consistent but also more perfect information. To make the information more perfect, they sometimes take the help of the cooperative staff who explores details of the information from relevant agencies. The exchange of consistent and more perfect information helps them to develop efficiency in undertaking production and marketing operations. Farmers said that growing more than one crop at a time; emphasizing to grow the crops that require multiple harvesting; continuous improvements in harvesting, sorting, packing and transporting are contributed largely through the flow of consistent information. They also said that the exchange of information through group meetings or assemblies and informal means is adequate to fulfil their information need.

The regular exchange of consistent and more perfect information, especially within the cooperative members (farmers) contributes to build information power among them on production and marketing operations. The Cooperative Chairman said that the cooperative members are able to educate hundreds of farmers visiting Charaudi every year from different parts of the country to observe and learn the production and marketing processes. The information power build on farmers is one of the motivating factors encouraging them to continue vegetable production for years. On the other hand, this power brings continuous improvements in marketing practices which help farmers to increase the quality of vegetables to satisfy changing needs of customers. This indicates that farmers are working towards the interest of the chain. The information power build upon farmers and their motivation to work towards the interest of the chain makes them more transparent in information sharing.
The flow of consistent and more perfect information at adequate frequency within the groups or the cooperative increases the quality of information. So, the degree of information quality depicts towards the higher side but the need for farmers to rely on cooperative sometimes to exchange more perfect information and on informal means to share the information at adequate frequency slightly lower down it (see Figure 6.3). Similarly, the development of information power, focus of activities towards the interest of the chain and transparency in information sharing shows high willingness of farmers to exchange information. Hence, the degree of willingness to exchange information depicts at the end of higher side of the willingness scale (see Figure 6.3). The exchange of high quality information and the high willingness of actors to exchange information results in the information structure with more complete information at the farmers’ level.

6.3.2.2 Assemblers’ Level
Assemblers are local and almost all of them are cooperative members. Assemblers said that they get information on market demand, market arrivals and prices mainly from the cooperative office and wholesalers of different markets. The information which they receive from these two sources is consistent in normal situation but it becomes inconsistent when there is strike, road blocks or other disruptions in transportation and marketing. These assemblers normally meet and discuss before the transaction begins and share the information which they receive from these sources. This enables them to set prices with farmers and develop an idea how much to buy and where to send. However, they admitted that they sometimes do not share total information, which they receive from wholesalers, especially when the demand and supply situation changes and market prices of vegetables go up suddenly. Yet, the exchange of information every day before transaction is adequate and helps them to undertake marketing operations properly.

According to assemblers, the information exchanged between them before transaction is focussed in developing buying strategy and helps less in developing information power. It can also be said that they sometimes show opportunistic behaviour by sharing partial information in their group. However, they share the information in transparent manner for most of the time. The transparency in information sharing helps them to develop a consensus of paying certain prices to farmers so that they need not to compete among themselves during transaction.

The discussion suggests that the information exchanged among assemblers is neither fully consistent nor perfect but it enables their capacity to set prices. However, the information is
exchanged at adequate frequency among them. The first two features contribute in decreasing the degree of information quality to some extent but the last two features contribute in increasing it. So, the degree of information quality is somewhere in the middle of that scale but slightly towards higher side (see Figure 6.3). Although assemblers are relatively transparent in information sharing, the low level of information power and opportunistic behaviour that they show indicate that the degree of willingness to exchange information lies towards lower side somewhere between the lowest end and the midpoint (see Figure 6.3). So, the information structure at the assemblers’ level is asymmetric.

6.3.2.3 Summary of Horizontal Information Structure

The horizontal information structure of the Charaudi vegetable supply chain is summarized in Figure 6.3. In this figure, the degree of information quality and willingness to exchange information are depicted as continua with the left side of the continua depicting low quality and unwillingness, and the right side depicting high quality and willingness respectively. Since both of these attributes are depicted towards the right side of the continuum, information structure is more complete at the farmers’ level. This has been associated with changes in the production and marketing operations undertaken by farmers to satisfy their buyers.

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Figure 6.3 The degree of information quality and willingness to exchange information at the farmers’ and assemblers’ level in the Charaudi vegetable supply chain

At the assemblers’ level, the degree of information quality is towards the right of the continuum but willingness to exchange information is lying towards the left of the continuum, indicating that the information structure is asymmetric. Although the information structure is asymmetric at the assemblers’ level, the horizontal exchange of information between
assemblers increases the source of information to know the demand, supply and price situation in different markets. So, it further contributes to increase the completeness of overall horizontal information structure of the chain. Therefore, the overall horizontal information structure of this chain is complete.

### 6.3.3 Vertical Information Structure

Vertically, the actors of Charaudi vegetable supply chain form dyads with other actors who come in contact with them one step above or down in the chain. These actors transact vegetables and exchange information with their dyadic partners. The vertical information structure in this chain is analysed in different sequential dyads from input suppliers to retailers. After the analysis, the degree of information quality and willingness to exchange information in each dyad is presented in continua in Figure 6.4 in Section 6.3.3.6.

#### 6.3.3.1 Input Suppliers – Producers

Farmers reported that they express their input requirements to the cooperative and private input dealers who are their input suppliers. These input suppliers provide product information to farmers while selling the inputs. In case of seeds, they also supply the information on market demand for that crop or variety. The cooperative supplies information to farmers not only during transactions, but also on other occasions, like farmers’ visits to the cooperative, meetings, trainings and gatherings. The GO and NGO officials disseminate the information on market demand for crops or varieties and important attributes of commonly available inputs to farmers during their visits or by conducting training and information sessions. Farmers said that they find consistency in the information related to demand for crops or varieties but inconsistency in the attributes of inputs. Particularly, the attributes described by private input dealers differ with the attributes described by other agencies. The effects of inconsistent information on the attributes of inputs are insignificant as farmers rely more on the information supplied by the cooperative than private input dealers. So, the flow of consistent information on the demand for crops or varieties enables farmers to prepare production plans for the next season and implement.

The cooperative collects information about past performance of the crop or variety from the seed supplier, GOs, NGOs and the area where it was produced before. The cooperative is a big buyer of seeds, fertilizers, pesticides and other inputs of private entrepreneurs. Due to this reason, these entrepreneurs disseminate detail information on the benefits of using the inputs, their market demand and current use. Considering the past performance and current situation of crops in farmers’ field, the cooperative also forecast prices of vegetables for that season.
The cooperative collects detailed information from the input use to price forecasts from various sources and supplies total information to farmers in their meetings, gatherings or individual visits to the cooperative. Since the cooperative attempts to pass more perfect information to farmers in various ways, information exchange takes place between the cooperative and farmers at required frequency. Therefore, farmers rely heavily on the cooperative and very less to the private input dealers for information. 

The exchange of consistent and more perfect information on the demand for a crop or variety and the attributes of inputs between the cooperative and farmers broaden the knowledge level of farmers on the use of seeds and other inputs. Private input dealers also suggest farmers to grow the crops which have high market demand. Farmers of Charaudi are found well ahead in introducing the recently introduced varieties and other inputs from the information power they built from their knowledge level. The production of red kidney beans (rajma) in remote hills, introduction of ‘Pali’ variety of bitter gourd (a high yielding variety) all around the area, extensive production of bottle gourds are some examples. The increasing production of these items helps to increase the benefits for all chain actors. So, the exchange of information between input suppliers and farmers is contributing to fulfil the interest of the chain. Since, the cooperative is dedicated to share the perfect information through various means; it is transparent with farmers but private input dealers are less transparent as they exchange information just to make transaction.

Since the cooperative is the main source of information in this dyad, the flow of information from private input dealers and their behaviour have little effect on the degree of information quality and willingness to exchange the information. The exchange of consistent and more perfect information at required frequency between the cooperative and farmers suggest that there is exchange of high quality information. So, the degree of information quality is towards the higher side of that continuum, but due to the exchange of inconsistent information at inadequate frequency between input dealers and farmers lowers the degree and depicts it near the midpoint (see Figure 6.4). Features like the development of information power, motivation to work towards the interest of the chain and transparency indicate that the cooperative and farmers have high willingness to exchange information. This depicts the degree of willingness to exchange information towards higher side of that continuum but the non-transparent behaviour of input dealers lowers down it but not as much as the information quality (see Figure 6.4). The flow of high quality information and high willingness of actors to exchange information depict the information structure with more complete information in this dyad.
6.3.3.2 Producers – Assemblers

Farmers said that being members of the same cooperative, they meet assemblers in the collection centres or in the villages during meetings and gatherings. Farmers share the types and quantity of vegetables they are ready to sell and enquire about the prices that they can get in Charaudi with assemblers. Assemblers tell them the prevailing prices in Charaudi and the demand and wholesale prices of those commodities mainly in Pokhara and Kathmandu markets. Sometimes, assemblers do not share recent changes in demand and prices of vegetables to farmers if these prices go up suddenly in wholesale markets.

When farmers come to the collection centres, they check the prices of vegetables posted in the cooperative’s notice board. Since farmers visit the cooperative early afternoon, they get the information of yesterday’s transaction from the notice board and find out from the cooperative staff whether the published information is still valid or not. The Cooperative Manager said that the cooperative collects information on the expected supply of vegetables from the area through its Ward Representatives; maintains records of the types, quantity and prices of everyday transactions; inquires about the prices in nearby collection centres; and collects prices and demand from the wholesale markets, and then collates all of this information. The cooperative prepares a comparative price table of vegetables at different markets and publishes this on the notice board every day in the late afternoon. It maintains other information on its records and provides this to chain actors when they enquire.

The other farmers who come to sell their vegetables on that day, retailers, FM radios, GO and NGO officials are the other sources of price information. The information exchange takes place less frequently with the GO and NGO officials but they share the information on demand and supply situation in different markets. Since farmers get similar information on price, demand and supply from various sources, they verify and compare the information they received from assemblers with other sources. The Cooperative Chairman said that farmers find consistency in most of the information they received from different sources. Assemblers also compare the information they receive directly from farmers and through the cooperative about the types and quantity of expected supply and find it consistent. The exchange of consistent information enables both the farmers and assemblers, but particularly the farmers, to make decisions whether to sell the produce to assemblers or retailers in the collection centre or handover the cooperative to send to Kalimati Wholesale Market.

The Cooperative Chairman said that if the cooperative finds farmers and assemblers cheating each other by providing false information, the cooperative asks them twice or three times to
stop it. If they continue providing false information, the cooperative does not allow such actors to transact vegetables from its collection centres. The cooperative mediates and settles the dispute, if it arises between the farmers and assemblers or retailers on the price and quality of goods. It is also difficult for the assemblers to provide false information as it can be verified instantly from the cooperative. All these activities promote the exchange of reliable and more perfect information. Since farmers and assemblers get the information from various sources and get from the cooperative at anytime, the frequency of information exchange is adequate to fulfil their requirements.

The exchange of consistent and more perfect information at required frequency builds information power both on farmers and assemblers. Due to the openness and transparency maintained by the cooperative in sharing information with chain actors, farmers and assemblers become knowledgeable to disseminate perfect information to other actors. Farmers usually handover the vegetables to the cooperative to sell them through its stall at Kalimati Wholesale Market, if they are not satisfied from the information that buyers share during price negotiation. The information power build upon farmers and assemblers, transparency maintained by the cooperative in exchanging information and the role played by the cooperative to protect farmers from false information on price negotiation motivate both farmers and assemblers to become more transparent in information sharing.

The discussion suggests that the exchange of high quality information takes place between farmers and assemblers due to the flow of consistent, more perfect and adequate information. The degree of information quality depicts towards higher side of the continuum but near the midpoint since assemblers sometimes do not share reliable and perfect information with farmers to get vegetables at lower prices when the market prices are high (see Figure 6.4). The information power built on farmers and assemblers, their focus towards benefiting the whole chain and transparency maintained in exchanging information suggest that farmers and assemblers have high willingness to exchange information. So, the degree of willingness to exchange information remains in the far end of the continuum in higher side (see Figure 6.4). The flow of high quality information coupled with high willingness of actors to exchange it depicts the information structure with more complete information.

### 6.3.3.3 Assemblers – Wholesalers

Assemblers said that most of them transact regularly with the same wholesalers of Pokhara, Narayangadh and Butwal wholesale markets. All assemblers who send vegetables to Kathmandu sell their vegetables through the cooperative stall at Kalimati Wholesale Market.
These assemblers exchange information with wholesalers twice a day regularly by phones. In the morning, they collect wholesalers' requirements as well as the price, demand and supply situation in the markets. They also ask the sources of arrivals with wholesalers. The cooperative also collects the information about demand, supply and price situation from different markets; publishes the price information on its notice board and maintains the records of others. Assemblers compare the prices of vegetables in these markets through the information they received from wholesalers and the ones published by the cooperative. They find the information consistent for most of the time. The consistent information helps assemblers to decide how much of which vegetables to send where. They inform wholesalers instantly, if they are unable to fulfil their requirements but it is very uncommon.

Assemblers exchange information with wholesalers again after sending the vegetables. They inform wholesalers the types, quantity and prices of vegetables they have sent and also describe the production and collection situation in Charaudi area. The exchange of different types of information, like the prices, demand, supply, sources of supply, production situation, and collection by telephone (two-way communication means) makes the information more reliable and perfect. If they find something imperfect, they increase the frequency of phone talks and make sure that they are more perfectly informed. The frequency of information exchange is also adequate as they contact each other at least twice a day and more upon requirements.

The types of information they share and the frequency of exchange develop information power on assemblers and wholesalers. This power helps them to share consistent and perfect information with other actors who come in contact with them and set prices in the producers – assemblers, assemblers – wholesalers and wholesalers – retailers’ dyad. The exchange of consistent and more perfect information develops cooperative behaviour that motivates assemblers and wholesalers to conduct marketing activities towards increasing the quality and reducing transaction costs. The increase in quality and reduction in transaction costs benefits not only them but also the retailers and consumers who receive vegetables later. The cooperative behaviour between assemblers and wholesalers develop trust that makes them more transparent in exchanging information.

The features of exchanged information, like the consistency, enabling ability of assemblers, perfectness and being exchanged at adequate frequency suggest that high quality information is exchanged between assemblers and wholesalers. If the market situation changes frequently, assemblers get reliable and perfect information at adequate frequency from wholesalers but
not from the cooperative. Assemblers and wholesalers communicate each other as many times as they need but the cooperative collects and publishes the information not more than one time a day. This reduces the consistency of the information as well. Since this situation arises only in few occasions in the market, these activities lower down the degree of information quality a bit from the highest end of the continuum (see Figure 6.4). The restraint of information power, cooperative behaviour and transparency suggests that these actors have high degree of willingness to exchange information and depicts it towards the end of the higher side of the continuum (see Figure 6.4). The exchange of high quality information and high willingness of actors to exchange information depict the information structure with more complete information in this dyad.

6.3.3.4 Wholesalers – Retailers

The Cooperative Manager said that the vegetables bought by assemblers reach retailers via the wholesalers in Pokhara, Narayangadh and Butwal, and via the cooperative stall at Kalimati Wholesale Market in Kathmandu. Except at the cooperative stall at Kalimati Wholesale Market, most of the wholesalers transact with the same retailers. These retailers visit wholesalers every morning to buy vegetables. During this visit, they also exchange information. In some occasions, they exchange information by phones. Wholesalers share the place of origin, price and attributes (if something special) of vegetables to retailers and retailers share consumer preferences, and the type and quantity they require to wholesalers.

Retailers said that they normally do not get the information from other sources except wholesalers. Since they do not have the other sources to compare the information, they trust wholesalers. So, wholesalers and retailers consider that the information exchanged between them is consistent. The information shared by retailers is the main basis for wholesalers to predict demand and ask their suppliers to supply the types and quantity required to fulfil it. Similarly, the information provided by wholesalers is the main basis for retailers to find out the supply situation in the market and to develop strategies to fulfil consumers’ requirements. This suggests that the exchanged information enables both actors to plan and implement marketing strategies. The exchange of information almost every day by face-to-face conversation and sometimes by phone, and their complete interdependence on the information supplied by each other indicates that they exchange more perfect information at required frequency.

The exchange of consistent and perfect information at required frequency builds information power on both wholesalers and retailers. They are cooperative to each other in exchanging
information. The supply situation of vegetables provided by wholesalers and the vegetable demand provided by retailers are the main bases for both of them to develop buying and selling strategies. However some of the retailers provided false information to wholesalers in the past to get vegetables in credit for long duration and left the business without paying their debt. Wholesalers said that this problem is greatly reduced but not fully stopped. Leaving this exception, wholesalers and retailers exchange information in transparent manner.

The quality of information, which is exchanged between wholesalers and retailers, is considered high as it is consistent, enabling to plan and implement marketing strategies, more perfect and being exchanged at required frequency. Therefore, the degree of information quality is depicted towards the far end of the higher side of the continuum (see Figure 6.4). The information power built upon them, and the cooperative behaviour and transparency maintained in exchanging information by all wholesalers and most of the retailers suggest that the actors have high willingness to exchange information. However, due to the opportunistic and non transparent behaviour of few retailers keep wholesalers in suspicion that lowers down the degree of willingness to exchange information and depicts it near the midpoint of higher side of the continuum (see Figure 6.4). The high degree of information quality and willingness to exchange information depict the information structure with more complete information.

6.3.3.5 Retailers – Consumers
A full analysis of this dyad is not possible, since the data was obtained only from the retailer. So, the information structure of this dyad in the view of this retailer is presented but will not be used in further analysis. The retailer said that consumer preference is the main basis for him to purchase vegetables from different places. He talks to several consumers everyday during transaction. When consumers visit his shop they generally check the types of vegetables they want to buy. If they find according to their choice, they observe the maturity, colour, size, shape, marks and bruises, cleanliness, and freshness. Since this retailer does not put information tag on the vegetables, consumers ask the price and place of origin with him. If they do not find vegetables according to their choice, they ask the availability of that vegetable in his shop and in the market. These conversations give retailers an idea to find out the consumer preferences. On this basis, retailers plan how much of which vegetables to buy from where. As the focus of these conversations is to make transactions, chances of getting perfect information are not high. The exchange of information everyday but only during transaction is fairly adequate for retailers to arrange vegetables in normal situation.
The exchange of information in this dyad is indicative to know consumer preferences and to predict demand. It contributes less in building information power in retailers and consumers. Although retailers try to satisfy consumers from quantity, quality and prices of vegetables, they face difficulty as they have to deal with so many changing faces every day. They just respond each other’s queries and hence are not fully transparent in exchanging information.

6.3.3.6 Summary of Vertical Information Structure

The degree of information quality and willingness to exchange information in different dyads of the Charaudi vegetable supply chain is presented in Figure 6.4. The degree of information quality and willingness to exchange information are depicted in the right hand side of the continuum indicating that these attributes are lying towards higher side in all four dyads of this chain. Although the attributes are lying towards the higher side in the continuum, they occur in different positions due to the differences in their intensity. However, the depiction of attributes towards higher side suggests that the information structure is more complete in all four dyads of this chain. The more complete information structure in all dyads signifies that

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<tr>
<th>Retailers – Wholesalers</th>
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<th>Wholesalers – Assemblers</th>
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<tr>
<th>Assemblers – Producers</th>
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<th>Producers – Input Suppliers</th>
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Figure 6.4 The degree of information quality and willingness to exchange information vertically in different dyads of the Charaudi vegetable supply chain
the information on consumer preferences and market demand observed by retailers flows onto farmers without distortion. Similarly, the position of supplying the types, quantity and quality of vegetables from Charaudi reaches retailers without difficulty.

### 6.3.4 Information Structure of the Whole Chain

From the analysis of information structure horizontally at the producers and assemblers level and vertically in dyads from input suppliers – producers to wholesalers – retailers, the information structure of the Charaudi vegetable supply chain is constructed (see Figure 6.5).

In Figure 6.5, the actors involved in exchanging information, types of information structure and the direction of flow are presented. There is involvement of chain actors and external agencies in information sharing. The cooperative functions as a chain actor as well as a service provider. The cooperative members are the main producers and assemblers, and as an institution this is one of the input suppliers, assemblers and wholesalers. As a service provider, its main function is to exchange information with other chain actors (input suppliers, producers, assemblers and wholesalers) and service providers (Wholesale Market Boards, GOs/NGOs, nearby collection centres and radio). It lies at the centre of the structure and exchanges information with chain actors and service providers.

Figure 6.5 shows the information structure in different stages of the chain and the flow of information in three different ways. The first one is the flow of more complete information horizontally at the farmers’ level and vertically in the input suppliers – producers, producers – assemblers, assemblers – wholesalers and wholesalers – retailers’ dyads. There is flow of asymmetric information horizontally at the assemblers’ level. In all these stages, there is presence of cooperative as a chain actor and the flow of information is two-way. The second one is the flow of two-way information between the cooperative and the Wholesale Market Boards, GOs/NGOs, other collection centres and radio. The third one is the one way flow of information from wholesalers to Wholesale Market Boards from where it reaches to producers via GOs/NGOs and FM radios.

The information structure of this chain includes all three types of structure: horizontal, hierarchical and web. The structure is horizontal at the farmers’ and assemblers’ level; hierarchical from input suppliers to retailers via producers, assemblers and wholesalers in sequence; and web between the cooperative and chain actors and external agencies. Although all three types of information structure are present in this chain, the web type appears to
Vertical information structure:
  With more complete information

Horizontal information structure:
  With more complete information
  With asymmetric information

Two-way information exchange between the cooperative and chain actors as well as service providers

One-way information flow between chain actors and service providers

**Figure 6.5  Information structure of the Charaudi vegetable supply chain**

dominate the others. So, the overall information structure can be considered as predominantly *web* in shape.

## 6.4 Chain Coordination

The actors are coordinated at the same or different levels of this chain with a view to increase benefits by satisfying end customers. The coordination is observed horizontally at the farmers’ and assemblers’ levels through the cooperative and groups and vertically from input suppliers to consumers in dyads. The flow of goods and information, relationships between
actors at the same or different levels of the chain, and the involvement of the cooperative in chain activities determine the degrees of horizontal and vertical coordination in this supply chain.

6.4.1 Horizontal Coordination

The horizontal coordination among farmers and assemblers is analysed by evaluating the alignment within their levels in conducting production and marketing operations. The degree of horizontal alignment in these two levels is discussed in the following sub-sections. On the basis of these discussions, a judgement is made to position the degree of horizontal alignment separately at the farmers’ level and assemblers’ level on the continua in summary section (see Figure 6.6).

6.4.1.1 Farmers’ Level

Production and marketing activities that these farmers conduct are the bases to find out the alignment between them. The alignment is assessed by evaluating whether the activities undertaken by farmers comply with group or cooperative decisions or not.

The cooperative conducts the assembly of its members at ward level and the group members organize group meetings. These assemblies and meetings evaluate past performance, review ongoing programmes and develop future programmes, and finally make decisions on whether to continue or change production activities at the farmers' level. Their decisions are basically related to introduction of new varieties or crops, arranging required inputs, and consulting GOs/NGOs and private entrepreneurs for technical information. The groups and ward assemblies forward their decisions to the cooperatives for necessary actions. The cooperative support its members as well as group members in implementing their decisions and most of these members undertake production operations as per the decisions. The support of the cooperative is helping farmers to gain market power by increasing production. Therefore, the activities performed by farmers align them tightly for production operations.

Farmers said that they prefer to grow the vegetables which require multiple harvesting. Due to this reason, they informally discuss in their group or ward and divide farmers into smaller groups to harvest the vegetables in alternate days, if it is possible. To reduce competition between farmers of the same community and to ensure continuity of supply, they prepare a harvesting schedule of these smaller groups in such a way that their harvesting days do not overlap. They also do not compete in developing relationship with assemblers rather they develop consensus in choosing assemblers for transaction. These activities indicate that farmers are tightly aligned for marketing operations as well.
The discussion suggests that the production and marketing operations undertaken by farmers comply with group and cooperative decisions. So, the degree of alignment depicts towards higher side. However, there are variations in the decisions made by each group and the cooperative. These variations bring minor differences in the activities performed by different groups and the cooperative, and lower the degree of alignment a little bit from the far end of the higher side in the continuum.

**6.4.1.2 Assemblers’ Level**

The alignment between assemblers is assessed by evaluating the contribution of marketing activities they perform in increasing customers’ satisfaction. Being the members of the same cooperative, they follow cooperative decisions and rules in doing the business and mostly work together in buying, selling, handling and transporting vegetables.

Assemblers said that there is less competition among them in buying because most of them transact with the same farmers. They also discuss among themselves when establishing relationships with wholesalers in different markets and generally do not compete when making transactions with the same wholesalers. They have adopted the processes of reducing loss by deploying skilled labour for handling the produce and reducing transport cost by transporting vegetables jointly in the same vehicle to wholesale markets. These activities help in reducing transaction costs and increasing profit margins for them and wholesalers and retailers. However, assemblers themselves admitted that, for their personal benefits, they do not share reliable and perfect information with other assemblers sometimes, especially when the market prices of vegetables go up suddenly. Although assemblers share the information related to demand, supply and price in normal situation and do not compete for establishing relationships with farmers and wholesalers, the behaviour they show with other assemblers sometimes for personal benefits reduces trust and loosens the alignment between them. Therefore, the degree of alignment between assemblers is depicted towards lower side near the midpoint in the continuum.

**6.4.1.3 Summary of Horizontal Coordination**

The horizontal alignment between farmers and assemblers at their levels is presented in Figure 6.6. The position of alignment within groups depicted in this figure suggests that the horizontal coordination is strong at the farmers’ level and weak at the assemblers’ level. The strong horizontal coordination between farmers is successful to make necessary changes in production and marketing operations to adjust them with the changing needs of customers. Although assemblers are also performing activities to satisfy customers, the weak horizontal
coordination between them reduces collective efforts and they are trying to do it independently in many cases.

Figure 6.6 Position of horizontal alignment at the farmers and assemblers’ levels in the Charaudi vegetable supply chain

The horizontal coordination at the assemblers’ level is an additional effort and it contributes in fulfilling the chain goal even if it is weak. Therefore, horizontal coordination at the farmers’ level, which is strong, determines the overall horizontal coordination of this chain.

6.4.2 Vertical Coordination

Vertical coordination between actors in the Charaudi vegetable supply chain is analysed in different dyads from input suppliers to retailers. The focus of activities performed by these dyadic partners and the degree of vertical alignment between them are the two features which are assessed separately in different dyads to find out the strength of overall vertical coordination in this chain. The activities are considered focussed towards end customers if they contribute to satisfy consumers and reduce transaction costs. Similarly, the actors are considered aligned to each other if they have consistent goals, decision making ability in favour of the chain and interdependent business relations. The focus of activities towards end customers and tight alignment between the dyadic partners contribute to strengthen vertical coordination but the limitations in these features weaken it. From these discussions, a judgement will be made to position the degree of customer focus and vertical alignment in continua in Section 6.4.2.6.
6.4.2.1 Input Suppliers – Producers

The Cooperative Manager said that almost 60 percent of the input requirement of Charaudi area is fulfilled by the cooperative. The rest of the input requirement is fulfilled by the private input dealers. There are five to six such dealers in Charaudi area. Being an input retailer, the cooperative is in contact with bulk input suppliers, which provide seeds of new crops or varieties, to satisfy changing consumer needs. In addition to seeds, the cooperative supplies fertilizers, pesticides and other inputs that help to increase the production and quality of vegetables.

Generally, consumers want to vary the items in everyday meals. The cooperative gets such information from Wholesale Market Boards, GOs and NGOs, and arranges the seeds and all other inputs to farmers so that the production will fulfil this consumers’ need. Since private input dealers have to compete with the cooperative, they manage similar inputs as the cooperative. To attract farmers, these dealers also supply inputs in credit, which can be paid after selling vegetables. Farmers said that they sometimes find differences in the actual performance and explained attributes of the inputs supplied by these dealers.

Farmers said that their goal of producing vegetables is to make profit by fulfilling consumers’ requirements. The cooperative and most of the input dealers help farmers in attaining this goal by supplying required inputs. This type of cooperation between input suppliers and farmers indicates that they have consistent goal. The input arrangements by the cooperative as well as input dealers and production decisions taken by farmers both are guided by the decisions made by the cooperative. This type of broad decision made at the cooperative’s level enables input suppliers and farmers to make individual decisions. If farmers plan to use different inputs, they inform it to the cooperative in advance, which enables the cooperative to know the reasons behind the selection of different inputs and make arrangements to supply when required. In this chain, farmers prefer to buy inputs from the cooperative but they sometimes need to go to input dealers due to the unavailability of required inputs in the cooperative or to get inputs in credit for long duration. It suggests that farmers do not always buy inputs from the same input supplier. However, farmers buy negligible amount of inputs from outside and rely on the cooperative and local input dealers to fulfil their input requirements. Due to this reason, it can be inferred that input suppliers and farmers are interdependent to each other at the local level.

The concentration of input suppliers and farmers in fulfilling changing consumer needs and reducing transaction costs by making available all the inputs from the cooperative suggests
that the activities of these two dyadic partners are focussing towards consumers. However, there are some exceptions in the part of input dealers. So, the degree of consumer focus depicts towards higher side of the continuum. However, the problems in inputs supplied by some of the input dealers and low contribution of the activities in reducing transaction costs lower it near the midpoint. Similarly, the consistent goal, ability of making decisions in favour of both parties and interdependency denote that input suppliers and farmers are tightly aligned to each other. These elements favour the degree of vertical alignment to be depicted towards the end of the continuum in higher side. The focus of most of the activities performed by input suppliers and farmers towards satisfying consumers, and tight vertical alignment between them contribute to strengthen vertical coordination.

6.4.2.2 Producers – Assemblers

Farmers from surrounding area of the cooperative bring all of their vegetables to the collection centres to sell. Except in charging market fees, the cooperative treats its members and non-members equally in selling vegetables through the collection centres. The Cooperative Chairman said that farmers sell almost 80 percent of their vegetables to assemblers and around 10 percent to retailers directly. They hand over the remaining 10 percent of the vegetables to the cooperative to sell them directly through the cooperative stall at Kalimati Wholesale Market.

Farmers said that the production of vegetables is concentrated to satisfy the interest of consumers. They get information about the consumer preferences and overall demand for different types of vegetables mainly from the cooperative and assemblers, and also from the GOs and NGOs. They increase the production of vegetables which have high demand in the market. For example: the production of bottle gourds is increasing every year to meet its increasing demand. Farmers and assemblers interact regularly on harvesting stage and methods so that they can supply quality vegetables to the markets. Farmers adjust harvesting stage of the crop to meet consumer preferences and harvesting time of the day to supply fresh vegetables. Farmers undertake cleaning, sorting, and packing of vegetables properly before taking to the collection centres but they pack vegetables mostly in doko\textsuperscript{15}s which is not a good packing material. The loss of vegetables is high in doko\textsuperscript{15}s but the transport of vegetables from farm to collections centres is easy. They use vehicles in groups wherever possible to transport the vegetables from farms to markets. These activities help to increase quality and reduce transaction costs.

\textsuperscript{15} Big bamboo basket with eyes
The Cooperative Chairman said that consumers want to buy different types of vegetables from the market everyday to fulfil their culinary needs. The cooperative set its goal to fulfil this need of consumers and suggests farmers and assemblers undertake production and marketing operations to attain this goal. Farmers and assemblers consider this as their own goal and perform the activities to attain it. Also, the regular interaction between farmers and assemblers enable them to decide what vegetables to grow and how to perform marketing activities to satisfy customers. Although farmers sell their vegetables sometimes to retailers or through the cooperative, most of the farmers sell their produce regularly to the same assemblers. Regular transactions for a long time have developed interdependency between them.

From these discussions, we can conclude that the activities performed by farmers and assemblers are focussed towards satisfying consumers and reducing transaction costs. This denotes consumer focussed nature of farmers and assemblers. However, significant reduction in transaction costs is prevented by the use of dokos on which loss percentage is slightly higher than in other small packing materials. Hence, the degree of consumer focus remains in higher side of the continuum but a bit lower from the far end. Similarly, the consistent goal, increasing ability to decide what to produce and how to market, and interdependency denote tight vertical alignment between farmers and assemblers. So, the degree of vertical alignment remains in the far end of the continuum in higher side. The focus of activities towards consumers and tight vertical alignment between farmers and assemblers strengthen the vertical coordination in this dyad.

**6.4.2.3 Assemblers – Wholesalers**

Assemblers said that they transact regularly with the same wholesalers in Pokhara, Narayangadh and Butwal wholesale markets but all of them send vegetables to the cooperative stall at Kalimati Wholesale Market in Kathmandu. Regular transaction with the same parties makes them easy to maintain records and settle financial matters at periodic intervals.

Wholesalers communicate everyday to assemblers by phones and tell assemblers the types and quantity of vegetables they require. In addition, they describe the demand, supply and price situation in the market. Market demand is directly related with consumer preferences and they explain it to assemblers in more detail with their plans to fulfil it. Assemblers are committed to fulfil wholesalers’ requirements. They try to fulfil these requirements by the vegetables arrived at Charaudi. In case they cannot fulfil the requirements from Charaudi, they visit other nearby collection centres to find out the types of vegetables asked by
wholesalers. The supply of vegetables as per the demand of wholesalers helps to fulfil the types and quantity requirements of consumers linked with this chain.

From their experiences, assemblers know the preferences of consumers of different area. So, they buy and separate vegetables according to the preferences of consumers and supply those to the wholesalers of appropriate area.

To maintain the quality requirements of consumers and reducing transaction cost, assemblers pay attention in using packing materials as well as handling and transporting. One of the assemblers said that they prefer to pack bitter gourds in *dokos* to protect the ridges and sponge gourds in crates to save them from marks. They deploy skilled contracted porters to sort, grade, pack and load the vegetables in trucks. Usually, especially designed trucks are used for transporting vegetables from the collection centres to wholesale markets. Vegetables are transported to wholesale markets at night when the temperature is low. Transport of vegetables at night also helps to make them available for consumption in next morning. All these activities help in maintaining quality, making them available for consumption on time, reducing loss as well as transaction costs.

The target of the activities performed by assemblers and wholesalers is towards making benefits by satisfying the interest of consumers. This demonstrates that they have consistent goals. Assemblers and wholesalers always consider the production situation, preferences of consumers, and market demand and supply situation before making buying and selling decisions. It enables their capacity of making appropriate decisions which benefit them instantly but also the other actors later. These two actors trust each other and make transactions by phones. They transact in credit and settle their financial matters generally weekly or fortnightly. The way they transact and settle their financial matters makes them interdependent to each other.

The activities of assemblers and wholesalers help to satisfy consumers through the supply of required quantity and quality of preferred vegetables at appropriate time of the day. These two actors also perform the activities which help to reduce transaction costs. This suggests that the activities performed by assemblers and wholesalers are focussed towards consumers and the degree of consumer focus can be depicted at the far end of the continuum in higher side. Similarly, the consistent goals of benefitting them by satisfying consumers, increasing the ability of making buying and selling decisions and interdependency for transaction suggest that there is tight alignment between assemblers and wholesalers. Therefore, the degree of vertical alignment between these two actors remains at the far end of the continuum in higher
side. The focus of activities towards consumers and tight vertical alignment between assemblers and wholesalers suggest that the vertical coordination is strong in this dyad.

6.4.2.4 Wholesalers – Retailers

The vegetables sent from Charaudi are supplied to retailers through wholesalers in Pokhara, Butwal and Narayangadh but they are supplied through the cooperative stall at Kalimati Wholesale Market in Kathmandu. The Cooperative Manager said that the cooperative stall at Kalimati Wholesale Market performs like a wholesaler in other markets. Wholesalers and retailers said that they give due consideration in the preference of consumers while transacting vegetables. Retailers receive required type and quantity of fresh vegetables from wholesalers every morning and sell most of them to consumers within an hour or two. These activities are helpful to satisfy the interest of consumers by supplying required type, quantity and quality of vegetables at appropriate time. Wholesalers usually do not store and supply vegetables instantly to retailers in the same containers on which they receive from assemblers. Selling of vegetables so quickly to retailers helps to maintain quality and reduce volume loss. The reduction in volume loss helps to reduce transaction costs.

The consumer focussed activities of both wholesalers and retailers inferred that they want to increase benefits by satisfying consumers. This demonstrates the consistent goals of these two actors. At this stage, wholesalers gather the information from retailers about consumer preferences or changes in their consumption pattern. Wholesalers have to convey this message to assemblers and the cooperative, be vigilant on the production situation and develop strategies to fulfil this need by the chain itself, or by other domestic sources or by imports. Taking decisions frequently on such matters helps to develop the decision making ability of wholesalers. In addition to fulfilling the interest of consumers, these decisions are helpful in maintaining their relationship with retailers. Wholesalers and retailers develop mutual relationship from long term transactions. Most of these transactions take place in credit and wholesalers and retailers settle their financial matters at periodic intervals, like in the next visit or in a week or fortnight. However, there are few retailers who do not pay their debt on time. This trend is going down gradually but it is not nil. So, leaving these exceptions, they trust each other and are interdependent.

Targeting to satisfy consumers through the supply of required type, quantity and quality of vegetables at appropriate time, and reducing transaction costs by reducing volume loss indicate that the activities performed by wholesalers and retailers are consumer focussed. So, the degree of consumer focus remains at the far end of the continuum in higher side.
Similarly, the consistent goals of increasing benefits by satisfying consumers, developing the decision making ability by wholesalers and interdependency between wholesalers and retailers in making transactions suggest tight vertical alignment between them. However, due to the suspicious behaviour of few retailers, wholesalers are not fully dependent on them. This lowers down the degree of vertical alignment a bit from the far end of the continuum in higher side. The performance of activities focussing towards consumers coupled with tight vertical alignment is associated with strong vertical coordination between wholesalers and retailers.

### 6.4.2.5 Retailers – Consumers

In this dyad, the data were collected only from a retailer perspective and consumers’ view is absent. So, it is difficult to derive the strength of vertical coordination in this dyad from such data. The retailer said that the transaction between retailers and consumers is not regular as in other dyads of this chain. This retailer, who purchases vegetables directly from farmers in Charaudi, transacts with several customers every day and around half among them are changing. Whether they are regular or not but he wants to satisfy them by supplying required quantity of fresh vegetables which he collects from different collection centres. He visits different places every day to buy the vegetables which his customers usually want to buy from him. As these retailers buy small volume from the collection centres, they usually pay relatively a higher price to farmers. Collecting small volume from different places and transporting them to their outlet is costlier but they save assemblers’ and wholesalers’ commission in such buying. Since these retailers put higher profit margin in such vegetables, consumers will not be benefitted on price.

Retailers’ goal is to increase benefits by supplying the required type and quantity of fresh vegetables to consumers. Since consumers are changing, it is difficult for retailers to know how satisfied consumers are from their service. Due to the visits of changing consumers, retailers have difficulty in making prediction how much of which vegetables are appropriate to buy next day. On the other hand, there are several retailers in the market and consumers have choices. As a result, they need not to be dependent on a particular retailer.

### 6.4.2.6 Summary of Vertical Coordination

The degree of the performance of actors focussing towards consumers and vertical alignment between them in four different dyads of the Charaudi vegetable supply chain is presented in Figure 6.7.
The dyad by dyad analysis shows that the activities undertaken by dyadic partners are contributing positively in satisfying consumers and reducing transaction costs (elements of end customer focus) but there are variations in this contribution in each dyad. As a result, end customer focus is depicted in different positions towards the right of the continuum in different dyads. Similarly, the levels of goal consistency, decision making ability and interdependency (elements of vertical alignment) between the dyadic partners are towards the higher side of the continuum in all four dyads. However, there are variations in levels of these elements, which cause the vertical alignment to be depicted in different positions on the right side of the continuum. The depiction of both features towards higher side of the continuum suggests that the vertical coordination is strong in this chain.

### 6.5 Conclusion

The results of the analysis of factors constituting the external environment and the attributes of information structure and chain coordination have been presented in this chapter. Changing consumer preferences and regional competition, and demand and supply uncertainties have
been analysed to find out the condition of the external environment of this chain. The results showed that changing consumer preferences, festive season, marriage season and tourist season engender fluctuations in market demand for vegetables, but imports and exports do not have significant impact on demand fluctuations. Supply chain actors attempt to fulfil the changing demand, but the seasonal nature of production and the disruption on transport facilities obstruct it.

The quality of exchanged information and the willingness of actors to exchange information have been analysed horizontally at the farmers’ and assemblers’ levels and vertically in different sequential dyads to find out the degree of overall horizontal and vertical information structures of the chain. The results showed that both the overall horizontal information structure and overall vertical information structure of the Charaudi vegetable supply chain are complete. The integration of overall horizontal and vertical information structures and the exchange of information between chain actors and service providers form web like shape of this information structure.

The strength of horizontal coordination at the farmers’ and assemblers’ levels and the strength of vertical coordination in different sequential dyads have been analysed to find out the degree of overall horizontal and vertical coordination in the chain. The results showed that the overall horizontal coordination and overall vertical coordination are strong between actors in the Charaudi vegetable supply chain.

The results obtained from the analysis provide a basis to find out the association between the external environment, information structure and chain coordination. To find out this association, these results will be synthesized and then compared to other chains in the cross case analysis.
Chapter 7
CHAIN ANALYSIS AND RESULTS, SARKETARI

7.1 Introduction
The origin of the Sarketari vegetable supply chain is centred on the Agricultural Produce Market Management Cooperative Ltd. located in Phedikhola - 9, Sarketari, Syangja. It usually ends in Syangja District Headquarter, Putalibazaar. This is a relatively new chain and has been in operation since 2005. The vegetables produced in the surrounding area of Sarketari are either collected in the main and satellite collection centres established by the cooperative or sold directly to retailers of Putalibazaar and local rural markets. The main collection centre in the map of Syangja District is depicted in Figure C.1 (Appendix C).

The production area of this chain lies in the Sarketari area of Syangja District and is in the subtropical region. Since this area is on the border of Syangja and Kaski Districts, farmers from nearby Kaski District also supply their produce through this chain. Farmers of this area are organized into groups. Representatives from each group around Sarketari area amalgamated to form the cooperative. The cooperative provides services, such as collecting vegetables, selling fertilizer and other goods, and sharing market information to its members as well as non-members. Before the beginning of the production season, the cooperative decides which crops or varieties to give priority to growing in the next season. In making such decisions, the cooperative utilizes the experience of its members and staff, information provided by GOs and NGOs, and the crop calendar prepared by GOs and NGOs. These decisions are disseminated to all group members through their representatives in the cooperative. Since the crops or varieties that are suggested by the cooperative to grow have high market demand, farmers follow the cooperative’s decisions wherever possible.

In this chain, the flow of materials takes place from input suppliers to consumers via producers, the cooperative, the wholesaler, and retailers (see Figure 7.1). Farmers arrange the inputs required to produce vegetables mainly from the private input dealers. The cooperative also sometimes supplies fertilizers. When vegetables become ready to harvest, farmers inform retailers and sell nearly 60 percent of the vegetables to them directly from farms. In these transactions, retailers get selected good quality vegetables for a slightly higher price. Farmers sell the remaining amount of vegetables through the collection centres operated by the
Figure 7.1  Product flow in the fresh vegetable supply chain originating from Sarketari cooperative. Vegetables collected in the satellite centre are also transported to the main collection centre and the cooperative sells all of these vegetables to a wholesaler from Patalibazaar. The wholesaler sells these vegetables to retailers from different markets of the District from where they are supplied to consumers. Prices are set when vegetables are transferred from one actor to another, except between farmers and collection centres. On behalf of farmers, the cooperative sets the prices of vegetables collected in the collection centres with the wholesaler.

Transaction of vegetables between farmers and retailers takes place at any time but the transaction between the cooperative and the wholesaler takes place at around 11.00 am on every Tuesday and Friday. The cooperative and the wholesaler communicate in the morning on these two days to exchange information about the availability of vegetables. There is no collection at all on some of the collection days, especially between the middle of February and middle of April. The collection centres collect vegetables from farmers on the same morning that it transacts with the wholesaler. This ensures the supply of fresh vegetables to the markets. Although farmers supply the remaining and leftover vegetables to the collection
centres, they clean and sort their vegetables properly before bringing them to the collection centres. Vegetables are transported from farms to collection centres on the backs of people, from Sarketari to Patalibazaar generally on empty trucks or on the vehicles carrying passengers, and from the wholesaler’s store to retail outlets on passenger vehicles.

Being a subtropical area, vegetables produced and supplied from Sarketari are considered superior to the vegetables produced in the tropical region and have a high market demand. To capture this advantage, farmers are increasing the area under vegetable production and the supply through this chain is on an increasing trend. Despite the increase in production, volume of supply is still too small to influence the markets. Due to high demand and low supply, the supply of vegetables from this chain usually remains unaffected by the flow of vegetables from other sources, including imports and exports. However, the hail damage that occurs almost every year in the Sarketari area makes vegetable supply in this chain uncertain.

Further detail about this chain is presented in Appendix C. In this chapter, the influence of chain activities on the external environment, information structure and coordination of the Sarketari vegetable supply chain is analysed and results derived from this analysis are presented. From the information presented in this case description, the external environment is analysed in the next section. This is followed by the analysis and results of information structure and coordination between actors horizontally and vertically in different stages of the chain.

7.2 The External Environment

Changing consumer preferences as observed by the chain actors, export - import situation, and demand and supply uncertainties are the factors that make up the external environment. The effects of these factors in this chain are discussed and an analysis is carried out to ascertain how the activities conducted by chain actors contribute to minimize their effects.

7.2.1 Changing Consumer Preferences and Regional Competition

Farmers and the cooperative staff involved in the Sarketari vegetable supply chain said that they adopt various techniques to find out the changing preferences of consumers. Farmers observe the retailers and the cooperative staff observe the wholesaler regularly during transaction to find out what they prefer to buy more. These retailers and wholesaler also suggest farmers and the cooperative staff to increase the production of those vegetables which are highly preferred by consumers. Sometime, farmers themselves visit the markets where they are supplying vegetables and try to find out what consumers prefer to buy more than
others. From their own experiences, interactions and observations, farmers and the cooperative staff find changes in the preferences of consumers over time.

The preferences of consumers as realized in Panchkhal and Charaudi chain are also experienced by the actors of this chain. The wholesaler and retailers said that consumers prefer to increase the proportion of vegetables but change the items in everyday meals. They want continuous supply of salad items and prefer to purchase hill-grown vegetables in the market. In addition, they observed that most of their consumers prefer to buy the cabbage and cauliflower heads of around one kilogram.

The gradual change in the consumption behaviour of people, health awareness programme conducted by GOs and NGOs, and attraction towards good quality vegetables are the principal causes behind these changes in the preferences of consumers. The proportion of vegetables in everyday meals is gradually increasing in the places where vegetables are supplied from the Sarketari chain. In addition, people prefer to consume different items in raw, cooked or processed forms. These people are also motivated by the health awareness programmes launched by GOs and NGOs to increase the proportion as well as to consume different types of vegetables in their meals. The wholesaler said that consumers find the vegetables supplied from local chains like Sarketari are fresh, safe (due to low use of fertilizers and pesticides) and tasty (produced in the subtropical region) to eat in comparison to the vegetables supplied from Pokhara or Butwal wholesale markets. Since consumers’ focus is towards the consumption of different types of fresh vegetables, they do not want to buy big sized vegetables, especially cauliflowers and cabbages, in bulk.

To fulfil the preferences of consumers, vegetables are supplied from different sources, some of which are imported. The wholesaler said that he sells vegetables, like onions, pointed gourds, and big size tomatoes, which are imported from India. The Senior Agriculture Development Officer (SADO) said that vegetables are not only imported but also exported from Syangja District. Tomatoes produced in different parts of Syangja including Sarketari are exported informally to India during the rainy season. These imports and exports are done by the traders who are not involved in this chain. Also, the import and export is of regular type and does not affect the demand and supply situation adversely in the market.

7.2.2 Demand and Supply Uncertainties

The vegetables produced by the actors of this chain are sold in different markets within Syangja District. The demand for vegetables on these markets remains uncertain due to
changing consumer preferences. To fulfil the changing preferences of consumers, farmers focus their attention to increase the production, number of items, time of availability, and availability of suitable sizes of cabbage and cauliflower heads. However, the methods adopted by farmers, like increasing area, introducing appropriate varieties, constructing plastic tunnels, and installing drip irrigation facilities are not sufficient to increase the production and types of vegetables to fulfil the changing needs of consumers. This is due to the production of seasonal items and the reliance of farmers on weather for crop growth.

The seasonal and weather dependent nature of production, and strikes and road closure create uncertainty in supply from production site to markets. Farmers said that they produce vegetables mainly in summer (rainy) and winter seasons. Production level goes down sharply in rest of the months and even zero sometimes. The volume of production in these two seasons also depends on the distribution of rainfall and occurrence of hails. If rainfall is evenly distributed and hail damage does not occur in summer months, vegetable production increases and sometimes exceeds the market demand. In such cases, they also supply vegetables to the markets outside the district. Strikes and road closure called on by different interest groups frequently obstruct the transport of vegetables from production sites to markets. The cooperative try to supply vegetables before or after such strikes but it depends on their duration.

In summary, changing consumer preferences increase the vegetable demand and require continuity of supply but the export – import occurs regularly and does not affect the demand and supply situation. Due to high demand in the market and low supply from this chain, the vegetables produced by farmers are sold without difficulty even in the main season when there is bumper production and the demand and supply situation is fluctuating. During strikes and road closure, the actors try to supply vegetables before or after the collection day.

7.3 Information Structure

Information exchange takes place horizontally at the farmers’ level and vertically between dyadic partners from input suppliers to consumers in the Sarketari vegetable supply chain, and so the information structure is analysed horizontally at the farmers’ level and vertically in different sequential dyads. The analysis aims to identify the degree of information quality and willingness of actors to exchange information both horizontally and vertically in the chain, and the position and link of chain actors and service providers in the information structure of the whole chain.
7.3.1 Types of Information Exchanged between Actors

The information exchanged between all chain actors and between the chain actors and service providers is mainly related to the price, demand and supply. The flow of these three types of information horizontally between farmers, vertically between the actors in dyads from input suppliers to consumers, and sideways between chain actors and service providers across the Sarketari vegetable supply chain is presented in Figure 7.2. The horizontal flow is completed when information is exchanged between farmers in groups or the cooperative, but in the vertical and side flow, the same information needs to be passed through several stages to complete the exchange process. In addition, these three types of information are passed in different directions in the vertical and side flow.

The actors focus their attention on price information, as this is key determinant of the profit or loss from their businesses. They said that the wholesale prices (the prices on which wholesalers sell vegetables to retailers) are more important than others, as they are the main basis for setting prices between the cooperative and wholesaler, and retailers and consumers. The wholesale prices are set by considering the demand and supply situation of vegetables in the market. Therefore, the price information flows from wholesalers to farmers in one direction, and from wholesalers to consumers in the other direction in the chain.

Demand related information is generated by observing consumer preferences and the volume transacted between consumers and retailers. This information is then disseminated from one actor to another down to the farmers’ level. That is, the information related to demand flows from consumers to farmers via other actors in the chain.

The cooperative is the source of supply side information. The cooperative collects the types and quantity of vegetables that farmers sell through it and also directly to retailers. This information is then disseminated upwards to the consumers’ level. That is, the supply side information flows from farmers to consumers via other actors in the chain.

Information flows sideways from chain actors to service providers, and from service providers to chain actors. The wholesaler shares the price, demand and supply situation in the market to District Market Management Committee (DMMC) and Federation of Nepalese Chambers of Commerce and Industry (FNCCI), from where the information is passed on to the GOs, NGOs and the cooperative. The GOs, NGOs and the cooperative disseminate all three types of information to farmers, and market demand to private input dealers. The purpose of letting input dealers know the market demand is to help them to arrange the supply of seeds of...
Demand Side Information
Price Information
Supply Side Information

**Figure 7.2 Information flow in the Sarketari vegetable supply chain**

appropriate crops or varieties. In Syangja District, there is one FM radio that collects price information from collection centres operated by different cooperatives and the Pokhara and Butwal Wholesale Markets, and this broadcasts once a week.

This discussion suggests that farmers receive information both from the chain actors and service providers, but other actors do not. Farmers said that, because they are in close contact
with the cooperative, they get more recent information on price, demand and supply from the cooperative than the GOs and NGOs. However, getting information from two different sources provides them with the opportunity to compare and find out the consistency of information.

7.3.2 Horizontal Information Structure

Horizontal information exchange takes place at the farmers’ level. The features of the information exchanged in groups or the cooperative are now discussed to determine the degree of information quality. Similarly, the features of farmers’ behaviour are discussed to ascertain the degree of willingness to exchange information. This discussion makes it possible to locate the positions of the degree of information quality and willingness to exchange information in the continuum which is presented at the end of this section.

Farmers involved in this chain are the members of producers’ groups or the cooperative. The Cooperative Chairman said that producers’ groups work under the auspices of cooperative. So, every member of the cooperative is represented in a farmers’ group. These members then work as a bridge between the groups and the cooperative. This structure helps the cooperative to disseminate information to a large number of farmers through their groups. The group or cooperative meetings are usually held once a month where information exchange takes place between members. Information is also exchanged informally when they meet each other in the community.

Farmers meet first at the group level. During group meetings, members share their own experiences and discuss the information received from the cooperative, GOs and NGOs on how to improve production and marketing operations. To improve production operations, they focus their discussion mainly on selecting the most appropriate crops or varieties to grow in the next season, arranging seeds and other inputs, identifying possible problems that may occur during the production process, and uncovering measures to resolve these problems. To improve marketing operations, they discuss techniques of proper harvesting, cleaning, sorting, packing and smooth handling of the produce. The groups take decisions on these matters and then forward meeting minutes to the cooperative if the cooperative’s action is required on any point. The cooperative makes final decision on such matters at its monthly meetings.

Farmers said that they discuss the information they receive from different sources and reach a conclusion in group meetings. The conclusion is then converted into a decision which is read at the end of the meeting. As a result, consistent information is exchanged between farmers.
Discussion on any particular issue helps group members to explore the details about it before reaching a conclusion. Such details increase the perfectness of exchanged information. The exchange of consistent and perfect information enables farmers to undertake production and marketing operations as per the decision made by the groups. Since farmers meet and make production decisions well in advance, the monthly meeting is adequate to exchange information required to undertake production operations, but the frequency of meetings is sometimes inadequate to exchange information required to undertake marketing operations. Although the demand for vegetables produced in Sarketari is high within Syangja District, farmers need to sell their produce (mostly tomatoes) outside the district in the main season. In such a situation, farmers need information quickly to make a decision, but to get information quickly from the group is difficult due to its monthly schedule of meeting.

The discussion suggests that farmers exchange consistent and relatively perfect information, which helps them to undertake production and marketing operations more efficiently, but the frequency of information exchange is sometimes inadequate during the main production season. These features indicate that the degree of information quality lies towards the higher side of the continuum but not at its highest point.

Information exchanged in groups or the cooperative broadens the knowledge level and develops information power for farmers. The Cooperative Chairman said that the changes in conducting production and marketing operations are the resultant effects of this power. Some of these farmers use this power to motivate new farmers to start vegetable production. Although farmers have become knowledgeable in conducting production and marketing operations, the information they received from groups or the cooperative does not change their marketing practices. The majority of farmers are still selling selected vegetables from farms directly to retailers at higher prices, and then bring the remaining produce to the cooperative. The Cooperative Chairman said that this behaviour of farmers communicates the wrong message and discourages other farmers who are transacting regularly with the cooperative. However, these farmers who sell directly to retailers generally share the information about such transactions with other farmers, and so it is relatively transparent.

This discussion on the features of willingness to exchange information suggests that the actors fully build information power from the exchange of information, but their behaviour is not necessarily cooperative. However, they share the information generally in transparent manner. As a result, the degree of willingness to exchange information is depicted slightly towards the lower end of the continuum, close to the midpoint.
In summary, Figure 7.3 shows the positioning of the degree of these two attributes in the continua. This depiction of these two attributes in this Figure suggests that the horizontal information structure at the farmers’ level is incomplete but is reasonably symmetric.

![Figure 7.3](image)

**Figure 7.3** The degree of information quality and willingness to exchange information at the farmers' level in the Sarketari vegetable supply chain

### 7.3.3 Vertical Information Structure

The vertical information structure of the Sarketari vegetable supply chain is analysed on a dyad by dyad basis. The degree of information quality and willingness of actors to exchange information in all dyads are then presented in horizontal continua in aggregated form in Figure 7.4 in Section 7.3.3.7.

#### 7.3.3.1 Input Suppliers – Producers

Farmers said that the cooperative and private input dealers are their input suppliers. They occasionally buy fertilizers from the cooperative, and depend on private input dealers for rest of the inputs. These suppliers provide information on the broad market demand for a crop or variety and the attributes of inputs. Farmers also receive information on the broad market demand from GOs like the DADO, and NGOs like Nepal SIMI and Community Development Resource Centre (CDRC). The information they receive from these different sources on broad market demand is consistent. However, the situation is different for the attributes of inputs. The Cooperative Chairman said that farmers and the cooperative exchange information on fertilizer attributes, but the cooperative itself is not certain about the attributes that it got from suppliers and communicated to farmers. Similarly, input dealers sometimes do not have the seeds of the variety that farmers want to buy, and instead sell them the seeds of a different variety with similar attributes. In many cases, farmers verify the attributes communicated by input suppliers with GOs and NGOs later, and find them inconsistent.

The information on broad market demand is generally insufficient and imperfect, since it just indicates which vegetables are preferred more by consumers. Normally, it does not specify
how high the demand is, and when and where the demand is high. Farmers said that input suppliers either do not get perfect information on product attributes from their bulk suppliers or they manipulate the information to sell the inputs that they have. As a result, these suppliers exchange imperfect information with farmers. The exchange of inconsistent and imperfect information between input suppliers and farmers reduces the ability of farmers to decide whether to grow the same crop or change it in the next season. Information exchange takes place between farmers and the cooperative staff whenever farmers want, but it only takes place between farmers and the input dealers during transactions. The exchange of information only during transactions is inadequate, and farmers consult the cooperative or GOs and NGOs if they experience problems after the use of inputs.

Since the information exchanged between farmers and input suppliers (primarily private input dealers), is inconsistent and imperfect, it does not build information power for farmers. Farmers said that they trust the cooperative more as it does not manipulate the information. As a result, they rely on the information provided by the cooperative to broaden their level of knowledge. The behaviour of input dealers, who sometime manipulate the information to sell their stock, is relatively less cooperative and is not transparent.

This discussion on the features of information quality suggests that the information exchanged between input suppliers and farmers is partially consistent, relatively imperfect, unable to help in making some decisions, and mainly inadequate. These features indicate that the quality of information exchanged between input suppliers and farmers is relatively low, and so the degree of information quality is depicted towards lower end of the continuum, between the lowest end and midpoint (see Figure 7.4). Similarly, the lower contribution of exchanged information in building information power for farmers, and relatively less cooperative and non-transparent behaviour of input dealers, indicates that input suppliers and farmers have a low willingness to exchange information. These features reduce the degree of willingness to exchange information, and so this is depicted towards the lower end of the continuum, near the midpoint (see Figure 7.4). The exchange of information relatively with low quality, accompanied by low willingness of actors to exchange it, indicates an information structure with asymmetric information between input suppliers and farmers.

**7.3.3.2 Producers – Retailers**

In this chain, the majority of farmers sell selected vegetables to retailers, and exchange information required making these transactions. These two actors exchange information generally by phone before making a transaction. Retailers communicate the types and quantity
of vegetables they require, and farmers communicate the prices and market demand for the vegetables that retailers want. Farmers also get information on prices and demand for vegetables from the cooperative, and the prices broadcasted by FM radio on weekly basis. Farmers generally find the information provided by retailers and other sources inconsistent. Therefore, they do not rely on the information provided by retailers, and so enquire from other sources. In addition, the information provided by retailers is very brief and imperfect since it does not cover comparative prices and demand trend in different markets. The exchange of inconsistent and imperfect information makes it difficult for farmers to decide whether to make a transaction with the retailer or not. The information exchange is also concentrated on that particular transaction, and does not help in making further transactions. Therefore, the frequency of information exchange is inadequate.

The exchange of inconsistent and imperfect information to make a one-time transaction does not build information power for farmers and retailers both. Since farmers and retailers want to make as much individual profit as they can from the transaction, they pay less attention to benefitting the other actors in this chain. Sharing imperfect information and not giving required details indicates that these two actors are relatively less transparent with each other.

The exchange of inconsistent and imperfect information which does not enable the operational efficiency of actors and the exchange of information at inadequate frequency, suggests that the quality of information exchanged between farmers and retailers is relatively low. Hence, the degree of information quality is depicted towards the lowest end of the continuum (see Figure 7.4). Similarly, these two actors have a low willingness to exchange information as they are unable to build information power, pay less attention in benefitting other chain actors, and are less transparent. As a result, the degree of willingness to exchange information is depicted towards lower end of the continuum, close to the lowest end (see Figure 7.4). The exchange of information relatively with low quality coupled with low willingness of actors to exchange information suggests that the information structure between farmers and retailers is asymmetric.

### 7.3.3.3 Producers – Cooperative

Farmers supply the remaining amount of vegetables, which is left after supplying the retailers, to the market through the cooperative. The cooperative does not actually buy, but receives vegetables and sells them on behalf of farmers. Farmers said that the cooperative is the main source of information about the prices and demand for vegetables in different markets. They get this information from the cooperative staff while bringing their vegetables for sale or
during the visits made to the cooperative for other purposes. On these visits, they indicate their capacity to supply to the cooperative. They sometime enquire about the prices and demand with retailers, the Federation of Nepalese Chambers of Commerce and Industry (FNCCI) (Syangja Branch), GOs and NGOs. They also find out the prices of vegetables in different markets from radio on a weekly basis. They generally find the information received from the cooperative consistent with that supplied by other agencies, except for retailers. On a very few occasions, they have found inconsistency in the information. If this happens, they rely on the information provided by the cooperative.

The Cooperative Chairman said that the cooperative supplies perfect information to farmers whether they sell all or only part of their produce through it. The cooperative collects information from various sources, such as the wholesaler, District Market Management Committee (DMMC) of Syangja, Shree Complex of Pokhara, Vegetable Wholesale Market of Pokhara, FNCCI, GOs, NGOs and radio, to make it more reliable and perfect. Farmers also provide perfect information on their supply position to the cooperative. The exchange of more consistent and perfect information between farmers and the cooperative helps them to produce and supply highly demanded vegetables in the market. Since farmers and the cooperative exchange information when they need, the frequency of exchange is adequate.

The exchange of more consistent and perfect information between farmers and the cooperative develops information power for both parties. Farmers are utilizing this power to increase area and production and the cooperative utilizes it to gain the trust of both farmers and the wholesaler. The cooperative is committed to benefitting farmers by providing a range of required information, from selecting varieties to marketing of their produce, but many farmers sell selected vegetables directly to retailers from farms and bring the remaining to the cooperative. It indicates that farmers are motivated more by their own personal benefits than to satisfy the cooperative’s customers. However, these farmers share the information transparently with the cooperative on how and why they sell vegetables directly to retailers from farms. The cooperative is always transparent with farmers in exchanging information.

Since the features of information exchanged between farmers and the cooperative is mostly consistent, relatively more perfect, enables farmers to produce and supply highly demanded vegetables, and adequate to undertake production and marketing operations, the quality of this information is relatively high. Hence, the degree of information quality between these two actors is depicted towards the higher end of the continuum, somewhere between the midpoint and the far end (see Figure 7.4). Similarly, features like building information power for both
actors, more cooperative behaviour by the cooperative but less cooperative behaviour by farmers, and transparency in exchanging information, suggests a moderate willingness to exchange information. The degree of willingness to exchange information is depicted towards higher end but close to the midpoint of the continuum (see Figure 7.4). The exchange of high quality information with moderate willingness to exchange information suggests the information structure between farmers and the cooperative is relatively complete.

7.3.3.4 Cooperative – Wholesaler

The cooperative sells almost all of the vegetables it collects to a wholesaler from Patalibazaar. On every collection day, when collection from farmers is over and the collection of Jausidanda satellite centre arrives to Sarketari, cooperative staff communicate collection details to the wholesaler by telephone. Similarly, the wholesaler shares the current prices and demand for different types of vegetables and their trend in the market. Later, they share the information face-to-face when they meet each other to conduct the transaction. In addition to information from the wholesaler, the cooperative receives information on prices and market demand from Wholesale Markets in Pokhara, DMMC, FNCCI, GOs and NGOs. The Cooperative Chairman said that the information received from the wholesaler and other sources is consistent.

Since the cooperative is selling vegetables on behalf of farmers, the wholesaler and the cooperative discuss the prices and market demand in various places before setting the prices. Therefore, they exchange relatively perfect information. The exchange of consistent and perfect information regularly between the cooperative and wholesaler assists the cooperative to plan what to grow and how to sell, and wholesaler to plan how much to buy from Sarketari and how much to purchase from other sources. Since they exchange information as and when needed by telephone or face-to-face conversation, the frequency of exchanging information is adequate.

The exchange of consistent and perfect information develops information power for both the cooperative and wholesaler. As a result of this power, the cooperative becomes the main source of information for farmers and the wholesaler, and the wholesaler becomes the main source of information for the cooperative, retailers, DMMC and FNCCI. The exchange of required information between the cooperative and wholesaler at adequate frequency benefits both parties and also the other actors involved in the chain. Both of these actors do not want to change transacting parties because of their cooperative behaviour and the transparent nature of information sharing.
Features like the exchange of relatively consistent and perfect information, which assists in developing the ability to plan and implement production and marketing programmes through exchange at required frequency, suggests that the cooperative and wholesaler exchange the information relatively with high quality. These features indicate that the degree of information quality is depicted towards the higher end of the continuum, near its highest point (see Figure 7.4). Features, such as building information power for actors, cooperative behaviour and transparency in sharing information, indicate that the cooperative and wholesaler have a high willingness to exchange information. As a result, the degree of willingness to exchange information is depicted towards higher end of the continuum, near its highest end (see Figure 7.4). The exchange of high quality information and high willingness of actors to exchange information describes the information structure between the cooperative and wholesaler is relatively complete.

7.3.3.5 Wholesaler – Retailers

The wholesaler said that he transacts mostly with the same retailers and has done so for a long duration. The wholesaler and retailers usually meet once a day or communicate by phone to transact vegetables, during which time they also exchange information. Retailers inform the wholesaler of the types and quantity of vegetables they want to buy and ask their prices and availability. The wholesaler aggregates their demand from this information and then fulfils it.

Since the wholesaler and retailers do not want to change transacting parties, they rely on the information disseminated by each other. However, they want to keep themselves updated about the market situation, and so enquire informally about the prices and types of vegetables sold through other wholesale or retail outlets. In most cases, retailers find consistency in the information provided by the wholesaler and these other sources of information. The wholesaler and retailers have close relationship and communicate by phone or through face-to-face contact until all matters are explained and resolved. So, they exchange relatively perfect information. The exchange of more consistent and perfect information enables both actors to plan their activities to increase or decrease the volume of certain items for sale in different seasons and to fulfil the quality requirements. The exchange of information almost every day either by phone or by face-to-face conversation is adequate in making the information consistent, perfect and enabling both the actors to plan and implement marketing activities.

The information exchanged between the wholesaler and retailers builds information power for both of them. As a result of this, the wholesaler becomes the main source of information for
the cooperative and external agencies, and retailers for consumers. Since they are transacting with the same parties for long duration, they share necessary information required to get benefits from the business and to provide better services to consumers. The wholesaler said that he informs his retailers about strikes, field supply situations, scarcity of vegetables in the market, and manages to increase supply in the short term. Sharing of information in a transparent manner is another important reason which helps them to continue transacting with the same parties. The wholesaler said that there are few retailers who do not exchange information in a transparent manner in order to delay payment or not to pay at all, but this is not their regular behaviour and only occurs when they have other problems. So, this behaviour by few retailers has negligible effect on the overall willingness of actors to exchange information.

The exchange of more consistent (in most of the cases) and perfect information, which increases the ability of actors to plan and implement marketing activities, and the exchange at adequate frequency suggests that the wholesaler and retailers exchange information relatively with high quality. So, the degree of information quality between these two actors is depicted towards higher end of the continuum, between the midpoint and its highest end (see Figure 7.4). Similarly, the information power developed between the actors and their cooperative behaviour and transparency (except few assemblers) suggests that the wholesaler and retailers have a high willingness to exchange information. Due to these features, the degree of willingness to exchange information is depicted towards the higher end of the continuum but close to its midpoint (see Figure 7.4). The exchange of high quality information and the high willingness of actors to exchange information suggest that the information structure is relatively complete between the wholesaler and retailers.

7.3.3.6 Retailers – Consumers

The data for this dyad was collected only from retailers and so the consumers’ view is absent. Therefore, the degree of information quality and willingness to exchange information in the experiences of retailers only are discussed in this section.

Retailers said that they exchange information with consumers while selling vegetables. Consumers observe the quality parameters of vegetables and ask the price. Retailers tell them the price, place of origin and other information that the consumers want to know. They exchange consistent information to all consumers in the morning or evening when they usually come to buy, but they reply just to the questions raised by consumers. Hence, they exchange imperfect information. These conversations between retailers and consumers
provide the main basis for retailers to find out what vegetables consumers prefer and in what quantities. Therefore, the information exchanged between them enables the ability of retailers to predict demand. Although these two actors exchange information only during a transaction, the frequency of exchange is adequate to predict demand.

Since consumers observe the quality parameters themselves and use them as the bargaining tool to reduce prices, the information shared by consumers gives an indication of their preferences but it is not sufficient to build information power for retailers. Retailers said that they help consumers by providing required information about the vegetables, but they are unable to provide information to every consumer in detail. Therefore, both retailers and consumers behave in a less transparent manner.

### 7.3.3.7 Summary of Vertical Information Structure

The degree of information quality and willingness to exchange information in different dyads of the Sarketari vegetable supply chain is aggregated and presented in Figure 7.4. This chain is bifurcated from the producers’ level. In the first branch, information exchange takes place directly between producers and retailers, while in the second branch, information flows from producers to retailers via the cooperative and wholesaler. Due to this bifurcation, producers form two separate dyads with the cooperative and retailers, and so there are five dyads altogether from input suppliers to retailers.

Figure 7.4 shows that the information structure is asymmetric in the input suppliers – producers’ and in the producers – retailers’ dyad. The information structure of these two dyads suggests that the information structure is asymmetric in the first branch of the chain. However, there is an information structure with more complete information in the producers – cooperative, cooperative – wholesaler and wholesaler – retailers’ dyads. Although the information structure is asymmetric in input suppliers – producers’ dyad, the more complete information structure in other dyads from producers to retailers’ level in the second branch suggests that the demand side information flows smoothly from retailers to producers and the supply side information flows smoothly from producers to retailers.

The analysis shows that the involvement of the wholesaler and cooperative plays a crucial role in enabling the more complete information structure in the different dyads from producers to retailers in the second branch. Both of these actors are the main sources of information and share more consistent and perfect information at adequate frequency with their dyadic partners, contributing for more complete information structure. Since these two actors are absent in the first branch, producers and retailers get the information first from the
7.3.4 Information Structure of the Whole Chain

From the discussion on horizontal information structure at the farmers’ level, vertical information structure in different dyads, and the exchange of information between chain actors and service providers, the information structure of the Sarketari vegetable supply chain is prepared (see Figure 7.5).
Horizontal information structure:
  With incomplete but symmetric information

Vertical information structure:
  With more complete information
  With asymmetric information

One-way information flow between chain actors and service providers

**Figure 7.5** Information structure of the Sarketari vegetable supply chain

In this chain, the information flows both ways between chain actors, but it flows one way from specific chain actors to service providers, and from service providers to other chain actors. That is; the wholesaler shares the information outside the chain with DMMC and FNCCI. These agencies share the information with the cooperative as well as the GOs and NGOs. The GOs and NGOs also share the information with the cooperative and private input dealers. The price of vegetables broadcasted by FM radio is also a source of information for the cooperative. The external agencies focus on the cooperative in disseminating information, as it provides production and marketing technologies to farmers and sells vegetables on their
behalf. The cooperative performs the role of an input supplier and assembler, and an information provider to farmers and the wholesaler.

The presence of all three types of information structure in different stages makes the overall information structure complex. The information structure is horizontal at the farmers’ level, hierarchical between chain actors and web shaped between the cooperative, chain actors and external agencies. However, if we observe the information flow and positioning of actors in total, the information structure is predominantly hierarchical in shape.

7.4 Chain Coordination

As with the information structure, horizontal coordination is observed at the farmers’ level and vertical coordination is observed in sequential dyads from input suppliers to consumers. The impact of production and marketing activities conducted by farmers to increase production and influence the markets are analysed to determine the strength of horizontal coordination. Similarly, the contribution of chain activities in satisfying consumers and the alignment between dyadic partners is analysed to find out the strength of vertical coordination in different dyads of this chain. Alignment between dyadic partners is measured from the consistency in their goals and mutual cooperation, and the extent which they enable each other in making decisions, and interdependency.

7.4.1 Horizontal Coordination

Horizontal coordination is observed between farmers through their involvement in groups or the cooperative and the implementation of production and marketing activities as per the decisions of these groups or the cooperative. The strength of horizontal coordination is measured from the degree of horizontal alignment between farmers. The degree of horizontal alignment is analysed by evaluating the contribution of farmers’ activities in increasing production and influencing the market through vegetable supply from this chain. The degree of horizontal alignment is presented in continuum at the end of this section.

The meetings of these groups and Executive Committee of the Cooperative Board are usually conducted every month. Since the cooperative is selling groceries, the cooperative meeting is required to be held several times in some months to set the prices of grocery items. The Board members also discuss issues related to vegetable production and marketing in these meetings. These meetings review the types of vegetables farmers are producing and technologies they are using, discuss the need for changing technologies, arrangement of production inputs, and occurrence of problems in production and marketing and the ways to address these. Every
year the cooperative conducts its General Assembly in which its members review the annual progress, financial statements and ongoing functions. The cooperative adds or removes some of its functions from such assemblies.

The Cooperative Chairman said that the meetings, experience sharing and decisions made by the groups or the cooperative are helping their members to carry out production operations. Growing the same variety or crop, ordering and buying inputs, transporting fertilizers, the mutual exchange of labour, experience sharing to resolve problems, and borrowing and lending farm implements are the production operations that these members carry out jointly or together. The joint performance of these activities contributes to increase production and satisfying the preferences of consumers.

There are other benefits of working in groups or the cooperative for farmers. The Cooperative Chairman said that the activities undertaken by the cooperative and farmers' groups in the Sarketari area is attracting the attention of the GOs and NGOs working in the vegetable sector. These organizations provide a crop calendar, training and material support through groups or the cooperative to improve production and marketing of vegetables.

Despite the benefits of working together in groups or the cooperative, the majority of farmers prefer to sell their vegetables individually to retailers from farms. Big producers of the area are able to sell selected good quality vegetables to retailers for a marginally higher price than they can get from the wholesaler. They have realized that the sale of good quality vegetables directly from farms and the remaining from the cooperative put them at some risk. If the wholesaler stops accepting lower quality vegetables from the cooperative, then farmers will have difficulty to sell their vegetables.

This discussion clarifies the degree of horizontal alignment between farmers, and is presented in Figure 7.6. Although the production of similar crops, following the same crop calendar, undertaking production operations jointly or together, and interdependency in resolving problems contributes to improved production operations, the farmers’ preference for selling small volumes independently lowers coordination at the market level. This loosens the horizontal alignment between farmers. Therefore, the degree of horizontal alignment is depicted towards lower end, near the middle, of the continuum. As a result of this loose alignment, horizontal coordination is relatively weak at the farmers’ level.
Vertical coordination in the Sarketari vegetable supply chain is determined from the analysis of its two features: consumer focus and vertical alignment (as stated in Section 7.4). The analysis of these features is carried out in each sequential dyad; that is, input suppliers – producers, producers – retailers, producers – cooperative, cooperative – wholesaler and wholesaler – retailers. The degree of consumer focus and vertical alignment is ascertained and are depicted in continua in Figure 7.7 Section 7.4.2.7.

### 7.4.2.1 Input Suppliers – Producers
Farmers said that they occasionally get fertilizers from the cooperative and rest of their inputs from private input dealers. The cooperative not only supplies fertilizers but also the technologies to farmers through GOs and NGOs to produce the crops or varieties which have high demand in the market. Considering the market demand, the cooperative board decides to continue or change the crops or varieties, and requests farmers to grow those crops or varieties and input dealers to supply their seeds and other necessary inputs. Farmers said that they try to grow the crops as per the cooperative decision, but input dealers try to sell them the seeds that they have in stock. Often, the cooperative’s recommendation and the availability of seeds by input dealers do not match. So, farmers try to produce vegetables which give maximum satisfaction to consumers but input suppliers pay less attention to this.

Farmers said that they want to increase benefits by producing vegetables as per the market demand, but input dealers are more concerned with making profits from their transactions with farmers. In some cases, the inputs supplied by these input dealers do not perform, as it was explained they would during the transaction. This creates uncertainty for farmers as to what to grow in the next season, and from where to buy the seeds and other inputs. This uncertainty reduces their ability to make good decisions. Farmers also find that they need to change input suppliers frequently as they have problems in finding required inputs from a particular supplier. This indicates that farmers and input suppliers are not interdependent.
In this chain, the cooperative has a small contribution in supplying inputs. As a result, the activities performed by private input dealers can be considered the activities of input suppliers. Since the input suppliers and farmers do not work together to produce vegetables as per the market demand, their activities are focussed less towards consumers. For this reason, the degree of consumer focus lies towards the lower end, between the lowest end and midpoint of the continuum (see Figure 7.7). Similarly, the inconsistent goals, activities lowering the ability of farmers to make good decisions, and the independent nature of transactions loosen the alignment between input suppliers and farmers. Therefore, the degree of vertical alignment between these two actors lies towards the lower end, close to the lowest end of the continuum (see Figure 7.7). As a result, the activities focussed less towards consumers, and the loose vertical alignment between the dyadic partners, contributes to weaken vertical coordination between input suppliers and farmers.

### 7.4.2.2 Producers – Retailers

The Cooperative Chairman said that farmers sell more than half of the vegetables produced in the Sarketari area directly to retailers. There are two main reasons behind this direct sale. The first one is that farmers save transport cost and cooperative commission. The second one is that retailers pay a relatively higher price for the vegetables as they usually visit the farms when market demand is rising. Retailers said that they can get good quality items if they purchase directly from farms. So the direct purchase enables them to supply fresh and good quality produce to consumers. Since each farmer produces only a few items on his/her farm, retailers need to visit more than one farmer to get the vegetables that they want. Alternatively, some consumer demand is left unsatisfied. Also, retailers need to invest sufficient time and money in visiting places and contacting people to collect vegetables. Although this process increases transaction costs, retailers save the wholesaler’s margin, which is normally higher than the increased transaction costs. Hence, the direct purchase from farmers’ field reduces total added costs but retailers increase their margin so that the price they receive is on a par with the market price for such vegetables. So, these transactions between farmers and retailers do not contribute to reducing the price for consumers.

This discussion suggests that the transaction between farmers and retailers takes place only when both of these actors can increase their individual profits. They transact the selected items which give highest short-term return to both of them rather than focus on meeting a long-term goal of satisfying consumers. So, the goals of these two actors are changing and are inconsistent. Although farmers prefer to transact with retailers, these two actors do not necessarily transact regularly with the same parties over time. Due to this reason, they do not
rely on each other, and farmers verify the prices of vegetables in different markets from various sources before making decisions on whether to sell directly to retailers or not. They deal only in the profitable items, and the lack of commitment to an ongoing relationship suggests that the actors are not interdependent.

This discussion suggests that the transactions between farmers and retailers are appropriate for supplying fresh and good quality vegetables but they do not supply all the types and quantity required by consumers. In addition, their activities do not reduce the price for consumers. Hence, the activities performed by these actors are partially focussed towards consumers. Therefore, the degree of consumer focus is depicted towards the lower end of the continuum, near its midpoint (see Figure 7.7). Similarly, farmers and retailers are loosely aligned to each other due to inconsistent goals, difficulty in making joint marketing decisions, and the independent nature of the transaction between them. Therefore, the degree of vertical alignment between them is depicted towards the lower end of the continuum, between the lowest end and midpoint (see Figure 7.7). The partial focus of the activities towards consumers and loose vertical alignment contributes to weaken the vertical coordination between farmers and retailers.

### 7.4.2.3 Producers – Cooperative

The Cooperative Chairman said that farmers supply around 40 percent of the total vegetables produced in the area to the cooperative. However, the percentage sale through the cooperative is gradually increasing. The increasing sale through the cooperative indicates that the volume as well as the proportion of good quality vegetables, which were previously sold to retailers, is increasing. Further to increase the supply of good quality vegetables in the market, cooperative staff orient farmers regularly and monitor vegetable quality continuously. As a result of this, farmers are improving harvesting, cleaning and sorting techniques. The increase in the quantity and quality of vegetables helps to satisfy the wholesaler in the short-run and consumers in the long-run. The collection of vegetables in the cooperative provides the opportunity to observe, inquire and transport large volumes in one lot. Similarly, the improvements in quality reduce the wastage and volume loss. These activities can make some contribution to reducing the final price for consumers by reducing transaction costs.

Since farmers and the cooperative both are focussed towards satisfying their customers with respect to quantity, quality and price; their goals are consistent. The suggestions provided by the cooperative in the selection of variety, the construction of structures, like plastic tunnels, and improvements in harvesting, cleaning and sorting techniques, enable farmers to produce
and supply vegetables as per the requirements of customers. Since retailers buy only a limited quantity of selected vegetables, farmers must sell the remaining amount of their produce through the cooperative. Likewise, vegetable sales are the major source of income for the cooperative, and it is trying to expand this as much as possible. Therefore, farmers and the cooperative are interdependent.

Although farmers generally supply their remaining vegetables to the cooperative, increasing the supply and quality of vegetables at least possible price helps to satisfy consumers to some extent. Therefore, the degree of consumer focus is depicted towards the higher end, near the midpoint of the continuum (see Figure 7.7). The goal consistency, which increases the ability of farmers to produce and supply the vegetables as per the preferences of consumers, and the interdependency between the two parties, all contribute to tighten the alignment between producers and the cooperative. Hence, this relatively tight vertical alignment between these two actors is depicted towards the higher end, between the midpoint and the highest end of the continuum (see Figure 7.7). The consumer focussed activities and tight vertical alignment between farmers and the cooperative contribute to strengthen the vertical coordination in this dyad.

### 7.4.2.4 Cooperative – Wholesaler

The Cooperative Chairman said that the cooperative and the wholesaler have adopted a consumer focussed strategy by supplying good quality produce in a timely and regular manner. Although several farmers sell selected vegetables to retailers and bring the remaining to the collection centre, the cooperative is motivating farmers to harvest these vegetables at appropriate stages, clean and sort them properly, and transport them to the collection centre quickly to improve the quality. To supply the vegetables fresh and a timely way, the cooperative has developed a time schedule to collect from farmers and sell to the wholesaler. Since different types of vegetables are collected from farmers and supplied to a single wholesaler, this transaction helps to fulfil the types and quantity requirement of the wholesaler on collection days. The wholesaler transport vegetables from the cooperative to Putilibazaar in bulk, which reduces the transport cost. The improvements made in undertaking post harvest operations, collection in the cooperative, and transport from the cooperative to market, helps to reduce the volume loss. The reduction in transport cost and volume loss contributes to reduce transaction costs and ultimately could reduce the prices of vegetables to consumers.
The cooperative wants to increase farmers’ benefits by supplying vegetables as per the interests of consumers. The wholesaler also wants to increase his benefits ultimately by satisfying consumers. This shows that both of these actors have consistent goals of increasing benefits by satisfying consumers. The wholesaler purchases all the vegetables which are collected in the cooperative and provides regular feedback to the cooperative officials to improve production and marketing activities. This enables the cooperative to decide what changes are required at both the farmer and cooperative level, and disseminate these decisions to its members for implementation. The cooperative and the wholesaler have been transacting regularly for several years, and the wholesaler is picking up all the vegetables assembled in the collection centre, although their prices may vary according to quality. The Cooperative Chairman said that the cooperative is satisfied with the buying behaviour and depends solely on the wholesaler to sell vegetables. The wholesaler said that he has made a schedule of collecting vegetables from different cooperatives and depends on this cooperative for two days a week. The transactions between the cooperative and the wholesaler make them interdependent.

This discussion suggests that the activities undertaken by the cooperative and the wholesaler are focussed towards consumers through the supply of the required quantity, quality and types of vegetables at reasonable prices on collection days. Therefore, the degree of consumer focus is depicted towards the higher end of the continuum, between the midpoint and the highest end (see Figure 7.7). The consistent goals, enabling each other in performing activities ultimately to satisfy consumers, and the interdependency between the actors, indicates that there is tight vertical alignment between the cooperative and the wholesaler. As a result of this, the vertical alignment between them is depicted towards the higher end of the continuum, near the highest end (see Figure 7.7). The activities highly focussed towards consumers, and the tight vertical alignment between the cooperative and the wholesaler, contribute to strengthen the vertical coordination in this dyad.

### 7.4.2.5 Wholesaler – Retailers

The wholesaler said that he is paying attention to satisfying retailers with the type, quantity, quality and prices of vegetables. The purpose of supplying vegetables in such a manner is to satisfy consumers who purchase vegetables from retailers. Retailers of this area prefer to select vegetables from the bulk pack but the percentage of vegetable loss remains high in this type of transaction. To keep the loss percentage low, the wholesaler started getting vegetables in suitable pack sizes, or bundles, for retailers, who then sell the whole packs or bundles. To transport vegetables from the wholesale store to retail outlets, different types of transport are
used. Retailers from distant areas use public vehicles and spend only little on transport costs. Retailers of nearby areas also pay less on transportation as they carry the vegetables themselves or use public transport. Transport of vegetables in public vehicles, rough handling during transportation, and transfer from wholesaler’s to retailers’ containers, increases volume loss, which contributes to an increase in transaction costs.

The wholesaler visits the collection centre operated by the cooperative in Sarketari two days a week, and visits other collection centres in Syangja District and the wholesale markets in Pokhara and Butwal, to fulfil the vegetable requirement of retailers. The purpose of collecting vegetables from different places and so fulfilling the requirement of retailers is to increase benefits ultimately by satisfying consumers. Retailers also buy the required type, quantity and quality of vegetables everyday or on alternate days from the wholesaler to increase their benefits by satisfying consumers. Therefore, the wholesaler and retailers have consistent goals of satisfying consumers through vegetable supply. Regular transactions between the wholesaler and retailers help the wholesaler to know the preferences of consumers and retailers to know the supply situation of different vegetables from different sources. This helps both actors to decide which vegetables to buy more of and which ones to buy less of so that the needs of consumers can be properly addressed. Both the wholesaler and retailers said that they prefer to transact with the same parties. This makes it easy for them to transact in credit and settle the payment later. Although entering and exiting of the vegetable business is common among retailers, they transact regularly with the wholesaler while doing the business. The wholesaler provides vegetables in credit to some of them, who are doing business for long duration. The transaction of the wholesaler with the same retailers, and providing vegetables to some of them on credit, makes both actors interdependent.

The activities of the wholesaler and retailers are focussed towards consumers through the supply of the required types, quantity and quality of vegetables, but the prices of vegetables are slightly increased due to increased transaction costs. So, the degree of consumer focus is moderate and depicts towards the higher end of the continuum but very close to the midpoint (see Figure 7.7). The consistent goals of satisfying consumers, enabling the ability of actors to decide what to buy more of and what to buy less of, and the interdependency between the wholesaler and most of the retailers, denotes that there is tight alignment between the wholesaler and retailers. As a result, the degree of vertical alignment between these two actors is depicted towards the higher end, between the midpoint and highest end of the continuum (see Figure 7.7). The moderate focus of activities aimed towards satisfying consumers and
tight vertical alignment between the wholesaler and retailers contribute to strengthen the vertical coordination in this dyad.

7.4.2.6 Retailers – Consumers

In the absence of consumers’ view, the degree of consumer focus and vertical alignment in this dyad is discussed on the basis of data collected from retailers. Retailers said that the vegetable trade is a small component of the total grocery business for most of them. Their conversations with consumers during transactions help retailers to predict the demand for different types of vegetables, and to buy them directly from farmers or the wholesaler. As they need to store vegetables in natural condition, they prefer to buy everyday or on alternate day to supply them fresh to consumers. This indicates that retailers try to satisfy consumers by supplying the required type, quantity and quality of vegetables.

Retailers said that their goal is to increase benefits by satisfying consumers. To achieve their goal, they mostly purchase locally produced vegetables from farmers and the wholesaler and supply them to consumers. Although the majority of the customers of these retailers are irregular, their choices are similar. This helps retailers to decide which vegetables to buy more of and which to buy less of. However, the irregular transaction between retailers and majority of consumers suggests that they are not interdependent.

7.4.2.7 Summary of Vertical Coordination

The degree of consumer focus and vertical alignment between all actors in different dyads of the Sarketari vegetable supply chain is presented in the continua in Figure 7.7. This chain is bifurcated into two branches at the producers’ level. Since producers supply vegetables to retailers and the cooperative, they form dyads with retailers in one branch, and with the cooperative in the second branch. In the first branch, there are two dyads: input suppliers – producers and producers – retailers. In the second branch, there are four dyads: input suppliers – producers, producers – cooperative, cooperative – wholesaler and wholesaler – retailers.

Since both features of vertical coordination are depicted towards the lower end of the continua in both dyads, the overall vertical coordination is weak in the first branch. In the second branch, the features of vertical coordination are depicted towards lower end in the input suppliers – producers’ dyad but they are depicted towards the higher end in the rest of the dyads. Due to weak coordination between input suppliers and producers, farmers face difficulty in producing vegetables according to consumers’ preference but due to the strong coordination from producers to retailers, the actors follow appropriate procedures to satisfy consumers in every stage during vegetable supply. Although the coordination is strong.
### Figure 7.7 Position of consumer focus and vertical alignment between actors in different dyads of the Sarketari vegetable supply chain

between actors in conducting marketing operations, the weak coordination between them in conducting production operations contribute to weaken the vertical coordination of this branch to some extent. The weak coordination between the actors in the first branch, its domination in transactions and the moderate coordination in the second branch tentatively suggests that the overall vertical coordination in this chain is slightly weak.

### 7.5 Conclusion

The results of the analysis of factors affecting the external environment, and the attributes of information structure and chain coordination have been presented in this chapter. The results showed that the consumer preferences are changing and creating uncertainty in market demand, but import and export is of regular nature and does not affect on it. To fulfil market
demand, farmers have adopted various techniques to increase production and to extend the duration of supply from this chain. However, the supply from this chain is seasonal and remains uncertain as it depends on the distribution of rainfall and occurrence of hails. Also the strikes and road closure obstruct the supply from Sarketari to different markets.

The quality of information that flows in the chain and the willingness of actors to exchange information were analysed horizontally at the farmers’ level and vertically in the sequential dyads from input suppliers to retailers. The analysis found incomplete but reasonably symmetric horizontal information structure and asymmetric vertical information structure in this chain. The aggregation of horizontal information structure at the farmers’ level, vertical information structure in different dyads and the exchange of information between chain actors and service providers gave rise an information structure of hierarchical shape for the whole Sarketari chain.

The degree of alignment of farmers within themselves was analysed to find out the strength of horizontal coordination at the farmers’ level. The analysis found weak horizontal coordination between them. Similarly, to find out the strength of vertical coordination in sequential dyads from input suppliers to retailers, the degree of customer focus on the activities performed in each dyad and the degree of alignment between dyadic partners were analysed. From the analysis of these two features, vertical coordination was found weak in the Sarketari vegetable supply chain.

The results obtained from the analysis of this case will be synthesized and used for comparing these with the results of other cases in cross-case analysis.
Chapter 8
CHAIN ANALYSIS AND RESULTS, HARTHOK

8.1 Introduction

The Harthok vegetable supply chain originates in the Harthok area of Palpa District and ends generally at the Palpa District Headquarters, Tansen. The vegetables produced in the Harthok area are brought to the collection centre established by the Harthok Agricultural Multipurpose Cooperative Ltd for sale, and are then supplied to markets mostly via a wholesaler. The location of collection centre is presented in the map of Palpa District (see Figure D.1, Appendix D). This chain has been in operation since 2003 and farmers involved in this chain are in the process of increasing production to supply the markets in Tansen and Butwal16.

The production area of the Harthok chain lies in the subtropical region and includes the Bhairabsthan, Khasyauli and Deurali VDCs. In total, 422 farmers (both members and non-members of the cooperative) are supplying vegetables through this chain. However, the majority of these farmers produce vegetables for their own consumption and sell the excess to the cooperative. There are only a few commercial vegetable producers. The cooperative organizes the production and marketing activities for this chain in a methodical way. Considering the market demand, and suggestions of GOs and NGOs, the cooperative decides well in advance which crops or varieties should be grown in the next season. The cooperative disseminates its decision to farmers through group meetings and informs input suppliers so as to facilitate the arrangement of necessary inputs. Most of the farmers follow the cooperative’s decision in producing vegetable crops or varieties. The cooperative organizes an interaction programme between producers and buyers once or twice a year to let them exchange information on the production and marketing situation.

In this chain, product is transferred from input suppliers to consumers via producers, the cooperative, wholesalers, and retailers, as presented in Figure 8.1. They buy production inputs from the cooperative or the suppliers recommended by it. When vegetables become ready to harvest, farmers harvest them and transport them to the cooperative quickly after harvesting for sale. Almost 95 percent of the vegetables produced in the area are supplied to the market

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16 Tansen and Butwal are municipalities and their population was 20,431 and 75,384 respectively according to the population census of 2001. Butwal is also a regional market of western Nepal.
through the cooperative. The cooperative collects vegetables from farmers on Monday and Thursday afternoons and sells mainly to wholesalers in the morning of the next day. Except in the main season, all the collection of the cooperative is supplied to a wholesaler from Tansen. The middle of May to the middle of July, and the middle of September to the middle of February, are two main vegetable production seasons in the Harthok area. In these two seasons, the cooperative also supplies vegetables to other wholesalers from Tansen and Butwal. Wholesalers sell these vegetables to local retailers, who later sell them to consumers. Prices of vegetables are set between actors when they are transferred from one actor to another, except between farmers and the cooperative. On behalf of farmers, the cooperative sets prices with wholesalers and receives a commission from farmers.

Farmers, the cooperative, wholesalers and retailers adopt appropriate measures to add value for consumers by supplying good quality produce at lowest possible prices. They follow appropriate procedures for harvesting, cleaning, sorting, packaging, handling and transporting to minimize losses, supply vegetables fresh, and deliver them at the required time.
May to September is one of the main vegetable production seasons in the Harthok area but this is a difficult season to produce vegetables in the tropical region due to high temperature and high rainfall. In addition, the vegetables supplied from the Harthok area are highly preferred by consumers, as they are considered superior over the vegetables produced in the tropical region. However, the supply from the Harthok chain is insufficient to meet the market demand. To fulfil this excess demand, the supply of vegetables from other sources, including imports, is normal. So, the supply of vegetables from other sources does not affect the supply from this chain.

In this chapter, how these chain activities affect the external environment, information structure and coordination between actors in the Harthok vegetable supply chain are analysed, and results derived from this analysis are presented. The activities carried out in this chain are presented in detail in the case description in Appendix D. In the next section, analysis of the factors that constitute the external environment is carried out and its overall situation is presented. This is followed by the analysis and results of the information structure and coordination between actors horizontally and vertically in different stages of the chain.

8.2 The External Environment

Changing consumer preferences, export – import situation, and demand and supply uncertainties are the external environmental factors, which are going to be analysed in this section. This analysis helps to find out how these factors arise and how they influence chain activities.

8.2.1 Changing Consumer Preferences and Regional Competition

Local retailers, the regular wholesaler and the cooperative find out the preferences of consumers by observing their buying behaviour, and interacting with them during any transaction. These preferences are communicated later to farmers for the production of vegetables as per the demand and input suppliers for the supply of appropriate inputs.

Increased proportion of vegetables in everyday meals, diversified consumption and quality consciousness are the major identified changes in the preferences of consumers. The main reason behind these changes is the health awareness developed among people in recent years. Chain actors found that the behaviour of eating more than one vegetable item in every meal has increased overall vegetable consumption. One of the important vegetable items is green leafy vegetables, the consumption of which is sharply increased. The intake of same vegetable in different forms - such as raw, cooked, processed, and as a condiment of noodles and
dumplings – tremendously increases the consumption of tomatoes, cabbages, bottle gourds, pumpkins, cucumbers and carrots.

Consumers’ attraction towards good quality vegetables is increasing. The parameters of good quality vegetables are the vegetables harvested at appropriate stage, fresh, produced by using low amount of chemical fertilizers and pesticides, free from marks and bruises, long shelf life (especially in case of tomatoes), medium sized and appropriate shape and colour. Because of the taste, vegetables produced in a subtropical region like Harthok are preferred more than the vegetables produced in tropical terai.

Vegetable imports and exports depend on domestic demand and supply situation. Wholesalers gave the example of cabbage import from India in 2008/09 due to its unexpected drop down in production level and regular type of tomato export in the rainy season. The import of vegetables during scarcity and export during the main production season are regular and do not create demand and supply uncertainties in the markets where vegetables are supplied from this chain.

8.2.2 Demand and Supply Uncertainties

Vegetable demand in the markets, where vegetables are supplied from Harthok, fluctuates mainly due to changing consumer preferences, increasing consumption during festivals and declining production in terai during the rainy season. As stated in Section 8.2.1, changing consumer preferences shifts the demand for certain vegetable items but the overall vegetable demand has gone up. Market demand for the vegetables, like tomatoes and cucumber remains constantly high all the year round. In case of other vegetables, the overall demand is increased but it fluctuates according to the production seasons. Vegetable demand also increases during festivals due to high consumption and the rainy season due to production difficulty in tropical plain.

Seasonality and weather dependent production, and strikes and road closure are the factors, which cause supply uncertainties. Farmers said that there are two main seasons for producing vegetables in the Harthok area: May – August and August – January. May – August (the duration falls in the rainy season) is the main season when farmers produce tomatoes, gourds and cucumbers. They produce cabbages, cauliflowers, radishes and broad leaf mustard from August – January. The quantity of the production in both the dry and rainy seasons depends largely on the distribution of rainfall. If rainfall is distributed properly, vegetable production goes up and supply increases. If the distribution of rainfall is not even, vegetable production
drops down and supply decreases. Strikes and road closure affect the supply of vegetables mainly from production area to markets, due to the disturbances in collection and transport. The short-supply during the strikes and over-supply before or after the strikes also impact the vegetable demand on particular days.

The actors are putting their efforts to minimize the effects of these demand and supply uncertainties. To increase the total production and extend the duration of availability, farmers are increasing production during the rainy season and inside plastic tunnels in the off-season. Also, the cooperative has started setting the target of increasing the area to fulfil the increasing demand for selected vegetables.

The discussion on external environmental factors suggests that changing consumer preferences contribute to increase vegetable demand but vegetable imports and exports is regular and is too insignificant to affect the market demand. Supply of vegetables from production site to market can become uncertain due to seasonal and weather dependent production, and short-term uncertainty arises from strikes and road closure. Supply chain actors make their efforts to address the effects of these uncertainties through changes in the way that they conduct their production and marketing activities.

8.3 Information Structure

The analysis of the information structure begins with the types of information that flow along the Harthok vegetable supply chain and the actors involved in exchanging them. The analysis is carried out horizontally between farmers and vertically between the actors who come together in dyads to conduct transactions. The analysis aims to ascertain the degree of information quality and willingness of actors in all stages in the chain. The information structure of the whole chain is then determined by positioning the actors, and linkages between them.

8.3.1 Types of Information Exchanged between Actors

The types of information which are exchanged between the actors in the Harthok vegetable supply chain can be broadly categorized into price, demand and supply. The flow of these three types of information horizontally between farmers, vertically between dyadic partners from input suppliers to consumers and sideways between chain actors and service providers is presented in Figure 8.2. The horizontal exchange is completed when the information is shared between farmers in groups or the cooperative. In vertical exchange, the information is shared between the dyadic partners in different dyads from one end of the chain to another. The
information flows outside the chain from wholesalers and enters into the chain again through farmers or the cooperative and input dealers.

The actors considered the price information to be the most important as it determines the profit or loss from the business. There are three different stages in this chain where prices are determined. The farm gate prices are set between the cooperative and wholesalers or retailers,
the wholesale prices are set between wholesalers and retailers and the retail prices are set between retailers and consumers. Among them, the wholesale prices are set on the basis of market demand and supply, and provide the basis for setting the other two prices. Therefore, wholesale prices are considered the most important and they are disseminated from wholesalers to both directions in the chain and to service providers outside the chain.

Retailers estimate the demand for the types and quantity of vegetables they require from everyday transaction with consumers. On this basis, they purchase the types and quantity of vegetables from wholesalers. Wholesalers estimate their next day’s requirement from total transaction of that day and the trend of past few days. They communicate this requirement to their suppliers. Similarly, the information is transmitted to farmers from their buyers. Therefore, the information on demand flows vertically from consumers to farmers via other actors in the chain.

The cooperative collects information by phone on the types and quantity of vegetables that farmers are going to bring for sale on the collection day. The cooperative compiles this information given by farmers and informs the wholesaler on supply availability. Information is passed from one actor to another until this information reaches consumers. Therefore, supply side information flows vertically from farmers to consumers via other actors in the chain.

The exchange of all these three types of information also takes place between chain actors and service providers. The Apex Body of the Market Management Committees (MMC) of vegetable collection centres of Palpa District collects all three types of information from participating members and wholesalers of Tansen and Butwal. This body later disseminates the collected information to GOs and NGOs working in the vegetable marketing sector and the cooperative. This body also provides the price information to FM radios. The GOs and NGOs not only disseminate information to farmers generally through the cooperative but also transmits demand related information to private input dealers so that they can arrange to get seeds of appropriate varieties for farmers.

The cooperative receives information inside the chain generally from farmers and wholesalers, and outside the chain from the Apex Body, GOs, NGOs, other cooperatives and radio broadcast. The flow of information from inside and outside the chain provides an opportunity for the cooperative to compare and analyse information from all sources before disseminating it to farmers and wholesalers. In this chain, the dissemination of information both by the cooperative and service providers is focussed on farmers. The flow of information
from these sources helps farmers to enrich their knowledge, and to speed up the process of producing and supplying vegetables according to market requirements.

8.3.2 Horizontal Information Structure

Horizontal information exchange takes place between farmers in groups or the cooperative. The members of farmers’ groups or the cooperative formally exchange the information, usually once a month during a meeting. Since the cooperative was formed by amalgamating the representatives of 24 producers groups, the cooperative is linked with all these groups. Therefore, all cooperative members are group members, and take part in group meetings as well. This type of organizational structure helps in disseminating information to the large number of people involved in the groups, and so assisting the discovery of solutions for field problems. Information exchange also takes place informally between the groups or cooperative members when they meet each other in the community.

A key purpose of farmers being involved in groups or the cooperative is to get information and other support from these entities, in order to improve their production and marketing activities. The cooperative helps farmers in improving production and marketing activities through the supply of information, which it collects mainly from GOs, NGOs and MMC Apex Body outside the chain, and wholesalers and retailers inside the chain. The cooperative mobilizes its rural information centre to collect and disseminate the information from these sources. The Cooperative Manager said that he analyzes the information received from various sources before disseminating it to farmers.

Farmers reported that their involvement in groups or the cooperative makes them easy to receive information and support from the DADO, ASC, and Nepal SIMI. They participate in training, interactions, and visit programmes to receive information from these organizations. Participating farmers in all of these programmes later share the information with other farmers during group meetings. Another important support that these organizations provide to farmers is monitoring of production fields and suggesting measures to improve ongoing production practices.

Although farmers receive information from various sources, most of it comes through the cooperative. Cooperative board members sometime take part in group meetings to share information or share it with the Group Leader by phone so that it can be disseminated to other members during the meetings. Since farmers share the information received from the cooperative in their group, the information is at the more consistent end of the scale. Also, the
information shared among farmers is at the more perfect end of the scale as the cooperative will get the necessary detail from its sources before dissemination. The exchange of this more consistent and perfect information enables farmers to undertake production and marketing operations that are aimed towards satisfying customers of the produce. The exchange of information between farmers is judged to be adequate as it is exchanged through formal and informal means. The informal exchange is also strong at this level as the cooperative members communicate the information to Group Leaders regularly and they share it to other members when required.

This discussion suggests that farmers exchange more consistent and perfect information, which increases their ability to undertake production and marketing operations more efficiently, and the communication between them is adequate to support their activities. These features suggest that the degree of information quality is towards the higher side, and towards the end of the continuum.

The interaction between farmers - formally in groups or the cooperative, and informally in the community - increases their information power. This power encourages self motivation among farmers to adopt new technologies, increase production and sell their produce through the cooperative. They use the knowledge and experience that they gain to motivate new farmers to try vegetable farming. For example, several national and international groups visit this cooperative every year to learn the practices adopted by these farmers in production, marketing and managing the groups or cooperative. These farmers are cooperative and maintain transparency in their information sharing. They also take suggestions and feedback from other members to improve the performance of their operations.

Building up information power among members, showing cooperative behaviour, and maintaining transparency in exchanging information, suggest that the farmers involved in these groups or the cooperative have a high degree of willingness to exchange information. Hence, the degree of willingness to exchange information can be depicted towards the highest end of this continuum.

The degree of information quality and willingness to exchange information at the farmers’ level that arises from this analysis is in the continuum in Figure 8.3. The degree of these two attributes increases from low to high as they move from left to right. The depiction of both attributes near the highest end of the continua suggests that the horizontal information structure at the farmers’ level is relatively more complete in this chain.
Figure 8.3 The degree of information quality and willingness to exchange information at the farmers' level in the Harthok vegetable supply chain

8.3.3 Vertical Information Structure

The degree of information quality and willingness to exchange information vertically in different sequential dyads of the Harthok vegetable supply chain is analysed from input suppliers to retailers to find out the information structures in all these dyads. These two attributes of the information structure are visually presented as continua that summarise the vertical information structure of this chain in Figure 8.4 in Section 8.3.3.6.

8.3.3.1 Input Suppliers – Producers

The cooperative and private input dealers are the input suppliers for farmers. The cooperative generally supplies cheaper inputs. The cooperative recommends to farmers that they buy all other inputs from two private input dealers of Tansen. Farmers said that they have a tendency to visit the cooperative first. They visit the input dealers later if they do not find the inputs of their choice in the cooperative.

Information is exchanged between the cooperative staff or input dealers and farmers generally during their transactions. However, the cooperative staff share information with farmers in other occasions as well. The types of information exchanged between farmers and input suppliers relate to the broad market demand for vegetables and the attributes of inputs they are transacting. Farmers receive both types of information from the cooperative whether they buy inputs from it or not, but input dealers generally do not share information with farmers if they are not transacting. Farmers receive similar types of information from the DADO and Nepal SIMI officials during trainings and other interactions. Farmers said that they find consistency in the information which they receive from all these sources. The cooperative collects information from various sources and disseminates to farmers on how to arrange and use the inputs and how to increase vegetable production. Although private input dealers make an equal contribution in supplying inputs, farmers rely more on the information provided by the
cooperative. Farmers also share their interest and capacity in producing vegetables openly to the cooperative. This indicates that these two actors exchange more perfect information.

The exchange of more consistent and perfect information improves the capacity of both input suppliers and farmers in performing their functions more efficiently, and in communicating to others ways to get more benefit from the vegetable business. The frequency of information sharing between cooperative staff and farmers is judged adequate as they share it formally in meetings and informally in other occasions when required.

The information exchanged between cooperative staff, input dealers and farmers broadens their understanding of market demand, the supply situation, and input requirements and measures to fulfil these. Broad understanding on these matters helps the actors to build information power. The cooperative and farmers use this power to disseminate consistent and perfect information to other actors who come in contact with them in other dyads, but input dealers do not get this opportunity as they do not have direct contact with other chain actors. The exchange of more consistent and perfect information with all actors increases trust and the actors become cooperative towards each other. This cooperative behaviour increases transparency in sharing information.

The discussion suggests that the information exchanged between farmers and input suppliers is relatively more consistent and perfect, able to increase the operational efficiency of both actors, and adequate. These features indicate that the exchange of relatively high quality information takes place in this dyad and the degree of information quality is depicted towards the higher side of the continuum close to the highest end (see Figure 8.4). Similarly, the development and use of information power by the cooperative and farmers in sharing information, and cooperative behaviour and transparency showed by the cooperative, input dealers and farmers indicates that the actors have high willingness to exchange information. Since input dealers do not have the opportunity to use their information power, the degree of willingness to exchange information is depicted towards higher side of the continuum somewhere between the midpoint and highest end (see Figure 8.4). The exchange of high quality information with high willingness depicts an information structure that has relatively more complete information between input suppliers and farmers.

8.3.3.2 Producers – Cooperative

The cooperative is the sole assembler in this supply chain. Farmers said that they exchange information related to vegetable marketing with the cooperative staff by phones or during their visit. On these occasions, farmers share the information on the types of vegetables they
are growing and the quantity they expect to produce in that season. The cooperative staff communicate to farmers the current market prices of vegetables which they are bringing or will bring for sale, and the demand and price trend. Farmers receive similar types of information from local retailers and sometime from the DADO and Research into Use (RIU) staff. They also get price information broadcasted by FM radios. Farmers find consistency in most of the information received from different sources. On very few occasions, particularly when the demand and supply situation are going up and down over a short duration, the information received from these sources differs. In such a situation, farmers verify the information with the cooperative staff and consider it.

The cooperative collects information about demand, supply and prices by phones from the wholesaler, the Apex Body of the market management committees of collections centres in Palpa District, local retailers and sometime from the wholesalers of Butwal Wholesale Market. In phone conversations, the cooperative staff enquire details from these sources and communicate the required information to farmers. Therefore, the information disseminated by the cooperative is more perfect for farmers. The exchange of relatively consistent and perfect information enables the efficiency of both farmers and the cooperative in developing the production and supply schedule and implement it. The sharing of information as and when required suggests that the frequency of exchange between farmers and the cooperative is adequate.

The information which enables the operational efficiency also develops information power by broadening the knowledge of farmers and cooperative staff or members. They use this power to disseminate consistent and perfect information to other actors and to communicate to visitors who want to learn about vegetable marketing processes and cooperative management. Farmers said that they do not need to wait for the cooperative staff or board members to be in the office, and can get the information by phone at any time. Farmers also share the information required for the cooperative during these conversations. This suggests that both of them are cooperative towards each other. Cooperative behaviour increases trust and encourages sharing of information in a transparent manner.

The discussion suggests that the information exchanged between farmers and the cooperative is relatively consistent and perfect, which contribute to develop working efficiency on both of them, and is adequate. These features indicate that they exchange relatively high quality information. So, the degree of information quality is depicted towards the higher side of the continuum close to the highest end (see Figure 8.4). Similarly, the features, like building
information power of each other, cooperative behaviour and transparency suggest that the actors have high willingness to exchange information. The degree of willingness to exchange information is depicted towards higher side of the continuum somewhere at the highest end (see Figure 8.4). Therefore, the information structure between farmers and the cooperative is relatively complete as they exchange high quality information with high willingness.

8.3.3.3 Cooperative – Wholesalers

The majority of the vegetables collected in the cooperative are supplied to a wholesaler from Tansen. To make transactions, the cooperative and the wholesaler exchange information by phone and face-to-face conversations. The Chairman and other staff said that the cooperative shares its supply position and receives price and demand related information from the wholesaler at least once every alternate day. The cooperative also gets similar types of information from the Apex Body, wholesalers in Butwal and other collection centres. The main functions of the Apex Body are to collect and disseminate market information from different collection centres associated with it and to undertake vegetable wholesaling in Tansen. This makes this body the second most important source of information for the cooperative after the wholesaler. Generally the cooperative consults wholesalers from Butwal if it has to sell vegetables to them and other collection centres just to verify information. The cooperative staff said that they get consistent information from these sources most of the time.

Since the cooperative has been transacting with the same wholesaler for long duration, they exchange information to the depth required by their needs. In addition, the cooperative receives information on the overall demand and supply situation of Palpa district as well as of Butwal Wholesale Market from the Apex Body. So, the information which is exchanged between the cooperative and the wholesaler is relatively perfect. The exchange of relatively consistent and perfect information enables them to develop alternative plans for buying and selling vegetables, and to inform other potential suppliers or buyers on time. As the information shared between actors is helping to undertake required functions, the frequency of exchange is adequate.

The exchange of consistent and perfect information makes cooperative staff or members and the wholesaler knowledgeable and develops information power on them. This power helps the cooperative to communicate required information to farmers, the Apex Body, collection centres established by other cooperatives, wholesalers, retailers, DADO and RIU. Similarly, this power helps the wholesaler to communicate required information to his buyers and other suppliers. In case the cooperative and the wholesaler do not have required information to
share, they enquire from other sources and make it available to the required party. From these activities, it can be inferred that they are cooperative with each other and transparent in sharing information.

The exchange of more consistent and perfect information, which allows the ability to develop alternative plans if necessary, and the exchange of information at adequate frequency suggest that the cooperative and wholesaler exchange high quality information. Therefore, the degree of information quality is depicted towards the higher side of the continuum, close to the highest end (see Figure 8.4). Similarly, the development and use of information power to share consistent and perfect information to other actors, cooperative behaviour and transparency suggest that the cooperative and the wholesaler have a high willingness to exchange information between them. Therefore, the degree of willingness to exchange information is also depicted towards the highest end of the continuum (see Figure 8.4). The exchange of high quality information with high willingness between the cooperative and the wholesaler suggests that the information structure on this dyad is relatively more complete.

### 8.3.3.4 Wholesalers – Retailers

A Tansen based wholesaler who is the main buyer of vegetables of the Harthok cooperative said that he supplies most of his purchase to the retailers of Tansen and the remaining to consumers directly. According to him, the majority of them are his regular customers. During transactions, these customers share information about the preferences of consumers, types and quantity of vegetables they want to buy, and the quality they are looking for. The wholesaler shares information related to the types, quantity, attributes and prices of vegetables he can supply. The customers of this wholesaler exchange information informally with other retailers who are buying vegetables from other wholesalers in the market. The wholesaler enquires the prices, demand and supply of vegetables from other wholesalers of Tansen and Butwal. The wholesaler and retailers also communicate information they received from other wholesalers and retailers during transaction. Most of the information they received from different sources is deemed consistent. Some of the information related to price can be inconsistent and they negotiate if this happens. The purpose of exploring information from different sources is not only to verify, but also to exchange perfect information, with the dyadic partners.

The exchange of consistent and perfect information develops the ability of both the wholesaler and retailers to prepare the buying and selling plan for the next season, and to convey this information to farmers via the cooperative. The frequency of information
exchange is adequate between them, as they communicate with each other almost every day to make transactions.

The information which enables the wholesaler and retailers to develop the operational plan for buying and selling vegetables develops mutual information power between them. This power helps the wholesaler to find out market demand and share this information to the cooperative. Similarly, retailers are able to communicate relatively consistent and perfect information about the types and quantity of vegetable supply and their future availability to consumers. The wholesaler said that the information provided by retailers helps him to buy different types and quantity of vegetables to fulfil their need. The wholesaler informs retailers about the disruption in vegetable supply due to unfavourable weather, strikes, and roadblocks and tries his best to fulfil the full or partial requirements of regular customers in difficult periods. He said that fulfilling the requirement of all customers is not possible at such times. This analysis indicates that the wholesaler and most of his customers exchange information in a cooperative and transparent manner.

The discussion suggests that the wholesaler and retailers exchange information, which is consistent for most of the time, is perfect and able to help in preparing plans and is adequate. These features suggest that they exchange relatively high quality information. Since some of the information exchanged between the wholesaler and retailers is inconsistent, the degree of information quality is depicted towards the higher side of the continuum somewhere between the midpoint and highest end (see Figure 8.4). Similarly, helping each other to build information power, cooperative behaviour and transparent manner of the wholesaler and most of the retailers suggest that the actors have high willingness to exchange information. However, the inability of the wholesaler to become transparent in sharing information with some of retailers lowers down the degree of willingness to exchange information a bit. So, the degree of willingness to exchange information is depicted towards higher side of the continuum somewhere close to the midpoint (see Figure 8.4). The exchange of relatively high quality information with high willingness implies that the information structure is relatively more complete in this dyad.

8.3.3.5 Retailers – Consumers

The data for this dyad is collected from the wholesaler who is also retailing some of his vegetables and informally from few retailers who directly transact with the cooperative. The DADO officials and the Nepal SIMI staff also talked about the information exchange process in this dyad but consumers’ view is absent. Retailers said that they answer the queries of
consumers during transaction. Retailers try to communicate consistent information, which they receive from other sources, but it is not possible for them to share all the information as they have to deal with several consumers every day. The information provided by consumers helps retailers to find out their preferences.

Retailers said that they collect information from consumers by interacting and observing their buying behaviour to estimate their demand and become able to communicate this and changes in the preferences of consumers to the cooperative. Since they do not exchange all the required information, they are not fully cooperative and transparent to consumers.

8.3.3.6 Summary of Vertical Information Structure

The degree of information quality and willingness to exchange information in different dyads of the Harthok vegetable supply chain is presented in Figure 8.4. In this Figure, the degree of information quality and willingness of actors to exchange information are depicted towards higher (right hand) side of the continua in all four dyads. Although the position of these two attributes differs in the continua, their depiction in higher side in all dyads suggests that the

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<tr>
<th>Retailers – Wholesalers</th>
<th>Unwillingness → Willingness</th>
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<td>Low quality</td>
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<tr>
<th>Wholesalers – Cooperative</th>
<th>Unwillingness → Willingness</th>
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<td>Low quality</td>
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<tr>
<th>Cooperative – Producers</th>
<th>Unwillingness → Willingness</th>
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<td>Low quality</td>
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<tr>
<th>Producers – Input Suppliers</th>
<th>Unwillingness → Willingness</th>
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<tr>
<td>Low quality</td>
<td>High quality</td>
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Figure 8.4 The degree of information quality and willingness to exchange information vertically in different dyads of the Harthok vegetable supply chain
information structure of the whole chain is more complete. The more complete information structure indicates that the information regarding the types, quantity and quality of vegetables required by consumers and produced by farmers, flows from one end of the chain to another without any difficulty.

8.3.4 Information Structure of the Whole Chain

The analysis of horizontal information structure at the farmers’ level, vertical information structure in four different dyads and information exchange between chain actors and service providers helps to construct the overall information structure of the Harthok vegetable supply chain (see Figure 8.5). In this Figure, the involvement of actors and linkages between them, types of information structure in different stages of the chain and the direction of information flow are presented.

The chain actors and service providers are involved in exchanging information. Farmers exchange the information horizontally in groups and the cooperative. The vertical exchange takes place from input suppliers to retailers in dyads. The MMC Apex Body, GOs and NGOs, other cooperatives, and FM radios are the service providers which share information with the chain actors. The cooperative performs the role of a chain actor as well as a service provider in exchanging information with others.

Since the information structure horizontally at the farmers’ level and vertically in four dyads of the chain is more complete, the chain actors share relatively high quality information with high willingness. The information exchanged between chain actors and service providers and between the cooperative (as a service provider) and others contributes to increase the quality of exchanged information.

The information flow is two-way between the chain actors, and between the cooperative and chain actors or service providers. The information that flows between the service providers and between service providers and chain actors is both one-way and two-way. The two-way exchange takes place between the MMC Apex Body and wholesalers and other cooperatives. The one-way flow takes place from MMC Apex Body to FM radios, and GOs and NGOs. FM radios also receive information from other cooperatives. The GOs and NGOs generally share one-way information with producers.
Vertical information structure:
  With more complete information

Horizontal information structure:
  With more complete information

Two-way information exchange between the cooperative and chain actors as well as service providers

Information exchange between service providers and chain actors
  Two-way flow
  One-way flow

**Figure 8.5  Information structure of the Harthok vegetable supply chain**

All three types of information structure (horizontal, hierarchical and web) are observed if we separate the stages of this chain. However, the web-shaped structure formed by the cooperative is dominant as it exchanges information with most of the actors and service providers. Therefore, the information structure of the whole chain is *web* in shape.
8.4 Chain Coordination

The coordination between actors is observed horizontally between farmers and vertically between the dyadic partners from input suppliers to consumers in the Harthok vegetable supply chain. Farmers are organized horizontally into groups or the cooperative, to increase volume of production in one place, by increasing production and assembling vegetables in the collection centre. Dyads are formed between the actors of an adjacent level, from input suppliers to consumers, and dyadic partners aim to satisfy each other by improving the process of material, information and money flow between them.

8.4.1 Horizontal Coordination

The association of farmers in groups or the cooperative is the means to coordinate them horizontally. Some farmers are associated only in groups and some farmers are in both the groups and the cooperative. These groups and the cooperative conduct meetings, usually once a month, and discuss the issues related to production, marketing, and other functions that they are undertaking. After discussing an issue, the group or cooperative members reach a conclusion which then becomes a decision. In such meetings, members review past activities and develop future production and marketing plans, which they implement in due course. Since the groups are working as sub-units of the cooperative, their meeting minutes are forwarded to the cooperative for reference purpose or necessary action. The issues that emerge from sources, such as group meetings, members and staff, are discussed in the cooperative meetings and appropriate decisions are taken.

Since the cooperative is the farmers’ own organization, it helps them in several other ways. The cooperative supports farmers by supplying inputs (and short-term credit for inputs), operating the collection centre to assemble and sell vegetables, collecting and disseminating information, providing technologies related to production and marketing through GOs and NGOs, suggesting ways to resolve field problems, and organizing interactions between producers and buyers. The decisions made in the groups or the cooperative, and the support provided by the cooperative, bring farmers closer together when conducting their production and marketing activities.

The group or cooperative decisions provide guidance to farmers in changing production and marketing activities. The major changes in production activities relate to growing crops or varieties as dictated by the market demand, increasing the use of organic manures and pesticides, producing vegetables inside plastic tunnels during the off-season, and developing irrigation facilities. These changes motivate farmers to grow similar types of crops; increase
the production, quality and availability; and reduce production costs. The major changes in marketing activities that arise from group or cooperative decisions relate to harvesting vegetables at appropriate stage, cleaning and sorting properly, increasing the use of crates to pack vegetables, and shortening the time gap between harvesting and transporting to the cooperative. These changes contribute to improve the quality of supplied vegetables and reduce the volume loss.

Because of their own motivation and with support from the cooperative, farmers are increasing the area under vegetables in the main and off season. That is vegetable production is increasing. This increase in production increases the volume in the collection centre operated by the cooperative. This helps the cooperative to fulfil the vegetable requirement of the regular wholesaler, at least in the main season. During the main season, the cooperative also supplies vegetables to wholesalers from Butwal. Selling vegetables to these wholesalers is primarily to establish a presence now, with the intention to develop the relationship in future when production has further increased.

This discussion suggests that farmers are tightly aligned to each other for the purpose of increasing production and responding to markets. Therefore, the horizontal alignment between them is depicted towards the higher side of the continuum, relatively close to the end (see Figure 8.6) suggesting strong horizontal coordination at the farmers’ level.

![Figure 8.6 Position of horizontal alignment among farmers in the Harthok vegetable supply chain](image)

### 8.4.2 Vertical Coordination

The degree of customer focus and vertical alignment between the actors in different sequential dyads from input suppliers to retailers are analysed to find out the strength of vertical coordination in all these dyads. After the dyadic analysis, these two features of the vertical coordination are presented as continua in Figure 8.7 in Section 8.4.2.6 to find out the strength of overall vertical coordination of this chain.
8.4.2.1 Input Suppliers – Producers

Farmers receive inputs from the cooperative and private input dealers. The Chairman said that the cooperative is relatively new and has a funding constraint. Therefore, it generally supplies cheap fertilizers, seeds, pesticides and other inputs, and recommends farmers to find rest of the inputs from two input dealers in Tansen. Since the cooperative is also buying the inputs from these dealers in bulk, it trusts the quality of inputs that they supply.

The Cooperative Board decides what would be best to grow in the next season and suggests to farmers that they follow this advice. This Cooperative Board decision is made after considering two factors: consumer preferences and return from the investment. The cooperative gets an indication of consumer preferences from transactions that it makes with vegetable buyers, and also conversations with the regular wholesaler. It finds out the cost of production of vegetables from farmers, and then selects the option which gives a high return from low investment. The cooperative manages all the inputs required to grow the crops or varieties if this is possible. If not, it manages whatever it can and asks the input dealers to provide the balance of the inputs. Since the cooperative suggests that farmers grow the vegetables that are profitable and makes the required inputs available, most of the farmers associated with this chain follow the cooperative’s advice. Because of production difficulties, a few farmers are unable to do this; but they grow some other crops or varieties that also have high market demand. These activities indicate that input suppliers and farmers focus their attention towards satisfying customers through the production and supply of vegetables that match their customers’ preferences.

Therefore, it can be concluded from this discussion that the activities performed by input suppliers and farmers are driven by the mutually consistent goal of satisfying customers. The arrangement made by the cooperative to make inputs available enables farmers to grow the crops or varieties that the cooperative recommends. Those farmers who are growing vegetables recommended by the cooperative then provide feedback on the performance of these vegetables and any problems encountered in producing them. This feedback provides a basis for the cooperative to revise its advice or to continue its recommendations for the production programme for the next season. Therefore, these intertwining decisions of the cooperative, input suppliers and producers mean input suppliers and farmers are interdependent.

In summary, the discussion suggests that the transactions made between input suppliers and farmers, and the activities performed by the input suppliers and most of the farmers are
focussed on satisfying customers. Since a few farmers are unable to produce the types of vegetables which are highly preferred by customers in the market, the degree of customer focus is depicted towards the higher side of the continuum, somewhere between the midpoint and the highest end (see Figure 8.7). Similarly with few exceptions, the goal consistency between input suppliers and farmers, cooperative’s support to farmers in making appropriate production decisions and the interdependency between parties suggest that input suppliers and farmers are relatively tightly aligned. However, those farmers who are unable to follow cooperative’s advice in producing vegetables neither have consistent goals with the input suppliers nor they can provide feedback for the improvements in production process but contribute to reduce the degree of alignment a bit. Hence, the degree of alignment between them is depicted towards the higher side of the continuum, somewhere between the midpoint and the highest end (see Figure 8.7). Thus activities that are focussed towards customers, and the tight alignment between the dyadic partners, contribute to strengthen the vertical coordination between input suppliers and farmers.

8.4.2.2 Producers – Cooperative

The Cooperative Chairman said that almost 95 percent of the vegetables produced in the area are supplied to markets through the cooperative. The cooperative does not take ownership and sells the vegetables to buyers on behalf of farmers. In return, the cooperative receives commission.

Farmers said that the cooperative suggested they increase the production area, emphasizing particular vegetables, motivates them to construct temporary plastic tunnels and rain water harvesting structures, and gives advices on harvesting, sorting, cleaning, packing and transporting operations in an appropriate manner. These suggestions are designed to increase the quantity, quality and availability of vegetables. Since marketing of vegetables is done by the cooperative, farmers follow the suggestions of the cooperative in conducting these production and post production activities. Upon harvesting, they bring their vegetables to the cooperative for sale. A cooperative staff member then inspects the vegetables that quality is adequate. If the cooperative staff member is satisfied, he weighs the vegetables, puts them in the cooperative’s store, maintains records, calculates tentative prices and asks farmers to contact him later to get payment. If the staff member is not satisfied, he asks farmers to do cleaning and sorting again, but such incidents do not occur frequently. The purpose of conducting all of these activities is to satisfy buyers of the vegetables. It is difficult to directly reduce transaction costs at this stage, because of the collection of small volume in total by the cooperative. However, because farmers and the cooperative reduce the time gap between
harvesting and selling, and conduct post production activities in an appropriate manner, this reduces volume loss, which in turn, contributes to lowering transaction costs indirectly.

The Cooperative Chairman explicitly said that the goal of the cooperative is to increase profit by satisfying customers. To achieve this goal, the cooperative suggests farmers to make particular changes to their production and post production activities. Being their own organization, farmers consider the goal set by the cooperative as their own goal, and so conduct the activities according to the cooperatives suggestions. The focus of farmers on improving production and post production activities enables them to produce vegetables according to market demand. The sale of most of the vegetables through the cooperative helps the cooperative to set prices in advance, and to decide whether to call wholesalers from Tansen only or from Butwal as well. This supply of vegetables primarily through the cooperative suggests that farmers and the cooperative are interdependent. Farmers depend on the cooperative to sell their vegetables and the cooperative depends on farmers for its business since the commission received from vegetable sales is its main source of revenue.

In summary, the discussion implies that the activities of farmers and the cooperative are focussed towards customers with respect to quantity, quality and availability of supplied vegetables. Both farmers and the cooperative staff realize that they are not able to reduce the transaction costs significantly at this stage as the volume of vegetables sold is low. Therefore, the degree of customer focus is depicted towards higher side of the continuum, somewhere between the midpoint and the highest end (see Figure 8.7). Similarly, their consistency in goals, enabling each other to make buying and selling decisions and interdependency, aligns farmers and the cooperative tightly. So, the degree of vertical alignment is depicted towards higher side of the continuum, near the highest end (see Figure 8.7). The focus towards customers and tight vertical alignment both strengthen vertical coordination between farmers and the cooperative.

8.4.2.3 Cooperative – Wholesalers

The cooperative tries its best to satisfy the wholesaler from Tansen whom it supplies around 75 percent of the collected vegetables. To satisfy the wholesaler, the cooperative is focussing its attention on increasing the volume of supply, the duration of supply over the season, the quality of supplied vegetables, and supply of highly demanded items. The wholesaler said that he is satisfied with the quality and prices of vegetables supplied from Harthok. He is getting some of the vegetables in the off-season as well. However, the quantity of vegetables supplied from Harthok is insufficient to fulfil his requirement, except in the main production season. In
the main season, he has to buy only a few of the vegetable items from other collection centres in Palpa District or Butwal Wholesale Market, as he gets sufficient quantity of most of the items at Harthok. The cooperative does not hold vegetables for more than 12 hours in order to supply them fresh. It also accepts vegetables from farmers just before selling them to wholesalers. This discussion reveals that the activities performed by the cooperative and the wholesaler are focussed towards satisfying consumers.

The wholesaler said that he is satisfied from the vegetables supplied from the cooperative and tried his best to satisfy his own customers. Due to the competitive environment in the markets, attracting and satisfying customers, and augmenting the volume of produce transacted are the principal ways of increasing his profit. The wholesaler’s statement indicates that the cooperative and the wholesaler have a consistent goal of increasing profits by satisfying customers.

The cooperative collects vegetables from farmers and informs the wholesaler of the quantity that it can supply. This helps the wholesaler to decide how much of which vegetables to buy from where. The cooperative also benefits from the wholesaler’s planning particularly in the main growing season. Vegetable collection is high during this season, and the cooperative can plan where to sell the remaining amount once it gets response of the wholesaler. Thus, the cooperative and the wholesaler help each other in developing selling plans for each season’s production.

Although the local retailers get priority in buying from the cooperative, they only buy a small proportion of the collected vegetables and the regular wholesaler is the main buyer. The wholesaler brings some other wholesalers or retailers with him when the volume of vegetables to be sold is high in the cooperative. The cooperative supplies vegetables to wholesalers from Butwal only when the vegetable available is greater than that required by the group of buyers visiting from Tansen. Therefore, the cooperative depends heavily on the wholesaler. However, the wholesaler does not depend on the cooperative in the same way. He depends on the cooperative for seasonal vegetables two days a week. For other vegetables, and other days of the week, he needs to visit other markets. Therefore, there is some, but not high, interdependency between these two actors.

In summary, the discussion shows that the cooperative and wholesaler focus their attention on satisfying their customers by increasing the quality of vegetables, the number of items and duration of supply at minimum possible prices. However, the cooperative is unable to fulfil the quantity requirement of the wholesaler. So, the degree of customer focus is depicted
towards the higher end of the continuum but close to the midpoint (see Figure 8.7). Similarly, the cooperative and the wholesaler have a consistent goal, and work together to make decisions, but they have a medium rather than a high level of interdependency. So, the vertical alignment between these two actors is relatively tight and the degree of alignment is depicted towards higher side of the continuum, somewhere between the midpoint and the highest end (see Figure 8.7). The activities focussed towards customers and tight vertical alignment contributes to strengthen the vertical coordination between the cooperative and the wholesaler.

8.4.2.4 Wholesalers – Retailers

The regular wholesaler said that he sells vegetables mainly to local retailers, and the remaining to a student hostel and other consumers. Most of them have been transacting with him for a few years and depend on him for all kinds of vegetables. The wholesaler does not want to lose his regular customers and the quantity supplied from Harthok is not sufficient to fulfil customer requirements. So, the wholesaler gets vegetables from other sources in order to fulfil their demand. The retailers associated with this chain purchase vegetables from the wholesaler or directly from the cooperative in the morning, transport themselves to their outlets, store them in a shady place and sell to consumers generally for the whole day. The wholesaler and retailers said that they pay attention in minimizing the loss during transport, handling and storage. This practice helps to keep the transaction costs at a minimum level. These activities are focussed towards supplying the required type, quantity and quality of vegetables at reasonable prices to satisfy consumers.

To fulfil the interest of consumers, wholesalers purchase vegetables from Harthok on every collection day and from other markets on other days. The wholesaler and retailers transact vegetables almost every day with a view to supplying them fresh to consumers. While purchasing vegetables from the cooperative and other sources, the wholesaler also considers other quality parameters, like the colour, size, and shape as well as the types and quantity as per the interest of retailers. Retailers said that their interest is guided by consumer preferences. To compete in the market and to attract more consumers, retailers need to consider consumer preferences, which they manifest during transactions. It can be said from this discussion that the wholesaler and retailers have consistent goals of making profits by satisfying customers.

Depending on the interest of retailers, the wholesaler increases, decreases or changes the types of vegetable purchase from different sources. The wholesaler said that majority of retailers are
transacting with him regularly but few of them also purchase vegetables from other sources. Sometime, it makes the wholesaler difficult to decide how much vegetables are needed to be purchased actually to fulfil the requirement of his customers. To overcome this difficulty, he wants to make those retailers, who sometimes buy from other sources, his regular customers. For this, the wholesaler provides vegetables in credit to them. This shows that the wholesaler is helping retailers from various ways to keep on transacting with him. So, the dependency of wholesaler on retailers is more than the dependency of retailers on the wholesaler.

This discussion implies that the activities conducted by the wholesaler and retailers are customer focussed. Therefore, the degree of customer focus is depicted towards the highest end of the continuum (see Figure 8.7). Similarly, the wholesaler and retailers both have consistent goals. The wholesaler and majority of retailers are transacting regularly and helping each other in making buying decisions but due to the buying behaviour of a few retailers, the wholesaler needs to provide more help to retailers and depends more on them for his business than the dependency of retailers on him. As a result of this, the degree of vertical alignment between the wholesaler and retailers is depicted towards higher side of the continuum, somewhere between the midpoint and the highest end (see Figure 8.7). Therefore, the activities focussing more towards customers and tight vertical alignment contribute to strengthen the vertical coordination between the wholesaler and retailers.

8.4.2.5 Retailers – Consumers

The wholesaler who is also supplying some of his vegetables directly to consumers said that most of his customers transact regularly with him. However, the retailers who purchase vegetables directly from the cooperative said that their customers are changing. These retailers interact with consumers during transactions and also observe their buying behaviour to find out their preferences. On the basis of this finding, they purchase vegetables from the wholesaler in such a way that they can satisfy consumers with respect to the type, quantity and quality of vegetables sold. Since the consumers’ view is absent in this case, it is difficult to explain how satisfied they are from retailers’ efforts.

Retailers want to increase profit from the supply of vegetables as per the requirements of consumers. Retailers said that consumers generally compare the types, quality and prices of vegetables prevailing in different retail outlets and provide feedback. The feedback may be negative many times, but this helps retailers to make improvements in vegetable supply and so to avoid negative feedback again.
8.4.2.6 Summary of Vertical Coordination

On the basis of the analysis made in Section 8.4.2.1 to Section 8.4.2.4, the degree of customer focus and vertical alignment between the actors in four different dyads of the Harthok vegetable supply chain are presented in horizontal continua in Figure 8.7. The positions of these two features are depicted in different locations of the continua in the right hand side in all four dyads. The elements: level of consumer satisfaction and reduction of transaction costs determine the position of the degree of consumer focus; and the elements: goal consistency, enabling each other in making decisions and interdependency determine the position of the degree of vertical alignment. However, the depiction of both features towards the right hand side (higher side) of the continua suggests that the vertical coordination is strong in all four dyads and ultimately in the whole chain.

<table>
<thead>
<tr>
<th>Retailers – Wholesalers</th>
<th>Not aligned</th>
<th>Fully aligned</th>
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<tbody>
<tr>
<td></td>
<td>Unfocussed</td>
<td>Fully focussed</td>
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<thead>
<tr>
<th>Wholesalers – Cooperative</th>
<th>Not aligned</th>
<th>Fully aligned</th>
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<td>Unfocussed</td>
<td>Fully focussed</td>
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<thead>
<tr>
<th>Cooperative – Producers</th>
<th>Not aligned</th>
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<td></td>
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<tr>
<th>Producers – Input Suppliers</th>
<th>Not aligned</th>
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<td></td>
<td>Unfocussed</td>
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Figure 8.7 Position of consumer focus and vertical alignment between actors in different dyads of the Harthok vegetable supply chain

8.5 Conclusion

The results derived from the analysis of factors affecting external environment, and attributes of information structure and chain coordination have been presented. Changing consumer
preferences and regional competition, and demand and supply uncertainties have been analysed to find out how they arise and influence the chain. The results showed that the preferences of consumers are changing and they increase the overall demand, but vegetable import and export is of regular nature and does not have significant impact on changing demand and supply situation. Vegetable demand becomes uncertain due to the changes in vegetable consumption patterns, high consumption during festivals and low supply during the rainy season. Similarly, vegetable supply remains uncertain due to the production variation in different seasons and obstructions in road transport.

The quality of information exchanged between actors and the willingness of actors to exchange information have been analysed horizontally at the farmers’ level and vertically in different sequential dyads from input suppliers to retailers of this chain. The results showed that both the horizontal and vertical information structures of the Harthok vegetable supply chain are complete and the overall information structure is web in shape.

The degree of horizontal alignment between farmers and the degree of customer focus and vertical alignment between actors in different sequential dyads from input suppliers to retailers have been analysed. The results showed strong horizontal and vertical coordination in this chain.

The results derived from the analysis of information structure and chain coordination both horizontally and vertically are helpful to find out the association between them. So, these results will be synthesized and compared with the results of other chains in cross-case analysis.
Chapter 9
CROSS-CASE ANALYSIS AND DISCUSSION

9.1 Introduction

This chapter discusses the research results presented in Chapters 5 to 8. The results showed different information structures and degrees of coordination between actors in different horizontal and vertical stages of all four chains. It was also observed that the variations in information structure and coordination between actors in different stages of these chains appear to arise because of the differing impacts of the external environment and internal factors.

A theoretical framework was set up (see Figure 3.3) through the linking of a number of propositions that emerged from the review of literature in Chapter 2. This framework is revisited in Section 9.2 by comparing the expected patterns with observed patterns derived from the case study results. Then, the cases have been collapsed into two models on the basis of the degree of coordination. There are two cases within each model. A comparison has been done between the cases within each model, and between the models in Section 9.3. A discussion is carried out in Section 9.4 to answer the research questions. The findings of this research are compared with the literature in Section 9.5. Towards the end of this section, the influence of benefits on information structure and chain coordination and changing role of cooperatives are discussed. Then, the discussion is concluded in Section 9.6.

9.2 Theoretical Framework Revisited

The results of all four cases have been synthesized in this section by invoking the theoretical framework used in the research (see Figure 3.3); that is, by discussing the relationship between external environmental factors, external environmental factors and information structure and chain coordination, and information structure and chain coordination.

Although vegetable and potato supply chains are discussed separately in the Panchkhal case, these two chains were not completely separated in data collection, analysis and results, and were considered one. However, separate discussion of the vegetable supply chain and the potato supply chain was carried out where explanations were required separately. Therefore, the total number of chains or cases is considered to be four not five.
A summary of expected patterns stated in theoretical propositions and observed patterns found in the results of all four cases is presented in Table 9.1. In this table, expected patterns

<table>
<thead>
<tr>
<th>Propositions</th>
<th>Panchkhal</th>
<th>Charaudi</th>
<th>Sarketari</th>
<th>Harthok</th>
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</thead>
<tbody>
<tr>
<td>1. Changing consumer preferences and regional competition increase demand and supply uncertainties</td>
<td>Minimal impact of changing consumer preferences and regional competition in creating demand and supply uncertainties</td>
<td>Changing consumer preferences and regional competition in creating demand and supply uncertainties</td>
<td>Minimal impact of changing consumer preferences and regional competition in creating demand and supply uncertainties</td>
<td>Minimal impact of changing consumer preferences and regional competition in creating demand and supply uncertainties</td>
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<tr>
<td>2. Changing consumer preferences and regional competition reduce the quality of information</td>
<td>Insignificant effects of changing consumer preferences and regional competition in reducing the quality of information</td>
<td>Changing consumer preferences produce insignificant effects in reducing the quality of information, but regional competition contributes reducing the quality of information</td>
<td>Insignificant effects of changing consumer preferences and regional competition in reducing the quality of information</td>
<td>Insignificant effects of changing consumer preferences and regional competition in reducing the quality of information</td>
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<tr>
<td>3. Changing consumer preferences and regional competition strengthen horizontal and vertical coordination</td>
<td>Changing consumer preferences and regional competition contributes strengthening horizontal and vertical coordination to some extent</td>
<td>Changing consumer preferences and regional competition contributes strengthening horizontal and vertical coordination to some extent</td>
<td>Changing consumer preferences and regional competition contributes strengthening horizontal and vertical coordination to some extent</td>
<td>Changing consumer preferences and regional competition contributes strengthening horizontal and vertical coordination to some extent</td>
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<td>4. Demand and supply uncertainties reduce the quality of information</td>
<td>Insignificant effects of demand and supply uncertainties on the quality of information</td>
<td>Demand and supply uncertainties contribute reducing the quality of information</td>
<td>Insignificant effects of demand and supply uncertainties on the quality of information</td>
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Table 9.1  A Comparison between Expected Patterns in Propositions and Observed Patterns in Case Study Results
<table>
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<tr>
<th>5. Demand and supply uncertainties strengthen horizontal and vertical coordination</th>
<th>Demand and supply uncertainties contribute strengthening horizontal and vertical coordination to some extent</th>
<th>Demand and supply uncertainties contribute strengthening horizontal and vertical coordination to some extent</th>
<th>Demand and supply uncertainties contribute strengthening horizontal and vertical coordination to some extent</th>
<th>Demand and supply uncertainties contribute strengthening horizontal and vertical coordination to some extent</th>
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<tr>
<td>6. Complete information structure strengthens chain coordination</td>
<td>Relatively asymmetric information structure is associated with weak coordination</td>
<td>Relatively asymmetric information structure is associated with weak coordination</td>
<td>Complete information structure is associated with strong coordination</td>
<td>Complete information structure is associated with strong coordination</td>
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<tr>
<td>7. Flow of high quality information from various sources strengthens horizontal and vertical coordination</td>
<td>Wholesalers receive high quality information from different sources and the vertical coordination between actors associated with wholesalers is strong</td>
<td>Wholesalers receive high quality information from different sources and the vertical coordination between actors associated with wholesalers is strong</td>
<td>Farmers, cooperative, and wholesalers receive high quality information from different sources contributing to strengthen horizontal and vertical coordination in the whole chain</td>
<td>Farmers, cooperative, and wholesalers receive high quality information from different sources contributing to strengthen horizontal and vertical coordination in the whole chain</td>
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<tr>
<td>8. Flow of high quality information from one actor to another strengthens horizontal and vertical coordination</td>
<td>The distortion in the flow of information from one actor weakens the horizontal and vertical coordination</td>
<td>The distortion in the flow of information from one actor weakens the horizontal and vertical coordination</td>
<td>The undistorted flow of high quality information strengthens both horizontal and vertical coordination</td>
<td>The undistorted flow of high quality information strengthens both horizontal and vertical coordination</td>
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<td>9. High willingness of actors strengthens horizontal and vertical coordination</td>
<td>Low willingness of farmers to exchange marketing information weakens the horizontal coordination, and high willingness of actors in some stages and low willingness in the remaining stages weakens the vertical coordination</td>
<td>Low willingness of farmers to exchange marketing information weakens the horizontal coordination, and high willingness of actors in some stages and low willingness in the remaining stages weakens the vertical coordination</td>
<td>High willingness of actors in all the stages strengthens the horizontal and vertical coordination</td>
<td>High willingness of actors in all the stages strengthens the horizontal and vertical coordination</td>
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are compared with observed patterns in brief. The comparison between these two patterns is carried out in detail in next sections.

### 9.2.1 The Relationship between Constituents of the External Environment

Changing consumer preferences and regional competition, and demand and supply uncertainties are the two factors that dominate the external environment. The relationships between these two factors (Proposition 1) are discerned from the results of all four cases.

Changing consumer preferences increase or decrease the vegetable demand. There is increasing demand for those vegetables which are highly preferred by consumers and decreasing demand for those vegetables which are less preferred by consumers. The effects of changing consumer preferences are observed in all chains, but the actors are uncertain how much of the demand for their produce has changed because of changing consumer preferences and what strategies other competing chains and importers/exporters have developed to address it.

Consumers in the Nepalese markets, where vegetables are supplied from these chains, give priority to the taste and appearance of vegetables, rather than to other attributes; for example, food safety or convenience. Because of their superior taste and better keeping quality, consumers have a preference for vegetables produced in these chains, the production area of which are located in the middle hill range, over those produced in the southern plains. In addition, the preference of consumers towards organic vegetables is gradually increasing, and creating demand in Kathmandu. To fulfil this demand, a few producers of the Charaudi chain were found producing and supplying organic vegetables to Kathmandu. Since consumer preferences are changing gradually and supply chain actors are adapting to address these changes, there is minimal impact of changing consumer preferences in creating demand and supply uncertainties in Nepalese markets.

The effect of imports and exports is observed frequently in the demand for potatoes supplied by the Panchkhal chain. Cheap potatoes are imported almost every year from India during the main season to attract consumers, but the volume of imports increases or decreases according to the production situation in India. Demand for potatoes supplied by the Panchkhal chain decreases when the volume of imports is large, and it increases when the volume of imports is small. This creates uncertainty in demand for potatoes supplied from Panchkhal. Large scale potato exports also occur every few years. This export creates scarcity in domestic markets
and increases demand. By contrast, vegetable imports and exports are of regular nature and have less impact on domestic demand and supply from these chains.

### 9.2.2 Effects of the External Environment on Information Structure

It was envisaged in the theoretical framework that external environmental factors will affect the information structure of supply chains. Therefore, the effects of changing consumer preferences and regional competition on information structure (Proposition 2) and the effects of demand and supply uncertainties on information structure (Proposition 4) are now explored from the results of all four cases.

Retailers find out the preferences of consumers through observation of their buying behaviour and interactions with them during transactions. Retailers communicate this information to other actors, from whom they purchase vegetables, during transactions with these actors or by phone. On the basis of information received from retailers and from their own transaction records, these actors predict vegetable demand, and then transfer the information to other actors vertically until it reaches producers. This is just an indicative demand and does not specify how much quantity consumers want to buy at which time period and in what price range. Since changes in consumer preferences are gradual, the indicative demand also works well in signalling production and supply of vegetables to the markets. However, the information exchanged on the basis of this indicative demand is broad and incomplete and so reduces the quality of information.

In Charaudi, Harthok, and to some extent in Sarketari chains, cooperatives verify the predicted demand from other sources so they can share more reliable information with farmers. In the case of the Panchkhal chain, only a small proportion of farmers depend on the information provided by the cooperative. So, majority of farmers have to rely on the information about vegetable demand disseminated by their buyers.

The Panchkhal, Sarketari and Harthok chains consider the information on market specific consumer preferences when making production decisions because they supply the majority of their vegetables to a single market. In the case of the Charaudi chain, information on consumer preferences for a specific market does not work well, because vegetables from this chain are supplied to different markets.

Farmers in the Charaudi, Sarketari and Harthok chains exchange information about changing consumer preferences among themselves in the groups or cooperatives. However, in the Panchkhal chain, farmers do not share information related to marketing. Therefore,
information related to consumer preferences is not communicated horizontally in the groups or cooperatives in this chain. The exchange of such imperfect information contributes reducing the quality of horizontal information structure in the Panchkhral chain.

Vegetable imports and exports take place regularly between India and Nepal. The information generated from regular imports and exports does not affect the information structure of all four vegetable supply chains. However, potato imports and exports occasionally disrupt this pattern, with information changing frequently as a result of sharp increases or decreases in imports and exports. These frequent changes in the information make it inconsistent and it also becomes difficult for actors to receive information when they need. Therefore, the import and export of potatoes leads to the exchange of inconsistent and infrequent (low quality) information between the actors of the Panchkhral potato supply chain.

Demand for vegetables in the markets and supply through these chains becomes uncertain when they change frequently. Changing consumer preferences and imports and exports have a minimum impact on vegetable demand in the markets. In comparison with demand, supply from these chains is significantly affected, due to seasonal and weather dependent production, and road blocks as a result of strikes and adverse weather condition, but the overall effect is still insignificant. Hence, the occurrence of demand and supply uncertainties is low in all four vegetable supply chains and their impact on information structures is insignificant. On the contrary, uncertainty occurs in the demand and supply of potatoes due to unexpected imports and exports. This leads to the flow of frequently changing information in the chain, which makes it more inconsistent.

Thus, the external environmental factors cause incomplete, inconsistent and infrequent information to flow along the chain on some occasions. However, the presence of these factors is insignificant in reducing the quality of information in all four vegetable supply chains, but these factors are reducing the quality of information in the Panchkhral potato supply chain.

9.2.3 Effects of the External Environment on Chain Coordination

It was proposed in the theoretical framework that external environmental factors affect chain coordination directly. The effects of changing consumer preferences and regional competition on horizontal and vertical coordination (Proposition 3) and the effects of demand and supply uncertainties on horizontal and vertical coordination (Proposition 5) are now assessed using the case study results.
Changing preferences of consumers and supply through several other competing domestic chains and importers increases risk for the actors in these supply chains. To mitigate this risk, actors in all these four chains try to increase the volume of production and extend the duration of availability as far as possible by strengthening horizontal linkages between farmers, and then supply them fresh by strengthening vertical linkages between actors.

Considering the market demand, cooperatives or farmers’ groups take appropriate decisions before the onset of the production seasons in all four chains and encourage farmers to increase the volume of production of the types or varieties of vegetables or potatoes (in the case of Panchkhal) according to these decisions. Since these decisions are based on latest information on demand, supply, and price trend of the past, and forecast for upcoming season provided by wholesalers, wholesale market boards, and transaction details of wholesale markets, most of the farmers follow cooperative or group decisions in vegetable or potato production. To extend the production duration, the area under vegetables and potatoes has been expanded from low to high altitudes in Panchkhal and Charaudi, and plastic tunnels have been introduced in Sarketari and Harthok. Farmers also grow different varieties of the same vegetables in different seasons to supply them for long duration in the markets. These coordinated activities strengthen horizontal linkages between farmers so as to produce and supply vegetables or potatoes as per the preferences of consumers.

In these four chains, a schedule has been developed to harvest and transfer the vegetables from one actor to another vertically to make them available to consumers within 24 hours of harvest. Since potatoes are less perishable in comparison to green vegetables, they are stored from a few weeks to a few months in different stages of the chain in order to supply the right quantities according to market requirements. Improvements are also made to supply good quality produce to final consumers. Quality maintenance is done by harvesting at appropriate time, sorting, packaging, handling, and transporting vegetables. According to respondents, the activities undertaken to maintain the quality is at an acceptable level in Charaudi and Harthok, fair in Sarketari, but poor in the Panchkhal chain.

The effects of changing consumer preferences and regional competition on coordination between actors in the vegetable supply chains are difficult to observe because of the gradual change in consumer preferences and regular trend in importing and exporting. However, the effect of import fluctuations on coordination is observed between the actors of potato supply chain. To overcome the risk of excessive imports, farmers tighten transactional relationship with wholesalers so that they can sell potatoes at prevailing market prices in all types of
market situation. This further strengthens the vertical coordination between actors from producers to retailers.

Some impacts of demand and supply uncertainties are observed on horizontal and vertical coordination between actors. There appears to be little impact of demand and supply uncertainties on horizontal coordination between farmers in the Charaudi and Harthok chains as most of them follow group or cooperative decisions in production and supply of vegetables. In the case of the Panchkhal and Sarketari chains, farmers normally follow group or cooperative decisions in producing vegetables, but not in marketing. Farmers prefer to undertake individual marketing in these two chains. Actors in these chains normally do not change transacting parties vertically, except in Sarketari, where farmers sell their vegetables directly to different retailers in different seasons. In all four chains, the risk of finding buyers during the flush season and finding the produce during scarcity is minimized by undertaking regular transactions with the same parties.

The discussion suggests that the actors align the majority of their activities in all four chains in order to fulfil the preferences of consumers and in the case of potatoes, to minimize the effects of imports and exports. Thus, changing consumer preferences and regional competition, and demand and supply uncertainties, seems to have led, to some extent, to stronger horizontal and vertical coordination between actors.

9.2.4 The Relationship between Information Structure and Chain Coordination

The relationships between the overall information structure and horizontal and vertical coordination (Proposition 6), the quality of exchanged information and horizontal and vertical coordination (Proposition 7 and 8), and the willingness of actors to exchange information and horizontal and vertical coordination (Proposition 9) are evaluated from the results of all four cases.

Information structure and coordination were analysed horizontally and vertically in different stages of all four supply chains. Information structure was found to be complete horizontally between farmers for production purposes, and complete vertically between buyers (assemblers, wholesalers and retailers) and between producers and the cooperative for buying and selling purposes in these chains. The results also showed that the actors in these stages trust and rely on the information exchanged between them when making transactions. The actors align themselves in order to fulfil the requirements of consumers during these
transactions. Hence, horizontal and vertical coordination between them is also strong at the stages of the chain where the information structure was more complete.

Farmers, cooperatives and wholesalers receive information from various sources in all four chains. Farmers receive information from chain actors, GOs, NGOs, cooperatives and radios but the quality of information received from these sources is not high all of the time. Cooperatives associated with the Charaudi, Sarketari and Harthok chains receive information from chain actors, GOs, NGOs and market boards, and the quality of information received from the majority of these sources is high. Similarly, wholesalers receive information from assemblers and retailers from different locations. The quality of most of the information that they receive from these sources is high.

The flow of high quality information to the cooperatives and wholesalers from different sources encourages cooperation, and enhances the capacity of cooperative staff and wholesalers in performing functions aimed at attaining the chain goal. Hence, the cooperatives are performing a crucial role in strengthening horizontal coordination between farmers, and vertical coordination between other chain actors who are transacting with them. Wholesalers are also performing a similar role as the cooperative through strengthening vertical coordination with other actors, who transact with them.

In the case of the Charaudi and Harthok chains, information flows from one end of the chain and reaches the other end without significant distortion, and the quality of information is high. In these chains, farmers also exchange high quality information among themselves in a similar manner. In the case of the Panchkhal and Sarketari chains, high quality information flows between producers/assemblers/the cooperative – wholesalers – retailers. The flow of high quality information aligns the activities of all these actors in order to satisfy consumers and realize benefits for all of them. As a result of tight horizontal and vertical alignment of chain activities in order to satisfy consumers, the coordination between the actors, who transfer high quality information from one actor to another, is strong.

The main purpose of supplying high quality information to other farmers in the Charaudi and Harthok chains is to produce and supply vegetables according to market demand. Similarly, the purpose of sharing high quality information vertically between all chain actors in the Charaudi and Harthok chains, and between some actors in the Panchkhal and Sarketari chains is to add value for customers through price, quantity, quality and delivery time of vegetables. So, these actors willingly exchange high quality information to attain the common purpose. Hence, the high willingness on these actors in sharing information creates an environment of
trust and makes them committed to performing the required functions. This tightens the alignment between them, and strengthens both the horizontal coordination between farmers, and the vertical coordination between all the actors in the Charaudi and Harthok chains and between producers/assemblers/ the cooperative – wholesalers – retailers in the Panchkhal and Sarketari chains.

In summary, this discussion suggests that observed patterns do not contrast with expected patterns. However, due to the minimal presence of external environmental factors, they produce small effects on the information structure and chain coordination. However, the impact of information structure on horizontal and vertical coordination is significant. The observed pattern also shows that complete information structure is associated with strong coordination and asymmetric information structure is associated with weak coordination, except for the coordination at the farmers’ level in the Sarketari chain. At this level, an incomplete but reasonably symmetric information structure is associated with weak coordination.

9.3 Case Study Models

Different degrees of coordination are observed in the four cases studied in this research. These cases have been grouped into two models on the basis of degree of coordination. Highly coordinated chains – Charaudi and Harthok – comprise Model One, and less coordinated chains – Panchkhal and Sarketari – comprise Model Two. The two chains that comprise each model are similar but not identical, as there are some differences in their structures and profiles (see Appendices A – D). However, similarities dominate differences in the chains comprising each model.

9.3.1 Model One: Highly Coordinated Chains

The overall coordination level is high in Charaudi and Harthok chains due to strong horizontal and vertical coordination as derived in Chapter 6 and 8. Many similarities between these two chains have been observed, and these similarities are presented in Figure 9.1. Although similarities between these two chains are strong, there are some differences as well. Similarities and differences between these two chains are presented in Section 9.3.1.1 and Section 9.3.1.2, respectively.
Completeness of information structure  
Relatively Complete  
Degree of coordination and product flow  
Strong  
Information structure and coordination not  
fully analysed  
Highly coordinated part in this model  

Figure 9.1  The completeness of information structure and the degree of coordination  
in different stages of highly coordinated chains (Model One)  

9.3.1.1  Similarities between Highly Coordinated Chains  
There are similarities between the highly coordinated chains with respect to the effects of  
external environmental factors on information structure and chain coordination, the  
completeness of overall information structure and the degree of overall coordination.
Similarities were observed between the Charaudi and Harthok chains on the effects of external environmental factors (changing consumer preferences, demand and supply uncertainties, and imports and exports) on information structures and chain coordination. Gradual changes in the preferences of consumers and only occasional demand and supply uncertainties produce minimal and manageable effects on chain information structures and coordination between actors. Similarly, vegetables which are supplied by these two chains are not imported at the same time that they are sent to the markets from these chains. Also, vegetables produced by the actors of these chains are not exported. Therefore, vegetable imports and exports rarely produce any effect on information structure and coordination between actors in these chains.

The results showed similarities in aspects of information structure in both chains. These aspects are the sources of information, and features and shape of the information structure. Cooperatives associated with these chains collect information from different markets, market boards, and the GOs and NGOs, and disseminate the same information to farmers, assemblers, wholesalers and retailers whenever required. This type of flow increases the quality of information as well as increases the willingness of actors to share information, contributing the information structure to be complete in all stages of both chains. The assemblers’ level in the Charaudi chain is an exception to this. As discussed earlier in Section 6.3.2.3, the relatively low willingness of assemblers in this chain does not reduce the completeness of horizontal information structure. Therefore, the overall horizontal and vertical information structure in both chains is complete (see Figure 9.1). The relationship portrayed from the exchange of information between different actors and agencies forms a web-shaped structure in both chains. In this structure, the cooperative occupies the centre position in both chains.

These two chains also showed similarities in the performance of chain activities and the degree of coordination. The majority of production and marketing activities in these chains are under the control of cooperatives. Most of the farmers produce the types of crops or varieties as per the recommendation of these cooperatives and supply them to the markets under the cooperatives’ arrangements. In the Harthok chain, the cooperative sells all the vegetables collected from farmers, and in the Charaudi chain, the cooperative asks farmers to sell whatever they can from its premises and takes the responsibility for selling the remaining amount. Since vegetables are supplied from producers as per the market requirements, buyers also align packaging, transporting and handling functions to conform to the needs of consumers as much as possible. Performance of activities in a properly aligned manner not
only satisfies consumers but also aligns the benefits realized from the business to all chain members. For these reasons, the overall horizontal and vertical coordination in these chains is strong (see Figure 9.1).

### 9.3.1.2 Differences between Highly Coordinated Chains

The results showed minor differences between the Charaudi and Harthok chains in the way that pricing between producers and buyers is undertaken, and minor aspects relating to the horizontal information structure and horizontal coordination. Prices of most of the vegetables, which farmers supply to markets from the Charaudi chain, are set between farmers and assemblers, but in absence of assemblers in the Harthok chain, farmers assemble their vegetables in the cooperative without pricing. When the cooperative sells these vegetables to wholesalers or retailers, it sets the prices on behalf of farmers.

Information structure and coordination are observed horizontally at the farmers’ level and assemblers’ level in the Charaudi chain but it is observed only at the farmers’ level in the Harthok chain. Even though horizontal information structure and coordination are weak at the assemblers’ level, these are additional efforts and contribute to strengthen the overall horizontal information structure and coordination of the Charaudi chain.

In summary, the discussion on similarities and differences between highly coordinated chains confirms the similar but insignificant effect of external environmental factors on completeness of information structure and the degree of coordination. In these chains, overwhelming similarities were observed within the overall information structure and overall coordination and minor differences in individual components were identified.

### 9.3.2 Model Two: Less Coordinated Chains

The results derived in Chapter 5 and 7 depict that the Panchkhal and Sarketari chains fall into the category of less coordinated chains. These two chains have many similarities, and a model has been developed based on these similarities (see Figure 9.2). Although there are many similarities, minor differences are also observed between these two chains. Similarities and differences between these two chains are presented in Section 9.3.2.1 and Section 9.3.2.2.

#### 9.3.2.1 Similarities between Less Coordinated Chains

Similarities between the Panchkhal and Sarketari chains are observed with respect to the overall information structure, coordination between actors, and the effects of external environmental factors on information structure and chain coordination.
Completeness of information structure
- Relatively Complete
- Relatively asymmetric

Degree of coordination and product flow
- Strong
- Weak

Information structure and coordination not
fully analysed

Highly coordinated part in this model

Figure 9.2 The completeness of information structure and the degree of coordination in different stages of less coordinated chains (Model Two)

The overall information structure is relatively asymmetric (either incomplete but reasonably symmetric or asymmetric) in both chains (see Figure 9.2). Due to the differences in the degree
of information quality and the degree of willingness of actors, the horizontal information structure is asymmetric in the Panchkhal vegetable and potato supply chains, but incomplete and reasonably symmetric in the Sarketari vegetable supply chain. As shown in Figure 9.2, vertical information structures are more complete at the top end of these chains: assemblers – wholesalers – retailers. Conversely, information structures are found asymmetric at the bottom end of both chains: input suppliers – producers – assemblers. The Panchkhal potato supply chain is an exception. In this chain, information structure is complete between producers and wholesalers. Hence, the overall vertical information structure is asymmetric in the Panchkhal and Sarketari vegetable supply chains and complete in the Panchkhal potato supply chain. The integration of horizontal and vertical information structures of each chain revealed an asymmetric overall information structure. The interconnection between actors and agencies from the exchange of information revealed information structures of hierarchical shape in these chains.

The degree of overall coordination is found to be weak in all these chains as the activities performed in different stages are not properly aligned resulting from weak horizontal or vertical coordination. In these chains, horizontal coordination is weak at the producers’ level (see Figure 9.2). Vertical coordination between dyadic partners is strong at the top end, and weak at the bottom end. This mirrors the stages of the chain where the information structure is more complete or asymmetric (see Figure 9.2). As a result, vertical coordination is weak in both vegetable supply chains. Due to the absence of assemblers and strong coordination between producers and wholesalers, vertical coordination is stronger in the potato supply chain. However, the integration of weak horizontal and weak vertical coordination of vegetable supply chains, and weak horizontal and strong vertical coordination of the potato supply chain revealed weak overall coordination in all these chains.

In the results, two fundamental reasons were found behind the relatively asymmetric information structure and weak coordination in these chains. They are farmers’ attitudes and cooperatives’ involvement in business activities. The majority of farmers in these chains sell their vegetables independently to buyers outside of the cooperative. These farmers were found to be less aware of post production activities that might be undertaken to satisfy consumers, and in realizing the benefits that can accrue to all chain actors by their actions. Similarly, the involvement of cooperatives is insufficient to support chain activities. Cooperatives in these chains are involved more in other business activities and less in input supply and vegetable marketing.
There are similar but minor effects of external environmental factors, such as changing consumer preferences and regional competition, and demand and supply uncertainties, on the information structure and coordination of the Panchkhal and Sarketari vegetable supply chains, although the Panchkhal potato supply chain is affected by imports and exports. In general, actors of these chains change cropping patterns to supply produce according to the preferences of consumers and to minimize the effects of demand and supply uncertainties.

9.3.2.2 Differences between Less Coordinated Chains

Some minor differences between these chains are observed with respect to information sources. Vegetable buyers are the main sources of information for producers of the Panchkhal chain. In the case of the Sarketari chain, however, the cooperative is the main source of market information. In this chain, farmers seek information from the cooperative even if they sell their produce directly to retailers.

Differences also occur in the selection of dyadic partners. In the Sarketari chain, retailers and the cooperative are the dyadic partners of producers. In this chain, producers sell the majority of their produce to retailers and the remaining to the cooperative. With respect to relationships between producers and buyers, selling directly to retailers can be considered insecure since the transaction with retailers is unstable, several transactions are required to sell the total production, and bypassing the cooperative in vegetable transactions lowers the performance of the cooperative by reducing its potential throughput. In contrast, producers in the Panchkhal vegetable supply chain sell most of their vegetables to assemblers in three different markets.

In summary, as in the highly coordinated chains, key similarities are observed in the overall information structure and coordination, and minor differences are observed in small components in less coordinated chains. The effects of external environmental factors are similar but insignificant with respect to the completeness of information structure and the degree of coordination between actors in the Panchkhal and Sarketari vegetable supply chains. However, imports and exports affect the information structure and coordination of the Panchkhal potato supply chain to some extent.

9.3.3 Comparison between Model One and Model Two

Similarities and differences are also observed between Model One and Model Two. Since these two models represent highly coordinated and less coordinated chains, there are fewer similarities than differences. The main similarities are the observation of horizontal coordination at the farmers’ level, presence of similar types of dyads in the vertical structure,
and complete information structures and strong coordination between assemblers – wholesalers – retailers. These two models differ from each other in the completeness of information structure and the degree of coordination at the chain level. Because of complete information structures and strong coordination horizontally between farmers and vertically between actors from input suppliers to retailers, the overall information structure is complete and overall coordination is strong in the chains included in Model One. Due to asymmetric information structure and weak coordination horizontally between farmers and vertically between input suppliers – producers – assemblers, the overall information structure is asymmetric and overall coordination is weak in the chains included in Model Two.

9.4 Research Synthesis

The cross-case comparisons within the models and across the models give an insight on the impacts of external and internal factors on information structure and chain coordination, and the relationship between these two. Results of the analysis of three variables: external environment, information structure, and chain coordination; attributes of these three variables; and feature(s) of each attribute, wherever appropriate, are presented in Table 9.2 to make it easy to explain the relationships between all four cases. The detail discussion of these results as required to answer the research questions posed in Section 1.2 is undertaken in next sections.

9.4.1 Effects of External and Internal Factors on Information Structure and Chain Coordination

The comparison between the cases within and across the case study models implies that information structure and coordination between actors are influenced more by internal factors than external factors in vegetable supply chains. In general, information structure was complete in those stages where information quality and willingness of actors were high, and asymmetric in those stages where these attributes were low. This suggests that there is an interrelationship between these two attributes of information structure. On the basis of this finding, it is concluded that actors exchange high quality information when they have a willingness to exchange information, and also in addition, the exchange of high quality information between actors will arouse a willingness among them to continue exchanging such information.

Similarly, the strength of horizontal coordination was assessed by the degree of horizontal alignment, and vertical coordination was assessed by the degree of customer focus and vertical alignment between actors. Horizontal alignment, and so horizontal coordination, was
### Table 9.2 Summary of Case Study Results

<table>
<thead>
<tr>
<th>Variables, attributes and features</th>
<th>Panchkhal Vegetable</th>
<th>Potato</th>
<th>Charaudi Vegetable</th>
<th>Sarketari Vegetable</th>
<th>Harthok Vegetable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External environment</strong></td>
<td>Insignificant effects</td>
<td>Minimum effects</td>
<td>Insignificant effects</td>
<td>Insignificant effects</td>
<td>Insignificant effects</td>
</tr>
<tr>
<td>1 Changing consumer preferences and regional competition</td>
<td>Minimal impact on information structure and chain coordination</td>
<td>Minimal impact of changing consumer preferences but significant impact of regional competition on information structure and chain coordination</td>
<td>Minimal impact on information structure and chain coordination</td>
<td>Minimal impact on information structure and chain coordination</td>
<td>Minimal impact on information structure and chain coordination</td>
</tr>
<tr>
<td>2 Demand and supply uncertainties</td>
<td>Minimal impact on information structure and chain coordination</td>
<td>Minimal impact of changing consumer preferences but significant impact of regional competition on information structure and chain coordination</td>
<td>Minimal impact on information structure and chain coordination</td>
<td>Minimal impact on information structure and chain coordination</td>
<td>Minimal impact on information structure and chain coordination</td>
</tr>
<tr>
<td><strong>Horizontal information structure</strong></td>
<td>Asymmetric</td>
<td>Asymmetric</td>
<td>Complete</td>
<td>Relatively asymmetric</td>
<td>Complete</td>
</tr>
<tr>
<td>1 Degree of information quality</td>
<td>Low</td>
<td>Low</td>
<td>High at all levels</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>2 Degree of willingness to exchange information</td>
<td>Low</td>
<td>Low</td>
<td>High at the farmers’ level but low at the assemblers’ level</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td><strong>Vertical information structure</strong></td>
<td>Asymmetric</td>
<td>Complete</td>
<td>Complete</td>
<td>Asymmetric</td>
<td>Complete</td>
</tr>
<tr>
<td>1 Degree of information quality</td>
<td>High from assemblers to retailers levels and low from input suppliers to assemblers levels</td>
<td>High from producers to retailers levels and low between input suppliers and producers</td>
<td>High in all dyads</td>
<td>High between producers-cooperative, cooperative-wholesaler, wholesaler-retailers dyads, but low between input suppliers-producers and producers-retailers dyads</td>
<td>High in all dyads</td>
</tr>
</tbody>
</table>
Table 9.2  Continued

<table>
<thead>
<tr>
<th>2</th>
<th>Degree of willingness to exchange information</th>
<th>High from assemblers to retailers levels and low from input suppliers to assemblers levels</th>
<th>High from producers to retailers levels and low between input suppliers and producers</th>
<th>High in all dyads</th>
<th>High between producers-cooperative, cooperative-wholesaler, wholesaler-retailers dyads</th>
<th>High in all dyads</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Horizontal coordination</strong></th>
<th>Weak</th>
<th>Weak</th>
<th>Strong</th>
<th>Weak</th>
<th>Strong</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Degree of horizontal alignment</td>
<td>Loose</td>
<td>Loose</td>
<td>Tight at the farmers’ level, but loose at the assemblers’ level</td>
<td>Loose</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Vertical coordination</strong></th>
<th>Weak</th>
<th>Strong</th>
<th>Strong</th>
<th>Weak</th>
<th>Strong</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Degree of customer focus</td>
<td>Tight from assemblers to retailers levels and loose from input suppliers to assemblers levels</td>
<td>Tight from producers to retailers levels and loose between input suppliers and producers</td>
<td>Tight in all dyads</td>
<td>Tight between producers-cooperative, cooperative-wholesaler, wholesaler-retailers dyads, but loose between input suppliers-producers and producers-retailers dyads</td>
</tr>
<tr>
<td>2</td>
<td>Degree of vertical alignment</td>
<td>Tight from assemblers to retailers and loose from input suppliers to assemblers</td>
<td>Tight from producers to retailers and loose between input suppliers and producers</td>
<td>Tight in all dyads</td>
<td>Tight between producers-cooperative, cooperative-wholesaler, wholesaler-retailers dyads, but loose between input suppliers-producers and producers-retailers dyads</td>
</tr>
</tbody>
</table>
found strong in those chains in which the cooperative was actively involved in chain activities, but weak in those chains in which the cooperative was less active in the vegetable business. Vertical coordination was strong in those stages of the chain where the degree of customer focus and alignment between actors were high, and low in those stages where these two features were low. Since both of these attributes of vertical coordination are themselves components of the chain goal, they are interrelated, and the increase in the degree of one attribute will be associated with an increase in the other attribute, and vice versa.

Because of their regular nature, the external factors (changing consumer preferences and regional competition and demand and supply uncertainties) produce insignificant effects on information structure and coordination of vegetable supply chains. Among the external factors, the effect of imports and exports is occasionally observed in the information structure and coordination of the potato supply chain. There are two main reasons behind the small impact of these external factors on these chains. The first one is that the quantity of vegetable demand produced in these chains usually remains higher than the quantity of supply because of their superior taste and quality in comparison to the vegetables produced in the tropical plain region of Nepal. The second reason is that, being fresh produce, vegetable import and export takes place only with the border markets of India and China. Since domestic supply is increasing, it is becoming more difficult for imported vegetables to compete with domestic items due to high transaction costs. Due to these reasons, chain actors have been paying more attention to improving the internal factors than to external factors in order to increase the completeness of information structure and the degree of coordination.

### 9.4.2 Horizontal and Vertical Coordination in Vegetable Supply Chains

Nepalese vegetable supply chains are characterized by smallholder producers, supply of diversified vegetable products, comparatively long, and involvement of several actors in every stage. Production of vegetables in a small piece of land and supplying individually is costly and difficult. To overcome these problems, farmers have organized into producers groups or cooperatives. The purpose of farmers working in these groups or cooperatives is to improve horizontal relationships between them and vertical relationships with other actors to bring efficiency in production and delivery of vegetables. So, the organization of farmers in the groups or cooperatives contributes to both horizontal and vertical coordination.

There are three main contributions of horizontal coordination in these chains. The first one is to align producers for vegetable production and marketing to fulfil market requirements. The
second one is to realize economies of scale and develop market power. The third one is to disseminate knowledge and experience widely to develop efficiency among producers.

Vertical coordination also contributes to these chains in three ways. They are aligning actors for chain activities and incentives, fulfilling the chain goal, and improving efficiency in the delivery of produce.

9.4.3 Relationship between the Completeness of Information Structure and the Degree of Coordination

In these supply chains, actors are interdependent in order to succeed in the business. The flow of information and material in these chains, and the activities performed to enable these flows are guided by the success that actors want to achieve. However, variation occurs in the arrangement of information, flow of information and materials, and activities performed in the chains.

The study shows differences in the completeness of information structure and the degree of coordination in these chains. However, a key observation was that relatively complete information structure was associated with strong coordination, and relatively asymmetric information structure was associated with weak coordination.

9.4.4 Effects of Information Structures on Coordination of Vegetable Supply Chains

The association of a relatively complete information structure with strong coordination and relatively asymmetric information structure with weak coordination suggests that there is a positive relationship between information structure and chain coordination. This research not only observes this relationship, but also provides an insight on how completeness of information structure contributes to strengthening or weakening chain coordination.

Complete information structure at any stage of the chain denotes the exchange of high quality information between actors and high willingness of these actors to exchange information. The exchange of such high quality information improves the performance of chain actors by increasing their knowledge level and responsiveness to consumers’ needs. Also, the exchange of such information minimizes risks and increases benefits, which will eventually strengthen the coordination between actors.

On the contrary, in those stages of the chain where information structure is relatively asymmetric, the flow of conflicting information takes place from different sources. This generally happens between producers and the first tier of buyers. Although buyers and
suppliers are the main sources of information for each other, the information exchanged between them is not congruent with the information received from cooperatives, GOs, NGOs, and radio. Because of this conflicting information, buyers and suppliers do not fully trust each other. This reduced level of trust further reduces the quality of information they exchange and so does not help to better align the activities performed by these actors to fulfill the interest of consumers and to benefit the whole chain. In this situation, actors concentrate on making short term profits for themselves from the transaction.

This discussion of these two contrasting situations suggests that the attainment of benefits lies behind the differences in observed information structures and chain coordination. These benefits are in the form of profits, market assurance and strong buyer-supplier relationships. The availability of these benefits promotes cooperation and collaboration, but the reduction of these benefits promotes opportunism. When benefits are reduced, actors start making judgements, like whether to share all or selected information, whether to continue with the transaction or to find another buyer. This type of situation negatively impacts the completeness of the information structure and the degree of coordination between actors. The key conclusion is, therefore, that to improve the information structure of a chain and so the coordination between actors, the structure of the benefits between players needs to be changed. A more detailed discussion on these benefits is undertaken in Section 9.5.5.

A second key insight emerging from this research relates to the role of cooperatives in realigning the structure of benefits for chain actors. The finding of this research shows that the overall information structure is complete and coordination is strong in the chain when information required mainly for producers (but also for other actors) is disseminated by the cooperative, and the cooperative is actively involved in supplying inputs and facilitating the marketing of the produce. It was found that information structure is asymmetric and coordination is weak in chains in which cooperatives are less involved in such activities. Therefore, active involvement of cooperatives in information sharing and other activities contributes to increasing the patterns of benefits to all supply chain actors, and increases the completeness of the information structure and the degree of coordination in the chain. The role of cooperatives is further discussed in detail in Section 9.5.6.

### 9.5 Comparison of Findings with the Literature

In this section, a discussion is carried out to compare the findings with existing literature. The discussion intends to explore whether the findings support or contrast with the literature related to the external factors affecting information structure and chain coordination, the
completeness of information structure, the degree of coordination, relationship between information structure and chain coordination, and the findings on the distribution of benefits and the role of cooperatives.

**9.5.1 Effects of External Factors on Information Structure and Chain Coordination**

In this section, the impacts of changing consumer preferences and regional competition, and demand and supply uncertainties on information structure and chain coordination are assessed by comparing the findings of this research with literature.

**9.5.1.1 Changing Consumer Preferences and Regional Competition**

Literature describes the process through which changing consumer preferences and global competition affect chain information structure and coordination between actors. Da Silva and Baker (2009) reported that changing preferences of consumers diversified food production worldwide, and to adjust the changing needs of consumers, production of fruit and vegetables has increased rapidly since the 1990s. As a result, significant expansion was observed in the global transaction of fresh produce (Wilkinson & Rocha, 2009). This has an impact on information structure, particularly on the frequency of exchange and consistency of exchanged information, and coordination between actors. Boehlje, Hofing and Schroeder (1999) suggested that the timely flow of more accurate and reliable information to increase the frequency of exchange and consistency of information, and tight alignment between actors was necessary to fulfil the demand of end-consumers.

This relationship between imports and exports and information structure and coordination between actors of potato supply chain was observed in this research. Due to the fluctuations in the volume of imports and exports every year, producers and wholesalers associated with this chain remain in close contact and share reliable information in a timely and frequent manner. To overcome the effects of over or under supply from imports and exports, producers and buyers agree to conduct all operations from harvesting to final delivery of the produce to retail outlets as per the suggestions of wholesalers.

However, with respect to vegetable chains, a contrasting result was observed on the effects of changing consumer preferences and imports and exports on information structure and chain coordination. In these chains, the nature of changing consumer preferences was gradual and imports and exports were regular. Although they have an impact on information structure, the changes they produce on the information to be exchanged have been accommodated in normal information sharing processes. Similarly, changing consumer preferences, and imports and
exports produce an insignificant effect on coordination between actors. To remain safe from any occasional incident that these factors may cause, producers and buyers normally do not change the transacting parties in those chains, where volume of transactions is normally high, such as in the Panchkhal and Charaudi chains.

9.5.1.2 Demand and Supply Uncertainties

Literature suggests that external environmental factors, such as changes in socio-economic and agro-climatic situations affect demand and supply of agribusiness products (Batt, 2006; Petrovic, 2001; Yawson & Aguiar, 2006). This is supported by the results of this research, which suggests that socio-economic factors, such as changing consumer preferences, and imports and exports, impact on vegetable demand. Similarly, agro-climatic factors, such as seasonality of production, rain and drought, and socio-economic factors, such as strikes, impact on vegetable supply. Except in the case of potatoes, these external environmental factors produce small and manageable impacts on the demand and supply situation in all four chains.

To minimize the effects of demand and supply uncertainties and to coordinate chain actors, Batt (2006) suggested that the timely flow of required information is necessary. The results of this research support this statement. As stated in Section 5.3.3.6, producers and buyers in the potato supply chain increase the frequency of information exchange to share more reliable and perfect information to each other. Since fluctuations in the demand and supply situation are small and manageable in the case of vegetables, they do not have a significant impact on information structure and coordination between actors. Whatever changes occur in the demand and supply situation are observed in the markets and wholesalers inform the situation to retailers directly and to producers via assemblers or the cooperative. Transaction between same parties is a measure that chain actors have adopted to minimize the impact of fluctuations in demand and supply. Regular transactions between the same parties prepare a basis for chain actors to strengthen coordination between them.

9.5.2 Completeness of Information Structure

The results showed that the completeness of information structure is the outcome of interrelationship between information quality and willingness of actors to exchange information. These two internal factors were measured horizontally at the producers’ level in all chains, and the assemblers’ level in one chain, and vertically in different dyads in all four chains. In this section, the impact of these two internal factors on the completeness of information structure that was found in this research will be compared with the literature.
9.5.2.1 Impact of Information Quality on Completeness of Information Structure

Various studies have been undertaken regarding the impact of information quality on information structure and information sharing. Omar, Ramayah, Lo, Sang, and Siron (2010) reported that, out of the five quality parameters namely, accuracy, credibility, adequacy, timeliness, and completeness, the importance of accuracy is highest and completeness is lowest in increasing the quality of information exchanged between manufacturers and suppliers of manufacturing companies. In contrast to this, four quality parameters studied in this research, namely consistency, reliability and perfectness, enabling operational efficiency, and frequency of exchange, are all found important for increasing or decreasing the quality of exchanged information. Since information is required to be passed through several stages to reach final recipients of vegetable supply chains, any reduction in the degree of any one parameter affects others, and so reduces the overall quality of information. Therefore, these parameters are considered complementary to each other.

Literature suggests that the behaviour of actors can affect the quality of information exchanged between them. Li and Lin (2006) argued that information sharing and information quality in manufacturing companies is influenced positively by trust and shared vision (a common view by actors), but negatively by supplier uncertainty, and is not influenced by customer uncertainty, technology uncertainty, and commitment of supply chain partners. The results of a similar study carried out by Cheng (2011) stated that profits from the business, customer satisfaction and market share are important in minimizing the occurrence of conflicts between chain members and ensuring the exchange of high quality information.

With regard to the behavioural impacts of information quality, the findings of this research, are closer to the findings of Cheng (2011) than to those of Li & Lin (2006). The results show that trust alone does not work unless the actors have a commitment to fulfil the chain goal. In highly coordinated chains, producers and buyers exchange necessary information and the material, financial, and assurance assistance required to produce and deliver the vegetables in such a way that they provide maximum satisfaction to consumers. The exchange that increases customer satisfaction enhances trust and commitment (Bauer et al., 2002). Such trust and commitment reinforces the flow of reliable and perfect information at required frequency, which increases the quality of information.
9.5.2.2 Impact of Willingness of Actors on Completeness of Information Structure

Previous studies found that willingness of actors to exchange information is influenced by company culture (Fawcett, Ellram, et al., 2007), information power on actors (Williams & Moore, 2007), behaviour and relationships between chain actors (Cheng, 2011), use of IT in sharing information (Fawcett et al., 2009), trust and economic value (Simatupang & Sridharan, 2001), and transparency (Eggert & Helm, 2003). It was found in the literature that willingness was studied as a component of information sharing or as a component of supply chain relationships. Therefore, these studies are incomplete with respect to the perspective taken in this study on the willingness aspect of information structure.

In contrast to these partial studies, a broader aspect of willingness is captured in this research. Hence, willingness of actors is judged from their information power, their behaviour, and transparency maintained in sharing information. The actors broaden their knowledge level from the information they acquire from different sources and gain information power in doing so. The willingness construct is also judged from the behaviour of actors, as the actors with cooperative behaviour share information with other actors in such a way that the information helps them to perform chain activities more efficiently, and maintain consistency in sharing high quality information with other actors. Similarly, the actors who are transparent and do not hide, withhold or distort information have higher levels of willingness to share information. The actors in these vegetable supply chains were found gradually acquiring the features of willingness from their knowledge level, dependency on the vegetable business, business culture – such as transaction on credit – and access to information, as well as convenient communication means, such as cell phones.

High willingness ensures the easy and consistent flow of information as requested by the exchange partners (Williams & Moore, 2007). Fawcett, Osterhaus, Magnan, Brau, and McCarter (2007) reported that information sharing in supply chains did not improve because of the lesser emphasis placed by the companies in arousing willingness among people, as opposed to their emphasis on information technology (IT) infrastructure. The willingness construct of that study is comparable to the one used in this study, but contrasts with the activities of cooperatives associated with vegetable supply chains in this research. Cooperatives pay more attention to performing activities to arouse willingness among staff and members than in developing communication facilities in all four chains. However, the frequency of conducting such activities by the cooperatives is higher in highly coordinated chains because of their involvement solely in the vegetable business. The frequency is low in
less coordinated chains as the cooperatives associated with these chains are involved more in businesses other than vegetables, which means that the willingness of staff and members to share information has only a minor contribution.

9.5.3 Degree of Coordination

The overall coordination in vegetable supply chains studied in this research consists of horizontal coordination, mainly between farmers, and vertical coordination from input suppliers to retailers. Since dyadic relationships are dominant over chain or network relationships in these chains, vertical coordination is ascertained by evaluating the coordination between dyadic partners from input suppliers to retailers. In this section, the findings on horizontal, vertical, and overall coordination, and the association between the coordination elements and the degree of coordination found in this study are compared with the findings of previous studies.

9.5.3.1 Horizontal Coordination

Very little literature is available on horizontal coordination, but available literature reports that horizontal coordination in agribusiness arises from the need to organize smallholder producers in a group, ranging from informal associations to investor-owned companies (Poulton & Lyne, 2009). The involvement of farmers in these groups helps them to accumulate produce in one place (O'Keefe, 1997; Poulton & Lyne, 2009), and to establish linkages with vertical partners to access the markets (Lyne & Martin, 2008). The findings of this research support the findings of these previous studies. Almost all producers associated with vegetable supply chains studied in this research are smallholder producers and most of them are involved in farmers’ cooperatives. The involvement of these farmers in the cooperative aligns them for vegetable production and marketing according to market requirements. Although farmers produce vegetables individually on their farms, the volume produced by individual farmers is too small to fulfil the quantity requirement of assemblers or wholesalers. Therefore, cooperatives establish collection centres and encourage farmers to collect vegetables in these centres to increase the volume. The collected vegetables are supplied to an appropriate number of buyers and transported together in a vehicle from the collection centres to distant markets. The activities from harvesting to supplying vegetables to distant markets are carried out in a scheduled manner that ensures vegetables are supplied fresh to consumers, and also to reduce the volume loss and transport costs.

It is also mentioned in the literature that, due to the imposition of some other costs and institutional problems, smallholders are discouraged from participating and investing in such
groups (Lyne & Martin, 2008). The authors mentioned ill-defined property rights as a possible cause of this problem. However, the findings of this research do not support this statement. Cooperative members were found to be satisfied with their involvement and investment, and non-members were found to be interested in joining the cooperative because of the benefits and services available to cooperative members.

Vegetable marketing and input supply are the important functions of the cooperatives studied in this research. Farmers pay commission to the cooperatives if they sell their vegetables at the collection centres established by cooperatives. From this commission, cooperatives manage their operating expenses and spend the rest in supporting farmers, such as supplying inputs and disbursing short term loans. The involvement of farmers in cooperatives is also a means of getting support from other organizations. GOs, NGOs and private organizations generally provide material or financial support and technical services, such as training and orientations to farmers through cooperatives. Later on, these farmers share technical knowledge and experiences among themselves during meetings. Although the magnitude of support and services to farmers from GOs, NGOs and private organizations depends on how actively the cooperative is performing its functions, benefits surpass the costs for farmers to be involved and invest in the cooperative. So, the performance of cooperatives has a direct positive impact on the alignment between farmers and on the strength of horizontal coordination.

9.5.3.2 Vertical Coordination

Factors affecting vertical coordination have been identified by several studies carried out in the past. According to the literature, the degree of vertical coordination between supply chain members is affected by the alignment of activities, incentives and information (Norrman, 2008; Piplani & Fu, 2005); interdependencies (Bankvall et al., 2010); and compatible goals, trust, commitment, and transparency in sharing information (Batt, 2006; Storey et al., 2006). These mechanisms align actors vertically for the benefits of all of them by producing and supplying products according to the requirement of customers (Arshinder et al., 2011; Lee et al., 1997). Arshinder et al. (2011) also pointed out that the focus of previous studies was often quite specific, covering, for example, aspects such as single coordination mechanisms in two-level supply chains (dyads), demand uncertainty, and contracts for single period of time.

This research tries to integrate and add to the findings of previous studies on vertical coordination. In this research, the results are derived from the study of more than one coordination mechanism adopted in whole supply chains. Coordination mechanisms, such as
information sharing, trust and commitment, goal compatibility, contracts, and incentive alignment between actors were studied in various stages of chains. Consideration was also given to the effects of changing consumer preferences, regional competition, and the impact of demand and supply uncertainties on information structure and chain coordination. This was done in terms of the history of each chain.

Similarly, literature highlights the benefits of coordination between actors. Coordination between actors benefits the chain by reducing inventory and lead times (Arshinder et al., 2011; Lee et al., 1997), developing efficiency in performing activities and utilization of resources (Haghighat, 2008), reducing costs and increasing profits (Haghighat, 2008; Jain, Nagar, & Srivastava, 2006), minimizing risks and uncertainties (Ballou, Gilbert, & Mukherjee, 2000), distributing risks and benefits equitably to chain members (Arshinder et al., 2011; Xu & Beamon, 2006), and improving responsiveness by timely information sharing in whole supply chain (Arshinder et al., 2011).

In this study, it was found that vertical coordination is providing benefits to the actors of Nepalese vegetable supply chains. The most important benefit is reducing costs and increasing profits. These actors have developed a schedule from harvesting to final delivery of the produce. As a result of this, harvested vegetables reach retail outlets within 24 hours. In addition, improvements have been made in activities, such as harvesting, storing, cleaning, sorting, assembling, packing, transporting, and handling. The efficiency in delivery of the produce and improvements in marketing activities helps to reduce volume loss and transport costs. Consumers also benefit from the supply of fresh vegetables at lowest possible prices. Another important benefit of vertical coordination is increasing and aligning business activities from input supply to final delivery, and growing the size of the vegetable industry. The alignment of activities is also helpful for developing efficiency among chain actors. As a result of this, farmers will have more time to invest in farm activities. Similarly, coordination between actors further strengthens their relationships, which widens the area of help and support that they give to each other. It was found in some of the chains that wholesalers were investing in seeds and other inputs required to produce the type of crops, which were highly demanded in the markets. In addition, vertical coordination gives producers assurance of selling their produce during the main season and assures buyers of getting the produce during periods of scarcity without much difficulty. The results also showed that such benefits are high in highly coordinated chains and less in less coordinated chains.
The results showed different degrees of horizontal and vertical coordination in different stages of the supply chains studied. Supply chain actors give equal importance to both types of coordination for bringing efficiency in production and delivery of vegetables to fulfil the requirements of consumers. Horizontal coordination is important in carrying out production activities and bringing the produce to markets, and vertical coordination is important in supplying the produce to final consumers in preferred condition.

9.5.4 Association between Information Structure and Chain Coordination

Literature on information structure and chain coordination shows different types of relationships between information structure and its components with different aspects of coordination. Important aspects of coordination captured in previous studies are interdependence, coordination problems, imbalanced inventory, and supply chain performance.

According to the literature, quality of information exchanged between actors affects the inventory level. Kaipia (2007) reported that information flow is positively related with material flow. Therefore, flow of inadequate information or inability to use shared information causes an imbalance on inventory level in different stages of the chain. Similarly, Rossin (2007) reported that the exchange of poor quality information in any stage results in an increase in the level of inventory in adjacent stages of commodity supply chains. Ding, Guo, and Liu (2011) stated that information sharing contributes to reduce the inventory level at the supply side of the chain.

A consistent finding is obtained in this research. Due to the occasional exchange of poor quality information, especially in the less coordinated chains, the information structure is unable to assure chain actors about demand, supply, and price situation in the market. As a consequence, producers and assemblers are less able to work efficiently in supplying the produce to the markets where demand is high but concentrate their supply on familiar markets which creates a market glut.

Previous studies show a positive relationship between information sharing and interdependence. Cheng (2011) found a positive relationship between information sharing and connectedness with both of these factors being influenced by relational benefits, such as profits, customer satisfaction, and market share performance. Williams and Moore (2007) reported that organizations build power from the acquisition of information and these
organizations use this power to create and foster the relationships with other organizations and increase interdependence.

The findings of this research support the findings of the literature. The level of interdependence is high in those chains where the exchange of high quality information takes place between actors with high willingness. In those chains, actors from one stage share their problem openly with other actors and are getting assistance occasionally or regularly. The arrangement of transport vehicles, mostly by wholesalers, transaction in credit at different levels, and occasional supply of inputs by the cooperative or wholesalers are some such examples.

In one study, Babbar, Addae, Gosen, and Prasad (2008) found that the divergence of information flow in a decentralized network can lead to a bullwhip effect and negatively affect supply chain performance. Supply chain performance deals with the entire chain’s ability to fulfill customer needs, and depends on how well all members work together rather than on how well each member performs separately (Simatupang et al., 2002). In this research, a similar but not identical finding is obtained with respect to coordination problems. The bullwhip effect and inaccurate forecasts are the two common coordination problems noticed in uncoordinated chains. Actors of these chains normally get information about broad market demand from different sources. The bullwhip effect occurs when farmers produce the types of crops or varieties on the basis of this information. The supply of such crops or varieties normally then exceeds the demand in the next year. The price does not then reach the forecast, due to this variation in demand and supply. So, producers are affected by this bullwhip effect.

This research also gained insight into the impact of the structure of the chain and behaviour of actors on information structure and chain coordination. Asymmetric information structure and weak coordination in some of the chains are impacted by the factors, such as the structure of the chain, behaviour of actors, and the process through which information is passed along the chain. The supply chains studied in this research have five to six stages from input suppliers to consumers and have several actors in every stage. Transfer of information from one actor to another in such a long chain, dissemination of it to several actors in every stage, and verbal communication, can distort the information that flows along the chain. This is further aggravated by opportunistic behaviour of some chain actors. It was found that, for short term personal benefits, some of the actors disguise or manipulate information. Since information is passed from one actor to another, the distortion of information in any stage of the chain causes
distorted information to flow along the whole chain. The exchange of such information makes the information structure asymmetric, which reduces trust between actors, and the actors could not become interdependent with respect to each other for information, materials, or resources. As a result of this mistrust, the activities performed by chain actors are misaligned and coordination becomes weak.

It was also observed from the results that the role of cooperatives, and support from GOs, NGOs and private organizations, impacts on both information structure and chain coordination. The involvement of cooperative impacts positively but the impact of support of other organizations is less obvious. The flow of information as well as fresh produce is difficult in vegetable supply chains due to their length and complexity, but the active involvement of cooperatives eases the flow in some of the chains. These cooperatives help farmers from their own resources or the resources received from GOs, NGOs and private organizations. These organizations provide valuable information as well as technical, material, and financial support to farmers through cooperatives for developing efficiency in performing production and marketing operations. Since such information and support are focussed on farmers, buyers have a feeling that these organizations protect producers. Although this is not a widespread feeling, some of the buyers do not give importance to the price information disseminated by these organizations, and do not properly align the benefits to farmers, especially in less coordinated chains.

9.5.5 Role of Benefits on Information Structure and Chain Coordination

The association observed between the completeness of information structure and the degree of coordination indicated that the factors that influence information structure also influence coordination in the same direction. A review of different stages of particular vegetable supply chains is now done to find out why information is not shared and activities are not performed according to the level required to increase the completeness of information structure and increase the degree of coordination. Since the actors in highly coordinated chains were working carefully to share information and perform activities to achieve the chain goal, the answer of this question is sought from the results of less coordinated chains. The review of the results of these chains shows that actors focus only on their individual benefits in a situation where they are convinced that the information exchanged and the activities performed by other actors do not benefit them according to their expectation.

The attainment of benefits depends on the achievement of chain goal. There are two components of the chain goal: customer satisfaction and benefits to all chain members. The
achievement of chain goal is contributed to the information that flows with respect to it, and activities performed by actors. In highly coordinated chains, actors are working for the benefits of the whole chain, but in less coordinated chains, they are working for the benefits of the whole chain in some stages and for the benefits of themselves only in some other stages. As a result, customer satisfaction remains less visible, especially in those stages of the chain where actors are working for their own individual benefits. This implies that, whether the actors are involved in the highly coordinated chains or less coordinated chains, they want to maximize their benefits from information they share and transactions they make.

The relationship between the benefits received by chain parties, information structure and chain coordination have been documented in the literature. Simatupang and Sridharan (2001) reported that an inequitable distribution of benefits and burdens tempted supply chain actors to distort shared information, which weakens the relationships between them and reduces the overall performance of the chain. Raghu, Jayaraman, and Rao (2004) added that organizations are unable to take advantage of a changed information structure unless incentive mechanisms are altered to benefit all associated with the chain. Similarly, the proper alignment of incentives, such as risks, rewards, costs, and benefits increases the degree of coordination (Narayanan & Raman, 2004; Simatupang & Sridharan, 2008). A very relevant study was carried out by Cheng (2011), which reported that relational benefits have an impact both on information sharing and connectedness. These relational benefits are profits, customer satisfaction and market share performance, and connectedness is interdependency between actors. Actors become interdependent with each other because of these benefits, which ultimately strengthens inter-organizational relationships.

The types of benefits that chain actors want to acquire from the exchange of information and transaction of vegetables are profits from the business, market assurance and strong buyer-supplier relationships. Expecting profits from the business is natural as every individual wants to get a return from investments. Being fresh produce, assurance for buying and selling is an important benefit, especially for first tier buyers and producers. In the context of Nepal, where storage facilities are poor, producers want to sell their vegetables quickly after harvest to get a good price. Being a seasonal item, it is also important for the first tier of buyers to get vegetables from producers all the year round to run their business. These needs bring producers and buyers close to each other in sharing information and making transactions. Due to these needs, it was found in one chain that even though there was lack of trust between producers and buyers, they were transacting regularly with the same parties. Strong buyer-supplier relationship helps each other to fulfil market demand by improving production and
marketing activities. The actors who have strong relationships are inspired to exchange high quality information and transact vegetables regularly.

9.5.6 Changing Role of Cooperatives: Importance of Horizontal Coordination

The purpose of forming cooperatives by producer farmers is to benefit members through various services, cost savings, and/or profits (Harris, n.d.). The cooperatives that were subjects in this research are multipurpose in function and are involved in supplying inputs, and facilitating marketing of agricultural produce and consumer goods, and saving and credit operations. They are also involved in social and community development programmes. In addition to these functions, these cooperatives are collecting and disseminating market information to supply chain actors.

It is mentioned in the literature that one of the reasons for forming farmers’ cooperatives is to overcome barriers to information (Chambo, 2009; Ortmann & King, 2007). However, explicit discussion on how these cooperatives fulfil information needs of farmers is lacking in the literature. A cooperative is a strong form of horizontal coordination between farmers, but the role that information, disseminated by cooperatives, plays in vertical information structure and vertical relationships between actors has not been clear in prior literature. The finding of this research makes a contribution in filling these gaps through its in-depth analysis of the information sharing role of cooperatives, both horizontally and vertically.

The discussion on information structure in all four chains suggests that the presence of a cooperative and its dominant role in information exchange has a major contribution in improving information quality and increasing the willingness to exchange information at the farmers’ level, and in the whole chain. The flow of high quality information also helps to align the activities of actors and strengthens both horizontal and vertical coordination in the chain.

From the results of this research, it is suggested that the role of cooperatives as an information collector and disseminator is important and has been under-emphasized in terms of its contribution to the ability to deliver services, reduce costs and increase profits. The exchange of high quality information about markets, technologies, and services through the cooperative empowers supply chain actors, especially producers. Therefore, the actors in every stage of supply chains prefer to exchange information with the cooperative whether they transact with it or not. The performance of this role by cooperatives has a major contribution in developing
efficiency in production and marketing operations, and in gradually expanding the size of vegetable business.

9.6 Conclusion

This discussion of research results was conducted by considering four areas. The theoretical framework was revisited by comparing the expected patterns with observed patterns in the first area. In the second area, cross-case comparison was done by grouping the cases into two models. The third area directly answered the research questions. The discussion on the effects of external and internal factors on information structure and chain coordination, and associations between these two was conducted in the fourth area. The discussion carried out in these four areas led to insights on the changing role of cooperatives and benefits derived from business activities, and the impacts of these two on information structure and chain coordination.

In the course of comparing and contrasting, the findings of this research on the relationship between external environment, information structure, and chain coordination both confirm and contradict parts of the existing body of literature. This implies that no single theory can explain all aspects of the influence of external and internal factors on information structure and chain coordination and the association between these two. This further justified the multi-theoretic and integrative approach employed in this research.

Based on the discussion undertaken in this chapter, the summary of findings, their implications, the key contribution of this research, research limitations, and suggestions for future research, are presented in Chapter 10.
Chapter 10
CONCLUSION

10.1 Research Summary

The research context for this study is fresh vegetable supply chains in Nepal. The fundamental purpose of the research is to identify factors that impact on the environment external to these chains, information flows, and relationships between actors in supply chains, so that the role that information structure plays in coordinating chains can be more fully explored. This was achieved through answering four related research questions.

A review of literature on information flows and chain coordination was conducted to find out the type, nature, and outcome of research on those issues that had been carried out in the past. The focus of this review was on coordination theory, transaction cost economics, network theory, supply chain management, chain coordination and information structure. This review of theoretical material and their application to information flows and supply chain coordination suggested the need for a broad theoretical perspective to analyse the complexity of these two aspects of supply chains. Therefore, a model was developed that encapsulated theoretical aspects relevant for the study of information flow and coordination between actors in fresh produce supply chains. This was followed by the establishment of theoretical propositions that delineated possible relationships between the constructs of this model.

The nature of research questions, theoretical model developed from the review of literature, and theoretical propositions led to the development of a qualitative research methodology and the use of a case study strategy. To increase the robustness of outcomes through both literal and theoretical replication, a decision was made to study multiple cases. Considering the complexity of vegetable supply chains and the mechanisms used in sharing information and making transactions, the adoption of a multi-stage, multi-dyadic approach was required. Therefore, an embedded multiple case study design was used.

For the case studies, four domestic vegetable supply chains were selected from the middle hill range of Nepal. Primary data were collected from in-depth interviews with chain participants and service providers. In addition to interviews, data were also gathered by observing the participants and their marketing processes, and from secondary sources. The data collected from different sources were analysed to derive the results. On the basis of these results, these four cases were collapsed into two models. Model One comprised the more highly
coordinated Charaudi and Harthok chains, while Model Two comprised the less coordinated Panchkhal and Sarketari chains.

The research insights developed from the findings of this study are related to the influence of external and internal factors on information structure and chain coordination, association between these two components of supply chains, and forces behind the completeness of information structure and the degree of coordination. Vegetable supply chains studied in this research are developing to fulfil the domestic demand. Since other external factors, such as changing consumer preferences, imports and exports, and domestic supply are all associated with this demand, information structure and coordination of these chains are less affected by these factors. Potato supply chain is an exception. Occasional fluctuations in the imports and exports reduce the completeness of information structure and coordination between actors in this chain. Rather, the completeness of information structure on these chains depends on the quality of information that flows in the chain, and willingness of actors to exchange information. Similarly, the level of coordination depends on the degree of customer focus and alignment of benefits among chain actors.

Considering the role of these internal attributes, actors pay more attention in increasing the quality of information and arousing willingness among themselves to increase the completeness of information structure. They are also focussed towards satisfying consumers through production and delivery of vegetables according to their requirements and aligning benefits received from the business to all chain members to increase the degree of coordination. However, variation observed on these chains in the level of these attributes as well as the completeness of information structure and the degree of coordination. Despite these variations, uniformity was found in the association between the completeness of information structure and the degree of coordination. The finding showed an association of relatively complete information structure with strong coordination and relatively asymmetric information structure with weak coordination. Trust, commitment, satisfaction, and integrity developed between actors, as a result of the complete information structure, contribute to strengthen the degree of coordination.

Strong horizontal coordination accompanied by complete information structure at the farmers’ level aligns producers for production and supply of vegetables according to market requirements, assemble vegetables to attract buyers, and disseminate knowledge and experience to increase the efficiency of all members. Similarly, strong vertical coordination in association with complete information structure from input suppliers to retailers aligns
activities and incentives, leads actors towards achieving the chain goal, and increase efficiency in delivery of the produce.

A key insight is that similar patterns of information structure and chain coordination are observed as a result of the effects of same factor towards the same direction. This factor was identified as the benefits that chain actors receive or intends to receive from the information they shared and the transaction they made with other actors. Profits, assurance in buying and selling, and strong buyer supplier relationships are the benefits, which drive the completeness of information structure and the degree of coordination towards same direction. The findings also suggest that the completeness of information structure and the degree of coordination in these chains also depend on the role that cooperatives play in sharing information and performing business activities. Higher the role of cooperatives in information sharing and performing business activities, stronger is the coordination in the chain or vice versa.

10.2 Research Contributions

There are two areas, in which this research contributes. These are contributions to the literature, and operational and policy contributions.

10.2.1 Contributions to the Literature

This research has contributions to the literature in three different ways. They are the development and use of a multi-perspective model, the identification of the impacts of benefit distribution on information structure and chain coordination, and the role that horizontal coordination can play in increasing the completeness of information structure and the degree of coordination.

In the first instance, the development of the theoretical model by incorporating different theoretical perspectives is a contribution of this research. This research addressed problems related to symmetry or asymmetry of information structure, interdependency and relationships, governance structure of chains, and behaviour of chain actors. The integration of different theoretical perspectives helped to achieve depth in analysing these issues. The model developed for this research could be used in other similar studies in the agribusiness sector, either with or without modifications.

This theoretical model was employed to analyse the effects of external and internal factors on information structure and chain coordination. Similarities and differences in patterns of information structure and chain coordination observed in different stages of the chains studied, allowed identification of the underlying factors which drive these variables. It
became evident that the benefits from the business, in the form of profits, market assurance, and strong buyer-supplier relationships, are the main factors that drive information structure and chain coordination both.

The major theoretical contribution of this research was in revealing the importance of the role of horizontal coordination in information structure and vertical coordination. In general, prior studies related to coordination have been focussed on vertical coordination. Although horizontal coordination is important among producers in agribusiness supply chains, very few studies have captured it within their scope. Those studies that have been done have tended to focus on access to public goods (non-excludable, such as the market information posted on the notice board) or club goods (excludable, such as the technology available for use in farmer’s field), and the extent to which access to these public or club goods drive horizontal coordination, and strengthen contract enforcement. However, several other aspects of horizontal coordination were unexplained. These aspects were related mainly to the role of cooperatives in sharing information, contribution of horizontal coordination at the farmers’ level in improving vertical information structure and vertical coordination in the chain, and the contribution of cooperatives in commercializing the vegetable industry in developing countries like Nepal where farm sizes are small. This research helps to fill this gap, and reaches the important conclusion that information shared and activities performed by farmers’ cooperatives are the key factors in increasing the completeness of information structure in the chain, and strengthening the vertical coordination between chain members.

10.2.2 Operational and Policy Implications

The findings of this research have operational implications for supply chain actors and policy implications for governments. Supply chain actors and policy makers utilize the findings of this research as it has explained why the completeness of information structure and the degree of coordination is high in some stages of a chain and low in others. This research also identifies reasons for differences in information structure and chain coordination in different situations.

With respect to the results of less coordinated chains, this research has clearly pinpointed that problems occur in information sharing and aligning chain activities horizontally at the farmers’ level and vertically in the producers – assemblers’ dyad when conducting post-production and marketing activities. The main causes of these problems, as identified in this research, are the flow of conflicting information from different sources, cooperative support is less in information sharing and facilitating marketing of inputs and outputs, and opportunistic
behaviour of actors. As a result, observed problems can be mitigated by removing the causes of these problems, which can increase the completeness of information structure and degree of coordination in those stages of the chain, as well as in the overall chain. This study can provide insights for policy makers, and assist them to make necessary adjustments in policies and support that can increase the information flow and improve relationships between actors in supply chains.

10.3 Research Limitations

Although this research contributes to fill research gaps in information flow, supply chain coordination, and associated factors, it is constrained by number of limitations. The first limitation is related to the selection of cases. Four domestic vegetable supply chains, originated from the middle hill range of Nepal were selected purposively for this research. Since the production areas of these chains are located in the subtropical region, they normally supply similar types of vegetables in the same season. However, there are several other vegetable supply chains, which originate mainly from east to west and from the southern plain to middle hill range in Nepal. The contribution of vegetables supplied from the chains originating from the southern plain is high both in domestic and export markets, but they could not be captured in this study. Therefore, the cases selected for this research are not necessarily representative of all the vegetable supply chains in Nepal.

Another limitation is the focus of this research only on the supply of fresh vegetables to traditional wet markets. This research does not include the processing of vegetables as well, or the supply of vegetables through supermarkets. Since it was found in the fieldwork that vegetables were supplied for processing and supermarkets directly from wholesale markets, it was difficult to segregate how much of the vegetables delivered from these chains were supplied for processing and supermarkets. Due to this reason, those segments of supply chains could not be captured in this research.

The third limitation is undertaking research from cross sectional data. The collection of longitudinal data was not possible due to time and resource constraints. Any comparative changes in the process of information exchange and the alignment of business activities could not be included in the findings because of the use of cross-sectional data.

The fourth limitation was in the availability of data, especially in case of weakly coordinated chains. Very few secondary data could be obtained from these chains due to their recording
problems, so, the results derived from these chains are principally based on interviews and observation.

10.4 Suggestions for Future Research

This research prepares a basis for future to undertake research on the relationship between information structure and chain coordination in different sectors. In absence of in-depth study like this, researchers had to take references of studies, in which the relationship between information structure and chain coordination is dealt as components. The models developed from this research portray different types of relationships between information structures and coordination between actors, and can be employed to study such relationships in various sectors.

The information structure of a chain is analysed from its shape and arrangement of information in this research. The results of all four chains suggest that web-shaped information structure is relatively complete and hierarchical-shaped information structure is relatively asymmetric. Since this research does not go into the depth of this association, this could be a matter of research for other researchers.

Another aspect, on which future research can be undertaken, is verifying the first key insight of this research by collecting quantitative data. This research identified that profits from the business, market assurance for the produce, and strong buyer-supplier relationships as the underlying benefits, which drive information structure and chain coordination both towards the same direction. This claim can be verified by conducting a quantitative research.

This research has highlighted the importance of horizontal coordination on information flow and vertical relationship between actors in vegetable supply chains. Since horizontal coordination is equally important as vertical coordination in agribusiness chains, this research opens up the possibility of undertaking further research on horizontal coordination in different sectors of agribusiness. Horizontal coordination through farmers’ groups or cooperatives has been studied in this research, but other forms of horizontal coordination, such as farmers’ committees and companies can be the topics of study for other researchers.

10.5 Final Remarks

The growing competition between supply chains creates a mounting pressure over their actors to exchange high quality information to improve business activities and their own behaviour. In this context, the research findings suggest benefits from the business as the resolution that
addresses important issues towards increasing the completeness of information structure and the degree of coordination. This resolution provides an insight to supply chain actors that one group of actors share information and perform activities according to the requirements of other groups only when those actors are assured on benefits from other groups. This motivates the actors to align benefits, information and activities for the attainment of chain goal.
References


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Appendix A
Chain Description, Panchkhal

A.1 General Description of the Chain

The Panchkhal Valley is the production pocket of the potato and green vegetable supply chains. This is a fertile valley of Kavre District where different types of vegetables and potatoes are grown. Vegetables produced in this Valley are sold through assemblers doing business inside the collection centre established by a cooperative or through assemblers stationed in nearby markets. Potatoes are sold directly to wholesalers from farmers’ field. Panchkhal Village Development Committee (VDC) is the centre of the Valley but the Valley itself includes parts of Anekot, Baluwa and Raviopi VDCs. The location of the collection centre in Panchkhal VDC of Kavre District is presented in Figure A.1.

Figure A. 1 Map showing the location of collection centre in Panchkhal, Kavre District, Nepal

The rural market, located at the centre of the Valley, is known as Tamaghat. Tamaghat is 18 km east of Banepa and 44 km east of Kathmandu. Arniko Highway passes through Tamaghat, connecting the Valley to Kathmandu and Khasa (China). This Highway links Tamaghat not only to Kathmandu and Khasa but also to other markets, like Banepa, Dhulikhel, Lamosanghu, Barhabise and Tatopani. Tamaghat is connected to some other markets, like Chautara, Jiri, Charikot and Manthali from road networks. Kathmandu, the biggest consumer
market for agricultural produce, is only 44 km away and other market centres are also within the range of 150 km. The road link of Tamaghat to all these markets makes it easy to transport agricultural inputs from markets to production sites and primary produce from production sites to markets. Location of markets within a short distance also increases the market access for the produce and ultimately reduces the transaction costs associated particularly with transport and post harvest loss.

The Panchkhal chain does not have a long history of commercial vegetable production. The Chairman of Rural Women Development Multipurpose Cooperative Ltd who is also a vegetable producer noted that potato production was begun in 1985/86. According to her, the Women Development Section (WDS), a Government Organization (GO), contributed significantly to promote potato production in the Valley in 1980s. Production of green vegetables was started from the formation of farmers' group in 1994. The Centre for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED), a Non-Government Organization (NGO), has made major contribution in promoting the production of green vegetables. The efforts of these agencies encouraged farmers towards commercial vegetable and potato production.

Farmers reported that the WDS and the CEAPRED, in association with DADO, motivated them to form producers' groups. The process of forming producers' groups is generally informal as the interested farmers of nearby area meet and prepare their own rules and regulations to be in the group. DADO staff explained that the initial concept of forming farmers' groups was to make it easy to deliver the production technologies to more people at a time. The implementation of production programmes on these groups contributes to increase overall production but the volume of vegetables produced by individual farmers was small.

There was a need to establish collection centres in different parts of the Valley to collect vegetables produced by smallholder farmers. To cater for this need, Small Marketing Infrastructure Project (SMIP) under the Department of Agriculture (DoA) constructed two Vegetable Collection Centres (VCC): one in Tinpiple and another in Tamaghat of Panchkhal in 1998/99. Only the collection centre in Tamaghat is in operation now. This is working under the Market Management Committee (MMC) formed by the Progressive Multipurpose Cooperative Ltd. However, there are several other collection centres operated by local assemblers or cooperatives in different parts of the valley. These collection centres establish contacts with the wholesalers and retailers to supply vegetables and potatoes at distant markets, mostly in Kathmandu.
Marketing of vegetables produced in Panchkhal is Kathmandu centred. Farmers and assemblers noted that almost 90 percent of the vegetables produced in Panchkhal are sold to Kathmandu and the remaining 10 percent to other domestic markets and Khasa. Kathmandu is a densely populated Valley with an estimated population of about 2.7 million\textsuperscript{17} in 2011. There are people from very high to very low income category in this Valley. Hence, Kathmandu is the key market for both high and low quality goods. Therefore, farmers are selling what they are producing for the market, and buyers are buying what farmers are bringing for sale. Local assemblers said that they do not reject the produce that farmers bring for sale but there may be variation in price according to its quality and season of supply.

Farmers said that they harvest vegetables in the morning to sell them in the VCC or Tamaghat and in the late afternoon to sell them in Banepa next day. Assemblers collect vegetables in the late afternoon in the VCC or Tamaghat and early morning in Banepa. The VCC or Tamaghat-based assemblers supply the collected vegetables to buyers in the same evening but Banepa-based assemblers supply them to buyers soon after getting them from farmers. A Tamaghat-based assembler explained the timeline of collecting and supplying vegetables:

"We collect vegetables for 2-3 hours. Vegetables are dispatched to Kathmandu after 10.00 pm. It requires 2-3 hours to transport the produce to Kathmandu. The time when vegetables reach Kathmandu is 1.00-2.00 am next day. They are unloaded from the truck before 5.00 am. Nearly 75 percent of these vegetables are sold to retailers before 9.00 am. Potatoes are sold not so quickly and may be stored at wholesaler's store for 2-3 days."

The vegetable requirement of Kathmandu Valley is around 1000 tons per day\textsuperscript{18}. The market officials and wholesalers of Kalimati Wholesale Market said that this market fulfils more than half of the total vegetable requirement of the Kathmandu Valley. They said that Panchkhal is one of the important sources of supplying vegetables in this market. However, to fulfil the requirement of such a big volume, the market receives vegetables from several other sources, like other production sites of Kavre District, Prithvi Highway corridor of Dhading, terai\textsuperscript{19}, Palung area of Makawanpur and Southern part of Nuwakot. Local production and imports also contribute in fulfilling the vegetable requirement of the Kathmandu Valley.

\textsuperscript{17} Estimated population includes the total of permanent and temporary population of the Kathmandu Valley.
\textsuperscript{18} Estimated by Kalimati Wholesale Market
\textsuperscript{19} Plain area in southern part of Nepal
A.2 Chain Activities and Practices

A.2.1 Input Supply, Production Activities and Practices

Farmers said that they usually buy vegetable seeds from the market but they store their own potatoes in the cold store for seed purpose. The operator of Palanchowk Bhagawati Cold Storage P. Ltd, Panchkhal said that almost all potatoes stored in the cold stores are taken back during October – November, seed sowing time. Farmers buy other inputs, like fertilizers and pesticides for vegetables and potatoes mainly from the private input dealers. Cooperatives supply only the fertilizers some time. Farmers felt difficulty in buying fertilizers but other inputs were available easily in the past. Farmers are receiving technical services from the DADO or its Agriculture Service Centre (ASC). The DADO gives priority in providing such services to the farmers of Panchkhal as it has identified the area as a vegetable and potato production site.

Farmers reported that almost all members in their groups or cooperatives are involved in vegetable and potato production. They said that the size of holding is small in the Panchkhal Valley and ranges from 1 – 30 ropanies. These farmers generally produce vegetables and potatoes on their own land. However, the farmers with insufficient land produce these crops on rented land. According to the Chairman of Rural Women Development Multipurpose Cooperative Ltd., around 50 percent members of her cooperative have rented land for vegetable and potato production.

Depending on the availability of irrigation facility, the land can be divided into irrigated (khet) and unirrigated (pakho). Farmers generally own or rent both types of land and grow cereals, potatoes and vegetables in rotation. In summer months (June – October), they grow rice in irrigated land and other crops (including vegetables) in unirrigated land. Potatoes are normally produced in both types of land during October – February. After potatoes, farmers normally grow vegetables in irrigated land and maize in unirrigated land. From March – June, nearly half of the area is covered with vegetables and the rest by maize. Water scarcity is the limiting factor for vegetable production. Despite this limitation, Panchkhal is a famous production area for potatoes, tomatoes and other green vegetables, such as beans, asparagus beans, chillies, capsicum, egg plants, cucumber, bitter gourds, bottle gourds, snake gourds, pumpkins, okra, cauliflowers and cabbages.

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20 1 ropani = 74 ft x 74 ft (509 square metre) land area. For an approximate calculation, one ropani of land is considered 500 square metres.

21 *Vigna unguiculata* subsp. *sesquipedalis*. Also called yard-long bean, snake bean or Chinese long bean.
Farmers said that they prefer to use family labour from land preparation to marketing of vegetables and potatoes. However, they also use outside labours on hire or mutual exchange basis. Farmers get loans from their groups or cooperatives if they run out of money to undertake production operations. Farmers’ groups or cooperatives collect savings from each member to lend them for production or household purpose.

A.2.2 Product and Ownership Flow in the Chain

In this supply chain, product and ownership flow takes place from input suppliers to consumers via the actors working in between them (see Figure A.2). The input dealers or cooperatives are the input suppliers in this chain. Some of the input dealers associated with this chain also collect vegetables from farmers. However, any such quantities purchased by input dealers are negligible in total transaction.

![Figure A.2 Product and ownership flow in the fresh vegetable supply chain originating from Panchkhal](image-url)
Farmers said that about half of the vegetables produced in the Panchkhal area are sold to assemblers in the VCC or in Tamaghat market and the rest half to assemblers in Banepa. Majority of the vegetables purchased by assemblers in the VCC, Tamaghat, and almost all purchased in Banepa is supplied to wholesalers from Kathmandu. Some of the Tamaghat-based assemblers sell their vegetables directly to retailers of different markets in the Kathmandu Valley. Wholesalers sell most of the vegetables to retailers and negligible to consumers directly. Since Nepalese consumers prefer to buy fresh vegetables every day, retailers sell small amount to several consumers.

The ownership of production inputs and vegetables is transferred from one actor to another when they are sold. Farmers get the ownership of inputs from private input dealers or cooperatives. Farmers mainly purchase seeds from input dealers of Tamaghat, Banepa or Kathmandu, but purchase other inputs from input dealers or cooperatives of their periphery. The ownership of almost all vegetables is transferred from farmers to assemblers but the ownership of negligible volume is transferred directly from farmers to retailers via assemblers. The wholesalers of Kalimati Wholesale Market, Kathmandu reported that the ownership of around 80 percent of the vegetables is transferred from assemblers to retailers and they operate on a commission basis. The ownership of rest of the 20 percent is transferred first to wholesalers and then to retailers.

The product and ownership flow in the potato supply chain is presented in Figure A.3. In this chain, farmers sell majority of the potatoes to wholesalers directly from the field. These wholesalers sell potatoes to retailers in the Kathmandu Valley or again to wholesalers of distant markets. Since the storability of potatoes is high in comparison to green vegetables, some of the consumers prefer to buy potatoes directly from wholesalers in bulk.

In the potato supply chain, farmers get the ownership of inputs from private input dealers and cooperatives. After harvesting, farmers supply potatoes to wholesalers in two ways. Wholesalers said that the ownership of around 60 percent of potatoes, which they receive on commission basis, is transferred from farmers to retailers. Since wholesalers purchase the remaining 40 percent of potatoes, the ownership of this volume is transferred from farmers to wholesalers and then from wholesalers to retailers. The ownership of negligible volume of potatoes is transferred directly from wholesalers to consumers. When retailers sell, the ownership of potatoes is transferred from retailers to consumers.
Figure A. 3 Product and ownership flow in the potato supply chain originating from Panchkhal

A.2.3 Assessment of Demand and Supply Situation

Vegetable and potato demand is increasing in the markets where vegetables are supplied from Panchkhal. The causes of increasing demand are increasing urban population and changing food habits of the people. Kathmandu Valley is the main market of the vegetables and potatoes produced in Panchkhal. The growth rate of urban population inside the Kathmandu Valley is growing at a faster rate than the overall urban population growth rate of Nepal. The additional demand is created by increasing population as well as reducing local production. The local production is reduced due to the conversion of farm land into residential area to accommodate the increasing population.

The actors said that they observe several changes in the food habits of people in comparison to the past. In urban areas, people prefer to consume more than one vegetable item in meals. The consumption is diversified and people want vegetables in different forms: cooked, raw or processed. The consumption of noodles and dumplings which require plenty of vegetables to prepare is significantly increased. Although the demand for other vegetables goes up and
down depending on the season of production, the demand for potatoes, tomatoes, onions and garlic are almost similar all the year round. Out of these four items, potatoes and tomatoes are produced extensively in Panchkhal. Also, the demand for red potatoes and tomatoes produced in Panchkhal is very high. An assembler said:

“Consumers prefer to buy red potatoes and tomatoes produced in Panchkhal. Even though the pesticide use is high in Panchkhal, the demand for these two commodities is increasing. These two items are gaining popularity in the market saying that they are tastier than the ones produced in other places.”

Farmers said that they get information about market demand mainly from buyers, Government officials and the cooperative. Since the demand for red potatoes produced in Panchkhal is very high in the market, all farmers around the Panchkhal area produce them in the winter season. Similarly, tomatoes are produced in two seasons: May – June in irrigated land and August – September in unirrigated land. Other vegetables are produced in both types of land but the main vegetable production season lies between March to July. A Cooperative Chairman said that farmers supply around 60 tons of green vegetables a day to Banepa in the main season. The supply drops down to 10 tons a day in March – April. In other months, they supply around 30 tons a day. Approximately, equal amount of vegetables are supplied locally to assemblers inside the VCC and Tamaghat. Similarly, the leader of a farmers’ group said that every member of her group produces around 7.5 tons of potatoes per year. The Cooperative Chairmen agreed on this figure and said that around 20,000 tons of potatoes are produced and supplied to markets annually from Panchkhal by 2641 farm households.

Farmers said that they pay full attention in market demand while producing vegetables and potatoes. They are introducing high yielding varieties of vegetables and developing water efficient irrigation technologies (like drip irrigation) to increase production and duration of vegetable availability in the markets. A Cooperative Chairman said that the total vegetable supply in the main season reaches more than 100 tons a day in 2009 from around 10 tons a day in late nineties. Similar type of progress is achieved in potato production and supply. Only a few elite farmers were producing potatoes in late eighties. Due to their increasing demand, red potatoes are grown in the whole Panchkhal Valley now during the winter season.

A.2.4 Import and Export

Wholesalers and assemblers associated with this chain said that they import and export vegetables and potatoes. According to wholesalers, the share of imports and exports is less than 10 percent of the total transaction in the Kalimati Wholesale Market. Leaving some
exceptions, the value of imports and exports remains almost equal every year. Wholesalers import vegetables and potatoes from India, Bhutan and China, and export to India and China. Due to open border, easy access and short travelling distance, Nepal imports and exports vegetables and potatoes mostly with India.

The imports and exports between Nepal and India takes place in different seasons and leaving some exceptions, almost similar items are imported and exported. Potatoes, onions, big tomatoes, chillies, cucumbers, bitter gourds, yam and taro are imported from India. Sometimes potato is imported from Bhutan, but the volume of imports is insignificant. Garlic is imported from China but its proportion in overall vegetable transaction is insignificant. Wholesalers export potatoes, tomatoes, bitter gourds, sponge gourds, beans, cauliflowers and capsicum to India. Similarly, both wholesalers and assemblers export small volume of capsicum, carrots, cauliflowers and big sized potatoes to Khasa, a border town of China. Wholesalers export the vegetable items produced anywhere in Nepal but assemblers export only the items produced in Panchkhal. Most of the imports and exports between Nepal and India, and exports to Khasa take place informally.

Vegetable import and export takes place in a normal manner between Nepal and India. However, due to over production or crop failure in either side causes high variation in prices and excessive flow of vegetables takes place from one country to another. This type of imports and exports creates uncertainty in demand and supply situation. A Tamaghat-based vegetable assembler describes the effects of vegetable imports and exports between Nepal and India:

"In addition to the internal situations, Nepalese vegetable market is greatly influenced by the produce that arrived from and sent to India. Although, we are self sufficient in vegetables, cheap Indian vegetables enter the country and create imbalances in our market. Last year, I was selling potatoes in NPR 22.00 a dharni. In the mean time, Indian potatoes arrive in the market which dropped down the price to NPR 17.00. Some time, we have to face scarcity in domestic market due to the export of vegetables in large amount."

A.2.5 Marketing Activities and Practices

Marketing activities are begun by judging the maturity of crops. Maturity of green vegetables is judged by observation and the harvesting time is decided. There is a great controversy between farmers and assemblers in harvesting stage of tomatoes. Farmers want to harvest

\[ \text{USD 1.00} = \text{NPR 78.87} \text{ on 9 March 2012, downloaded from } \text{http://www.oanda.com/currency/converter/} \]
fully ripened tomatoes saying that their weight is heavier than the turning stage ones but assemblers want them to be harvested at turning stage as they are firm and safe to transport. Potato harvesting date is decided by discussing with the wholesaler. Harvesting and post harvest operations of green vegetables and potatoes are done manually by family labour. Hired labours are employed, if family labour is insufficient. Farmers reported that green vegetables and potatoes are harvested in dalos\textsuperscript{23}, plastic buckets and plastic tubs, and transferred to dokos when they are filled. Vegetables which are appropriate to make bunches are bundled and kept in sacks. Farmers transport the vegetables to the sheds when dokos or sacks are filled. This process continues until harvesting is finished for that day. Same process is repeated at 2 -3 days' intervals, if the vegetables require subsequent harvesting. When the demand is high and the prices are good, farmers increase the frequency of pickings.

Cleaning is done before packing vegetables or potatoes into dokos, crates or sacks. Sorting is done during harvesting and transferring them into packing materials to remove the diseased, insect infected, decayed, cut, and over-ripe items from the bulk. However, assemblers said that farmers do not sort out the inconsumable items properly. Grading is not common among vegetables. If buyers want, potatoes are separated manually into two grades: chips potatoes and normal potatoes.

The packed vegetables are transported to markets for sale as soon as possible. Since farm sizes are small, the quantity brought for sale by individual farmer ranges from 100 – 200 kg per harvest. However, this quantity depends on the types of vegetable. Therefore, assembling is necessary wherever farmers sell their vegetables. Potatoes are sold directly from the field to wholesalers.

Vegetable assemblers said that they have few resources. These are one or two manual weighing machines, few crates and other packing materials, one vehicle either on hire or self-owned. The cooperative has arranged weighing facilities for farmers who sell their produce inside the collection centre but they need to pay weighing fee. Normally, a particular farmer sells his/her produce to a particular assembler but farmers inquire about the market prices with other assemblers too. Although they do not enter into any contract agreement, farmers have built up a relationship with assemblers as a result of regular transactions for a long duration. Assemblers inspect vegetables and set prices on per dharni\textsuperscript{24} basis. When farmers and assemblers negotiate on price, the vegetables are weighed and transferred to the crates or bags of assemblers. Assemblers then load the crates or bags filled with vegetables in their

\textsuperscript{23} Small bamboo basket without eyes
\textsuperscript{24} 1 dharni = 2.3934 kg but in transaction one dharni is considered equal to 2.5 kg.
vehicle. If vegetables are sold by farmers to assemblers in Banepa, farmers manage the packing materials and the vehicle for transportation themselves. The transfer of vegetables from assemblers to wholesalers and wholesalers to retailers takes place generally in a fixed time schedule so that the vegetables reach consumers' hands when they are fresh.

A.2.6 Pricing

Pricing is done when the ownership of vegetables is transferred from one actor to another. Since the ownership of most of the vegetables is transferred from assemblers to retailers directly, pricing of such vegetables is not done when assemblers supply them to wholesalers.

Farmers said that the wholesale prices of vegetables in the Kalimati Wholesale Market are considered the basis of setting prices between farmers and assemblers. Farmers get this information from radio or the cooperative. Understandably, farmers want to sell their produce at higher prices and do not want to go lower than the costs incurred in production and marketing. In the experience of the Chairman of Rural Women Development Multipurpose Cooperative Ltd, the price difference between the VCC and Banepa ranges from NPR 5 – 10 per dharni depending upon the type of vegetables. Therefore, almost 75 percent of her cooperative members sell their produce directly in Banepa. Rest of the members sell their produce in the VCC.

Every actor in the chain wants to set the price on a cost plus basis. On this basis, the price is set by adding some profit in the total costs of goods. The profit margin is based on the market situation. In extreme cases, strategic pricing is also done. In this type of pricing, the actors usually reduce the prices to sell the vegetables before going waste in the field or in the stock. The actors try to recover part of the costs from such pricing. A member of a producers' group shared her experiences of the past:

"It is very difficult to sell tomatoes some time. The price went down such heavily that I had sold my tomatoes for NPR 2.00 per dharni once. I had to request the buyer a lot to take even in that price. Such a low price did not cover even our harvesting cost. It is better for us to leave them in the field to dispose in such situation."

Assemblers are in regular contact with wholesalers and they are updated with the price and market situation. On this basis, assemblers offer certain prices to farmers. Assemblers then supply 80 percent of vegetables to wholesalers without setting prices to sell for commission. They sell the remaining vegetables to wholesalers. Prices of these vegetables are generally determined on the basis of information which wholesalers share with assemblers to set the
prices with farmers. Wholesalers said that transacting in commission is a safe option for them as the demand, supply and prices of vegetables are affected by domestic production, imports and exports particularly with India, and strikes and other transport disturbances. Wholesalers set the prices with retailers on the basis of current demand and supply situation. For the vegetables which wholesalers receive in commission, they deduct their margin (usually eight to 10 percent) and marketing costs (transport cost, unofficial expenses paid on the way to Kathmandu and unloading charge) from the prices they received and send rest of the money to assemblers. Retailers add their margin on the prices they paid to sell the vegetables to consumers.

A.2.7 Logistics Activities and Practices

Transport of vegetables from farmers’ field to retail outlets via different buyers, storing, packaging and handling are the logistics activities performed in this supply chain. Green vegetables are harvested, cleaned, sorted out, packed and stored at farmers’ houses for few hours before they are transported to the market. Potatoes are harvested, cleaned, sorted out, packed and stacked on roadside near the farm from where they are transported to wholesale markets.

Farmers transport green vegetables normally on their back from their house to Tamaghat to sell them to assemblers. Those farmers who want to sell their vegetables in Banepa jointly hire a specially designed mini trucks or DI pick up vans\(^{25}\). The vehicles which are specially designed to transport vegetables are not used for other purposes. They load their vegetables in these vehicles in the evening and transport to the market early next morning. Farmers also travel in the same vehicle to sell their vegetables to assemblers. Assemblers in Tamaghat and Banepa sell these vegetables mostly to wholesalers and the remaining to retailers of Kathmandu. These wholesalers or retailers transport the vegetables to Kathmandu generally in trucks, mini trucks or pick up vans. Wholesalers purchase potatoes from farmers’ field and transport them to Kathmandu generally in trucks. Retailers transport the vegetables and potatoes from wholesale markets to their outlets in pick up vans, public transport vehicles or motorcycles.

Farmers store vegetables in shed for few hours before taking them to the market. All other actors involved in this chain do not store vegetables or potatoes for long duration. They need to keep vegetables in natural condition, if storing is required. Storing of vegetables in natural condition for long duration increases the loss percentage. So, they do not hold and transfer the

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\(^{25}\) The pick up vans introduced by TATA Engineering, India designed for both urban and rural use.
vegetables from one actor to another as soon as possible. Potatoes are generally not stored in any stage of the chain. However, some of the wholesalers may store them for few months in natural condition if they see any possibility of price rise in future.

The actors said that repacking of vegetables again and again increases loss. So, vegetables are transferred from assemblers to retailers normally in the same packs. Crates, *dokos*, jute or plastic bags are the containers used for packing vegetables. Assemblers and retailers generally use the containers arranged by wholesalers. Tomatoes, capsicum, bitter gourds, sponge gourds, egg plants, cucumbers are normally packed in crates or *dokos*. Cabbages, cauliflowers and pumpkins are packed in plastic or jute bags. Beans, okra, chillies and bundles of asparagus beans are packed in jute bags. Potatoes are packed in 60 kg capacity jute bags. The use of appropriate packing materials makes it easy to handle the vegetables and protect them from loss during loading, unloading and transporting.

**A.2.8 Value Addition**

Changes and improvements have been made in the production and marketing practices of vegetables and potatoes. These improvements add some value to customers. The changes made in production practices increase the continuity of supply and the quality of supplied vegetables in the market. In Panchkhal, the main season tomatoes are produced in spring just after the crop is finished in Sarlahi (a famous tomato producing district where tomato is produced in winter). Tomatoes are difficult to produce in the rainy season in flat plains but they are produced around the hills of Panchkhal in this season. Since consumers do not prefer the over mature or immature produce, farmers have started harvesting vegetables at appropriate stage and send to the market. Farmers are trying to satisfy the interest of consumers by minimizing the use of pesticides and inorganic fertilizers.

Several changes have also occurred in the marketing practices of vegetables. The first one is the supply of fresh produce to final consumers. Good time management allows the produce to reach consumers' kitchen within 18 hours of harvest. The second change is to pack the vegetables in small and suitable size packing materials. The introduction of crates, which contains 25 – 30 kg of vegetables, has given buyers the opportunity to pass on the vegetables from assemblers, wholesalers and retailers on the same crates and reduce the loss occurred in transferring from one container to another. It also saves the loss of tender vegetables, like tomatoes, caused by overpressure while packing in big containers like *dokos*. Assemblers noted that packing of vegetables in colourful plastic bags gives a different look and attracts customers. The use of 60 kg bags to pack potatoes saves them from loss during transport and
handling. Finally, the use of separate vehicle to transport vegetables helps in reaching the destination timely and quickly, and ultimately maintaining the quality. Also, the transport of vegetables in especially designed vehicles helps in reducing the loss.

**A.3 Summary of Chain Description**

This section covered the history and current situation of vegetable production in the Panchkhal Valley. How the vegetables and potatoes produced in the Panchkhal area reach consumers’ hand and what factors affect the flow of goods in the chain has been described. The changes made by the chain actors in conducting production and marketing practices to address the interest of consumers are also discussed in this section.
Appendix B
Chain Description, Charaudi

B.1 General Description of the Chain

The vegetable supply chain originating from Charaudi extends from Charaudi to nearby and distant domestic markets. Charaudi is a rural settlement located in Dhusha VDC Ward 26 Number 1. The Farmers Improvement Fruit and Vegetable Producers Cooperative Ltd., Charaudi has established the main vegetable collection centre at the cooperative premises. The location of main collection centre in Dhusha VDC of Dhading District is presented in Figure B.1. To reduce travelling distance for farmers, the cooperative has established two satellite collection centres at Khatritar and Khatauti Khola which are within the range of three

Figure B.1 Map showing the location of collection centre in Charaudi, Dhading District, Nepal

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26 A Village Development Committee (VDC) is divided into nine wards. There are 9 – 35 wards in a municipality (www.moha.gov.np/abtnepal.php).
kilometres from the main collection centre. The main and satellite collection centres of the cooperative are located on the side of the Prithvi Highway27.

The Cooperative Chairman reported that the celebration of "Agriculture Year" in 1975 motivated the farmers of Charaudi area towards commercial agriculture. However, the production of vegetables at commercial scale was only started from 1989. In the beginning, farmers were producing and marketing vegetables individually. To overcome the difficulties experienced in production and marketing, they formed the cooperative in 1993 and registered in 1995. The cooperative has been completely involved in supplying agricultural inputs and marketing of vegetables from the day of its formation. The cooperative also got a stall at Kalimati Wholesale Market in 1997 to sell vegetables in Kathmandu. Apart from these functions, the cooperative is supplying veterinary drugs and providing health services to the people of surrounding area.

The Cooperative Chairman also stated that the area and production of vegetables has gradually increased in the area after the start of cooperative marketing. Although little change has been observed in the area and production near the cooperative, which is a river basin of the Trishuli River, the area and production have been expanded significantly in the remote hills. This expansion is considered successful in improving the standard of living of Chepangs28.

Charaudi is located at the border of Dhading, Chitwan and Gorakha Districts. The Cooperative Manager said that the collection centres established by the cooperative are the market places for the vegetables produced in Dhusha, Benighat and Jogimara VDC of Dhading District, Ghyalchowk and Bhumlichowk VDC of Gorkha District and Lothar VDC of Chitwan District. Farmers from all parts of Dhusha and parts of other VDCs bring their vegetables to sell in these collection centres. The transport operator reported that the collection is highest from May to August (rainy season), medium from September to December and low from January to April.

To make the job of vegetable collection and transport easy, there is a market yard with vehicle parking facility at the main collection centre. There are market sheds with vehicle parking spaces at satellite centres too. These collection centres and satellite centres are equipped with

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27 The Prithvi Higway (176 km), which extends from Naubise to Pokhara, is a renowned vegetable production zone in Nepal.

28 One of the most socially deprived indigenous nationalities of Nepal inhabit in the remote areas of Dhading, Chitwan, Gorkha and Makawanpur Districts. The population of Chepang was 52,237 in 2001 census. Downloaded from http://www.wadlopen-nepal.nl/nepal/E-trips.htm on 19 April 2010
digital weighing machines. In these collection centres, there are 12 porters contracted by the cooperative to do the jobs of sorting, grading, packing, weighing and loading after buyers purchase vegetables from producers.

The Cooperative Chairman explained that the collection centres established by the cooperative are the only market places for the farmers of Charaudi area. The cooperative members are not allowed to sell their vegetables in other places according to the cooperative rule. The Cooperative Manager said that farmers bring vegetables from 10 minutes to five hours walking distance to the collection centres. Farmers of Gorkha and Chitwan Districts who bring vegetables to these collection centres are not cooperative members but are treated as members because of their contribution to realizing economies of scale. The Cooperative Chairman said that the cooperative is interested to make them members but the current rules and regulations do not allow it to distribute membership to the people of other districts.

The vegetables collected in Charaudi are purchased mainly by assemblers and supplied to wholesalers of Kathmandu, Pokhara, Narayangadh and Butwal. Kathmandu is located at a distance of 83 km, Pokhara 117 km, Narayangadh 62 km and Butwal 180 km from Charaudi. The cooperative has contracted a transport operator to transport all the vegetables from Charaudi to Kathmandu. Transporting vegetables to other markets is managed by buyers themselves. In some cases, wholesalers send trucks to transport vegetables from Charaudi to Pokhara. In all other cases, assemblers send vegetables to Pokhara, Narayangadh and Butwal in empty returning vehicles. Retailers of some small markets, like Malekhu, Mugling, Damauli, Gorkha, and Besisahar visit Charaudi and purchase small quantity of vegetables directly from farmers. These retailers transport vegetables generally in buses or jeeps carrying passengers. Transport arrangements to all these markets are done in such a way that they reach retail outlets early next morning of the collection day. Therefore, most of the vegetables are available to consumers within 24 hours of harvest.

**B.2 Chain Activities and Practices**

**B.2.1 Input Supply, Production Activities and Practices**

Charaudi has been a commercial vegetable production pocket from the 1990s. According to the Cooperative Chairman, roadside farmers were involved in vegetable production and marketing from its beginning. This roadside is located in the tropical river basin. Gradually, vegetable farming moved towards the subtropical hills. The availability of inputs and marketing of vegetables through the cooperative helped in the rapid expansion of production.
So, vegetable farming has now become popular from the tropical to subtropical region of the cooperative.

The Cooperative Manager stated that almost all of the 914 cooperative members are involved in vegetable farming. Vegetable farming is also a business of non-members in this area. These farmers (members and non-members) normally require seeds, fertilizers and pesticides to produce vegetables and most of them get these inputs from the cooperative or local input dealers. The cooperative does not provide inputs to farmers on long-term credit (i.e. for a season), but the local input dealers may do so. If the cooperative staff find creditworthy behaviour on the part of farmers, they can provide inputs in credit just for few weeks. Out of the inputs used for vegetable production, the availability of fertilizers is a problem in several parts of the country but the Manager stressed that it is not a problem in Charaudi. The quality of available fertilizer may be a problem, but the cooperative tries its best to minimize it.

According to the Cooperative Chairman, each farmer produces vegetables in five ropanies of land on an average. Most of the farmers grow vegetables on their own land but the Chairman said that there are around 70–80 farmers on the roadside who produce vegetables on rented land. Farmers produce vegetables both in irrigated and unirrigated lands. In irrigated land, farmers usually grow rice in the rainy season and produce vegetables in other seasons of the year. In unirrigated land, they produce vegetables mainly in the rainy season due to irrigation difficulty.

The Cooperative Chairman reported that all vegetable producers prefer to use family labour for intercultural operations but Pakhure (Parma29) is also used when the family labour is insufficient. The capital requirement for vegetable production is mostly fulfilled from their own resources.

Farmers said that they can increase their profits by increasing production and by fulfilling customers’ requirements. To increase production, they adopt improved technologies recommended by DADO officials, cooperative staff or the promotional staff of the seeds/fertilizers distributors. They adopt these technologies to produce as many crops as they can. To fulfill the requirements of buyers who want to buy different types of vegetables from the same collection centre, every farmer produces at least two or more vegetables in the same season. Growing different types of crops in the same season also minimizes their risk. If the

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29 Mutual exchange of labour
price of one vegetable goes down, the loss on this vegetable may be compensated by other vegetables.

**B.2.2 Product and Ownership Flow in the Chain**

The product and ownership flow begins from input suppliers and ends at consumers (see Figure B.2). The cooperative is the main source of inputs for farmers. The Cooperative Manager reported that the cooperative fulfils almost 60 percent of the total input requirements of the area. Farmers buy rest of the inputs (mainly seeds and pesticides) from local input dealers. Generally, those farmers buy inputs from local input dealers, who supply them on long term credit. They also buy negligible amount of inputs from Kathmandu during their visits for some other purposes.

![Figure B.2 Product and ownership flow in the fresh vegetable supply chain originating from Charaudi](image-url)
Farmers said that they sell all of their vegetables through the cooperative facilities. They sell around 80 percent of the vegetables to assemblers and 10 percent to retailers at the main and satellite collection centres, and send the remaining 10 percent to the cooperative stall at Kalimati Wholesale Market. Out of the 80 percent of the vegetables, which assemblers purchase from farmers, around 40 percent is supplied to Pokhara, 20 percent to Kathmandu, 15 percent to Narayangadh, and five percent to Butwal.

The percentage sale is high to Pokhara as the wholesalers of Pokhara Wholesale Market pay relatively a higher price for good quality vegetables. The markets like Narayangadh and Butwal are in their next priority. However, the percentage sale from Kathmandu is higher than Narayangadh and Butwal as the cooperative has its own stall at Kalimati Wholesale Market and the city is big enough to consume from very high to very low quality vegetables. All the vegetables sent to Kathmandu are dropped to the cooperative's stall at Kalimati Wholesale Market and are sold by the cooperative staff to retailers. The vegetables sent to the wholesalers of Pokhara, Narayangadh and Butwal are sold to local retailers and consumers buy these vegetables from the retail outlets.

In this chain, the ownership is transferred when vegetables are sold from one actor to another. The cooperative just mediates between the actors and does not take the ownership. The ownership of the vegetables sent to the Kalimati Wholesale Market is transferred to retailers directly from the farmers and assemblers who send them. The ownership of around 20 percent of the vegetables is transferred to retailers directly from farmers, 10 percent through the Cooperative stall at Kalimati Wholesale Market and 10 percent through direct sale in Charaudi. Out of the 80 percent purchased by assemblers, the ownership of around 20 percent is transferred to retailers through the Cooperative stall and 60 percent is transferred to the wholesalers of Pokhara, Narayangadh and Butwal. The actors who have the ownership of vegetables are responsible for any loss or damage in the marketing process before they are sold.

**B.2.3 Assessment of Demand and Supply Situation**

Increasing population and changes in food habits are the two main factors which affect the demand for vegetables supplied from the Charaudi vegetable supply chain. The urban population is growing at a faster rate than the overall population growth rate of Nepal. Therefore, the number of vegetable consumers increased significantly in the cities where vegetables are supplied from Charaudi.
The dietary pattern of Nepalese consumers is changed and the proportion of vegetables is significantly increased in everyday meals. An official of Kalimati Wholesale Market Board said that the people who were taking only one vegetable item before started eating more than one vegetable item in meals. The vegetables which were cooked before are now consumed in cooked, raw and processed forms. In particular, the demand of tomatoes, cabbages and bottle gourds is increased due to their consumption in different forms. The demand for some of the vegetables is market specific. The Cooperative Chairman gave an example of organic vegetables. The demand for organic vegetables is high in Kathmandu but this is not a matter of concern for majority of consumers in Pokhara. Consumers are attracted by the colour, size, shape, cleanliness and uniformity of vegetables in Pokhara.

The chain actors try to address the changing demand by increasing the overall production, changing proportion of production as per the market demand, making inputs available required for production and increasing the duration of availability. The cooperative's data show that the annual vegetable sale reached 3736 tons in 2007/08, increasing from 1761 tons in 2002/03. Farmers grow different types of vegetables on their farms in such a way that the proportion of the supply of vegetables which have high demand in the markets is higher than other vegetables. Farmers said that the position of eggplants around a decade ago has been taken by tomatoes now. The Cooperative Chairman explained it in bit detail:

“We are producing 17 – 18 types of vegetables and the volume of production depends on market demand.... From the volume of production, tomato is the number one crop (around 15 – 20 percent). Bitter gourds (15 percent) and cabbages are in the second and third position. The volume of cabbage production drastically goes up and down and depends solely on its last year’s price. Egg plants, bottle gourds and beans are produced at equal proportions (around 5 percent each)....... From return on investment point of view sponge gourds, bitter gourds, cabbages and tomatoes rank the first, second, third and fourth position.”

The availability of all the inputs from the cooperative is another motivating factor for farmers to grow the crops as per the market demand. The cooperative is an assured source and the biggest supplier of inputs for this area. The techniques, like stagger planting and production of appropriate varieties in different seasons in different altitudes are some other techniques which help to increase production as well as extend the duration of supply.

**B.2.4 Import and Export**

The vegetables produced in Charaudi are supplied to domestic markets. Since these vegetables are supplied to more than one market and the cooperative is involved in
wholesaling, farmers and assemblers are less affected by vegetable imports and exports with India. Wholesalers said that they generally import onions, peas, pointed gourds, chillies, okra, big sized tomatoes (for salad purpose) and export capsicum, beans, sponge gourds, bitter gourds, chillies and cauliflowers. This confirms that the types of vegetables which are produced in Charaudi are generally not imported. Although the items which are produced in Charaudi are exported, the proportion of export remains more or less same every year. Therefore, the imports and exports of vegetables do not bring significant changes in demand and supply situation.

**B.2.5 Marketing Activities and Practices**

Marketing activities are begun from harvesting. Vegetables are harvested at appropriate stages and brought to the collection centres for sale. Nearby farmers harvest vegetables in the morning and bring to the collection centres in the afternoon. The farmers from the remote hill tops of Dhusha and Lothar VDCs harvest vegetables in the late afternoon or evening and transport them to the collection centres in the next morning. Since harvesting is required to be done carefully to maintain the quality, farmers prefer to use family labour for it. Also, their farm sizes are too small to employ hired labour. Subsequent harvesting or picking depends on the type of crops. The Cooperative Chairman said that farmers harvest the vegetables in a bucket or tub and transfer to the crate, *doko* or sack kept in the shed. They normally sort out the off type items (diseased, decayed, and not according to the required size, shape and colour) during harvesting and transfer the good ones in the crates, *dokos* or sacks.

Vegetables are sorted out properly during harvesting and packing to meet the requirements of customers. Most of the vegetables are transported by porters from farmers' field to the cooperative. Bulky vegetables, like cabbages, cauliflowers, radishes and pumpkins are sometime sold mainly to assemblers directly from farmers' field. Even if the cooperative members sell vegetables directly from the field, they must inform and pay commission to the cooperative.

The main and satellite collection centres of the cooperative are the assembling places of vegetables and the meeting point of producers and buyers. Farmers asserted that vegetable marketing in this cooperative is systematic which protects both the producers and buyers. After bringing vegetables inside the collection centres, the cooperative staff weigh and record the type and weight along with the name of farmers. Then, farmers keep their vegetables in the market yard. In the meantime, they enquire yesterday's or that day's prices of vegetables.
Buyers prefer to buy vegetables from Charaudi as they can get the quantity they require due to higher daily turnover in comparison to nearby other collection centres. The records of two cooperatives show that the annual fruit and vegetable sale in Charaudi was 3736 tons for the revenue of NPR 53 million\(^3\) in comparison to 482 tons for the revenue of NPR six million in Bishaltar in 2007/08.

Assemblers reported that 30–50 buyers (assemblers wholesalers and retailers) visit the collection centres every day. Among the buyers, assemblers and retailers buy vegetables from farmers every day but wholesalers visit occasionally just to observe the marketing processes. Majority of the buyers are assemblers and most of them are local as well as the cooperative members. However, they give priority to outside retailers in buying since these retailers buy small quantity and are ready to pay higher prices. Retailers purchase only the selected vegetables but assemblers purchase different types of vegetables from farmers and separate according to their demand in different markets. The statement of an assembler explains how he decides which vegetables to send where:

“We can get slightly a better price in Pokhara but the market is small and consumers do not prefer all what we collect here. Being a tourist market, it requires good quality vegetables in terms of size shape and colour. Since we can sell almost all types of vegetables in Kathmandu, this is the best market for us. So, we separate and send appropriate vegetables to appropriate markets. There are some vegetables which are preferred by the consumers of Pokhara area and there are others which are preferred by the consumers of Kathmandu area. For example; green sponge gourd is preferred in Pokhara but the white one is preferred in Kathmandu. Similarly, Pokhara is not a good market for eggplants and we need to send them to other markets.”

Assemblers generally employ contracted porters to sort out, grade, pack, weigh and load the vegetables in trucks. The loaded trucks are dispatched from Charaudi in the evening so that the vegetables reach the wholesale markets in Pokhara, Kathmandu, Narayangadh and Butwal early next morning. Vegetables are unloaded from the trucks and wholesalers sell them to retailers soon after their arrival.

The Cooperative Manager stated that the process of supplying vegetables is different to different markets. All the vegetables which are sent to Kathmandu are sold by the cooperative from its stall at Kalimati Wholesale Market to retailers. The cooperative gets commission of this sale from farmers and assemblers. The Cooperative Chairman said that the establishment

\(^3\) This figure excludes the direct sale from the cooperative's stall at Kalimati Wholesale Market which was around 10 percent of the total annual sale.
of stall at Kalimati Wholesale Market and selling vegetables through it is an attempt to assure farmers on marketing of their produce. If farmers feel that they do not get appropriate prices of their produce from buyers or the buyers do not buy vegetables from farmers in the collection centres, they can handover such vegetables to the cooperative for sale. The cooperative deploys the contracted porters to sort, grade, clean, pack and load such vegetables on contracted vehicles to send to its stall at Kalimati Wholesale Market for sale. The cooperative sells these vegetables and returns money to farmers after deducting all the expenses incurred in the process plus its commission. The vegetables supplied to Pokhara, Narayangadh and Butwal are sold to wholesalers by assemblers. The retailers who purchase directly from farmers sell their vegetables to consumers.

The cooperative has developed close ties with the Government offices to get their support in technology transfer and infrastructure development. The DADO and ABPMDD transfer the technologies required for improving marketing practices by providing training and material support. In the course of infrastructure development, the cooperative received important support from the SMIP in 1999/2000 to construct its main collection centre. For the marketing of vegetables, it has also established direct relationships with vegetable wholesale markets in the cities. The system has been set up to sell all the fruit and vegetables produced in the area through the cooperative. All these activities have developed a very good marketing environment for the vegetables produced in this area. Farmers do not want this environment to deteriorate and are committed fulfilling the market demand. In the words of the Cooperative Chairman:

"The goods that are sold from this cooperative should not receive complaints. To ensure this, we (board members) attend the Ward Assemblies and educate farmers on the purpose of involving into the cooperative, the duties and responsibilities of cooperative members, what the cooperative is doing and what its future plans are, and what processes do farmers need to follow to sell the produce on time. We are convincing our farmers to give impression to buyers that the goods sent from Charaudi are in perfect condition and are not required to inspect and weigh."

### B.2.6 Pricing

Prices of vegetables are set between chain actors when ownership is transferred from one actor to another. Collection centre is the first place where prices of vegetables are set between producers and buyers. The Cooperative Manager said that the cost of production, overall trend of recent market prices, supply, demand, quality of goods and number of buyers come to buy vegetables in that particular day (competition among buyers) are the main bases of price
setting. In view of a local assembler, farmers do not need to exercise a lot in Charaudi to get good prices of his/her vegetables. In his words:

"In this cooperative, normally producers do not need to ask the price. They bring vegetables, weigh and put in the market yard. There are buyers from different markets in the cooperative. They go and ask to buy on certain price. If another buyer can pay more than that, he will offer higher price. It continues until buyers stop increasing prices."

According to the Cooperative Manager, the cooperative maintains the records of everyday minimum and maximum prices of vegetables transacted from its collection centres. It also collects the prices from major market centres and nearby collection centres. The cooperative compiles the prices of vegetables received from different sources and publishes the information on its notice board. Any actor can inquire the prevailing prices of that day with the cooperative staff. These are the factors which influence on price negotiation between producers and buyers. After setting the price, both the buyer and seller go to the cooperative to prepare a bill. The buyer pays money to the seller according to the bill from which the seller pays the weighing charge and cooperative commission.

According to a farmer, they pay NPR two per pack as the weighing charge, and two percent by members and three percent by non members as the commission to the cooperative. According to assemblers, farmers have to bear the part of volume loss in future and around 10 percent of the total weight is deducted to recover the weight of containers and the margin for volume loss in future.

Assemblers reported that they add the cost of sorting, grading, packing, weighing, loading and the volume loss during handling on purchased price to set the price for wholesalers. These assemblers get prevailing market prices and upper price limit when they collect demand from wholesalers in the morning. They take these two things into consideration while buying vegetables from farmers. In practice, they normally add NPR 1.00 – 5.00 per kg on purchasing price to cover the marketing costs and their profit to sell to wholesalers. The prices of vegetables which are sent to Kalimati Wholesale Market are negotiated between the cooperative staff and retailers on the basis of prevailing demand, supply and quality of goods.

The wholesalers of Pokhara and Butwal Market said that they set the prices of vegetables on the bases of supply, demand and quality of goods. They observed that consumers in their area consume plenty of vegetables in morning and evening meals and prefer to buy fresh vegetables from the retail shops everyday for this purpose. To fulfil this requirement almost
all retailers visit wholesale markets every morning to buy fresh vegetables which have recently arrived from the production sites. It creates high demand for fresh vegetables in the morning. One of the wholesalers of Pokhara said that he sells almost 90 percent of vegetables in the morning. The prices gradually go down with the passage of time over the day. If vegetables are not sold timely, they keep on reducing prices till the stock becomes clear because they have to get fresh produce again in the next morning.

**B.2.7 Logistics Activities and Practices**

Logistics activities are begun from packing of vegetables in the farm. Other logistics activities which are undertaken in different stages of the chain are repacking, transporting, loading, unloading and storing. Vegetables are packed in crates, *dokos* or sacks carefully after they are cleaned and sorted out properly.

Except the vegetables, like cauliflowers, cabbages, pumpkin, and radishes, the harvested volume is not big and stored at home until they are taken to the market. Normally, vegetables are carried on the back of family members from home to collection centre. Some farmers from distant locations transport vegetables in a hired vehicle to the collection centres, if their farms are connected to road networks. The Cooperative Manager said that construction of earthen roads in different villages makes it possible.

Farmers sell their vegetables to assemblers or retailers or leave in the collection centres to send them directly to Kalimati Wholesale Market through the cooperative. These assemblers and retailers mix the vegetables purchased from different farmers and make different heaps in the floor according to the types of vegetables. These buyers sort out; grade sometime on the basis of variety or colour; repack them in the crates, *dokos*, sacks or plastic bags; weigh them again and load them in the vehicles. They also employ porters contracted by the cooperative to do these works. Assemblers send vegetables in trucks to wholesalers of Pokhara, Narayangadh and Butwal. The cooperative send vegetables received from farmers together with the vegetables of assemblers in contracted trucks to its stall at Kalimati Wholesale Market. When vegetables reach the markets, they are unloaded from the vehicles and transferred to wholesalers’ store or cooperative’s stall by skilled porters deployed by the wholesale markets. Retailers transport vegetables from Charaudi together with them in the bus roofs, trucks or small vehicles.

Usually, the wholesaling time is early morning. According to the requirement of retailers, wholesalers as well as the cooperative staff sell the whole packs or part of the packs of
they prefer to sell vegetables in the same pack on which they receive from Charaudi as the frequent transfer of produce from one pack to another degrades the quality by abrasions. Wholesalers said that the introduction of small packing materials, like crates and plastic bags makes easy for retailers to buy the whole packs and transport them in motorbikes.

The actors follow practices to minimize loss during transport, handling and storage. However, in the experience of assemblers, they incur around five percent loss on an average when vegetables remain in their ownership. The volume loss is high when vegetables are under the ownership of wholesalers. One of the wholesalers of Pokhara Wholesale Market who also receives vegetables from Charaudi said that the amount of loss during transport and handling differs with the type of vegetables. In his words:

"The percentage of loss depends on the types of vegetables. We need not to lose even a kg per 100 kg in some vegetables and more than 10 kg in others. We experience nearly 20 percent loss in tomatoes purchased in collection centres but around 5 – 7 percent purchased locally. We should throw at least five kg from a doko of 50 kg which we buy in the collection centres like Charaudi."

"The loss is around 20 percent in cauliflowers and cabbages. The loss is high as we have to buy them with the leaves and remove them before selling. We should pay for 95 kg for 100 kg of cabbages with leaves but we can sell only 75 kg from it. The loss is lower in beans in comparison to tomatoes, cabbages and cauliflowers. We can deduct some proportion of loss margin from the total weight while purchasing if the production is high but if the production is low like now, we need to pay full price."

**B.2.8 Value Addition**

The Cooperative Chairman said that producers have given priority to satisfy customers from the supply of vegetables produced in Charaudi. To increase customers' satisfaction, they increase production, manage to supply vegetables all the year round, manage to supply the same vegetables for long duration, increase the availability of different types of vegetables in the same season, and adopt techniques to reduce the post harvest loss and transport costs. All these activities help to fulfil the requirements of customers at minimum costs.

Farmers, assemblers and cooperative staff reported that the improvements made in production operations help to increase the production of vegetables in Charaudi in past few years. The cooperative's data show that the annual vegetable sale reached 3736 tons in 2007/08 up from 1761 tons in 2002/03. To reach this stage, the area under vegetable cultivation has been expanded from the river basin to hill tops. Production season differs in tropical river basins.
and subtropical hills. This facilitates to produce different crops in different regions in the same season and to produce the same crop in different regions in different seasons. This is helpful for the cooperative to supply vegetables all the year round and to supply the same vegetables for long duration. Also, the tendency of every farmer to produce more than one crop in the same season helps to increase the availability of different types of vegetables in the Charaudi area all the year round.

Similarly, improvements have been made in marketing operations to reduce the volume loss and transaction costs that ultimately help to reduce the price for consumers. The introduction of small packing materials, like crates and bags is one among them. The use of small packing materials reduces the need to repack the vegetables again and again, makes easy to handle and finally reduces the loss. The replacement of manual weighing machines by digital ones is another improvement. The use of digital weighing machines has made vegetable weighing more efficient and increases trust and transparency among the actors. The use of skilled porters in vegetable packing, handling and loading in the collection centres as well as wholesale markets helps to reduce the loss.

The chain actors adopted several measures to reduce the loss of vegetables during transport and handling, and to reduce transport costs. Vegetables are now transported in separate vehicles which do not transport other goods. The use of such vehicles is helpful in maintaining the quality and transporting vegetables in required destination quickly. Vehicle contract with transport operator, use of empty trucks and use of wholesalers’ own trucks to transport vegetables from Charaudi to different markets help to reduce vegetable loss as well as the transport costs. To reduce the transport cost from farms to collection centres, farmers have started selling bulky vegetables directly from farms. For other vegetables, some of them assemble the vegetables in one place and transport them in a hired vehicle to the collection centres. Farmers, buyers and transport operators have adjusted the harvesting time, selling time and transporting time to keep the vegetables fresh till they reach consumers' hand.

Despite these improvements, chain actors have still to improve some production and post production activities to add value to customers. The Cooperative Chairman stated that farmers are unaware on the ill-effects of plant growth regulators and pesticides on human health. One of the farmers opened up the mystery that increases post harvest loss in tomatoes (number one in transaction). The harvest of fully ripened tomatoes is the main reason of high post harvest loss but farmers do not want to harvest them at turning stage because they are lighter than the fully ripened ones. Grading is yet to be practiced in Charaudi. Buyers have complained that
farmers do not sort out vegetables properly. Majority of vegetables are still packed and transported in *dokos* which are considered inappropriate packing material from the point of view of loss protection.

**B.3 Summary of Chain Description**

The involvement of different actors and the activities undertaken by them have been described in this section. There is significant contribution of the cooperative in forming this chain and supplying inputs, marketing vegetables, sharing information and aligning actors towards satisfying consumers. These contributions are highlighted where appropriate. The changes made in performing production and marketing operations are discussed in this section. The effects of these operations in chain information structure and coordination between actors are discussed in Chapter 6.
Appendix C
Chain Description, Sarketari

C.1 General Description of the Chain

The Agricultural Produce Market Management Cooperative Ltd, Sarketari is the centre of chain activities. The Cooperative Chairman said that the cooperative was formed in early 2004 by involving the members of already formed producers' groups of Phedikhola, Arukharka and Bhatkhola VDC of Syangja District. These producers got support from the DADO, Nepal SIMI and Community Development Resource Centre (CDRC) in forming and registering the cooperative. After completing the formalities from the day of its formation, the cooperative was registered in 25 May 2005 in the Division Cooperative Office (DCO), Syangja.

The Cooperative Manager said that the initial purpose of registering the cooperative was to make it easy to collect milk from farmers and supply it to Pokhara Milk Processing Plant. When the ownership of this plant was transferred from the Government to the private sector, farmers found they could not sell their milk regularly like before. As a result, farmers shifted their business from milk production to vegetable production. However, the cooperative has now resumed milk collection and supply.

Supplying fertilizers and collecting vegetables are the two main functions of this cooperative. Besides these functions, the cooperative also collects milk and sells cattle feed and consumer goods. The cooperative performs all these functions from its office cum collection centre established in Sarketari. The location of the collection centre in the map of Syangja District is presented in Figure C.1. To further promote vegetable collection, the cooperative has recently established a satellite collection centre in Jausidanda of Arukharka VDC.

The cooperative is providing services to farmers (both members and non-members) of Phedikhola and Arukharka VDCs of Syangja District and Pumdibhumdi VDC of Kaski District. The members of Bhatkhola VDC are unable to access cooperative services as the locations of the cooperative office and collection centres are not convenient for them. However, farmers in Kaski District have been accessing its services from the day of its formation, even though they remain outside the command area.
The Cooperative Chairman said that there are 107 members in this cooperative. Of these, 85 members and several non-members are involved in vegetable production. They produce cucumbers, cauliflowers, cabbages, beans, tomatoes, chayote, sponge gourds and bitter gourds on their farms. Cucumbers, cauliflowers and cabbages are in the first, second and third position according to volume of production. Beans and tomatoes are ranked after cabbages in terms of volume of production, but from the perspective of market prices these two vegetables are more important than other vegetables.

The Cooperative Chairman said that it is not made mandatory for farmers to sell all the vegetables through the cooperative. As a result, majority of farmers sell their vegetables directly to retailers from their farms. Farmers sell a certain quantity of selected vegetables to fulfil the requirement of these retailers, and they then bring the remaining amount to the cooperative for sale. However, to streamline the selling process, the cooperative is motivating farmers during meetings to assemble vegetables in the collection centre. This effort becomes successful in gradually increasing the supply of vegetables through the cooperative.
Almost all vegetables assembled in the collection centre of the cooperative are supplied to a wholesaler from Putalibazaar. The wholesaler purchases vegetables from the collection centre and transports them to his store, from where he supplies them to retailers of Putalibazaar and rural markets. Therefore, vegetables produced in Sarketari are consumed mainly in Putalibazaar and different rural markets of Syangja District.

C.2 Chain Activities and Practices

C.2.1 Input Supply, Production Activities and Practices

Farmers said that they mainly use seeds, manures and fertilizers, and pesticides to produce vegetables. Out of these inputs, farmers prepare manures and pesticides of organic origin themselves. They buy chemical fertilizers generally from the cooperative, and seeds and pesticides from private input dealers located in Phedikhola, Putalibazaar and Pokhara.

The Cooperative Chairman said that there are quality problems with fertilizers and seeds wherever farmers buy them from. The quality of fertilizers supplied by the cooperative itself is not assured as it receives them from a dealer who sells illegally imported fertilizers in Bhairahawa (a border town adjacent to India). Although farmers are not assured of quality, they prefer to buy fertilizers from the cooperative due to the reliability in prices and the product information that it provides. The seeds supplied by private input dealers often do not germinate properly and may not be true to type.

Farmers reported that they occasionally need to buy seeds, fertilizers and pesticides according to availability rather than their requirements. Buying seeds according to availability affects their ability to achieve their goal of making a profit by supplying highly demanded vegetables in the market. The vegetables produced from such seeds generally have lower market demand.

Farmers, the cooperative and service providers are trying to adopt technologies which can reduce the use of chemical fertilizers and pesticides in vegetable production. The Cooperative Chairman and the SADO said that the main such technologies are the use of Integrated Pest Management (IPM)\textsuperscript{31} and Integrated Plant Nutrition Systems (IPNS)\textsuperscript{32} techniques. With these techniques, farmers substantially increase the use of manures and pesticides of organic origin. The increased use of organic manures helps to avoid losses that arisen from the unavailability or the use of low quality fertilizers. Under IPM techniques, farmers use pesticides bought

\textsuperscript{31} A pest management strategy that focuses on long-term prevention or suppression of pest problems with minimum impact on human health, the environment and non-target organisms (Flint, Daar and Molinar, 1991).

\textsuperscript{32} A system of maintaining or enhancing soil productivity through a balanced use of mineral and organic fertilizers for sustainable increase in crop yields.
from the markets only when the home made organic pesticides are insufficient to control pest problems.

The Cooperative Chairman said that many farmers have constructed temporary plastic tunnels on their farms to produce tomatoes and cucumbers in the off-season. These tunnels help to protect the crop from cold during winter and excessive rain during summer. The vegetables produced in the off-season inside these tunnels extend the duration of availability of supply and fetch higher prices in the market, and this increases farmers’ net profit.

The Cooperative Chairman said that the support from GOs and NGOs is crucial in adopting new technologies and undertaking vegetable production and marketing in a planned manner. He said:

"The DADO prepares a crop calendar for different areas of Syangja District and the MOAC publishes a diary with useful agricultural information. We get the calendar and diary from the DADO and Nepal SIMI. The calendar and diary state when to sow seeds and when to harvest the crop both in the main and off-season. These organizations also provide us trainings on production technologies and support in constructing micro irrigation projects."

After taking into account the crop calendar, suggestions given by the GOs and NGOs, farmers' interests and availability of inputs, the cooperative prepares a production plan that it disseminates to farmers. This plan motivates existing vegetable producers to increase their area and attracts new farmers towards this business. Although the efforts of the cooperative and GOs and NGOs are contributing to increase the area under vegetable production, farmers can be discouraged because of hail, which occurs in the Sarketari area. The Cooperative Manager said that the production area of this supply chain lies in the subtropical region and a hail prone zone. The hail generally occurs in May – June and September – October and causes small or big losses every year. The hail occurred in May 2009 was the latest example, and it completely destroyed ready to harvest cucumbers and tomatoes.

The Cooperative Chairman said that farmers generally produce vegetables on their own land. The farm size ranges from a quarter of a ropani to nine ropanies but majority of them are less than a ropani. Since the sizes of these farms are very small, the cooperative is suggesting farmers increase the area and specialize in certain crops, rather than producing many crops in a small area. The purpose of increasing the area is to reduce cost of production, as well as to raise income of vegetable producers.
The labour requirement for vegetable production is generally fulfilled by family members. There are only a few big farmers who need to employ hired labour. The Cooperative Chairman said that it is difficult to find labour in the villages as most of the people from working age group has gone abroad in search of job. Due to this reason, the wage rate of the hired labour is increasing. The cooperative is not in a position to provide loans to its members, and farmers generally invest their own savings in vegetable production. A few farmers borrow money from the funds established by farmers’ groups.

**C.2.2 Product and Ownership Flow in the Chain**

Product flow takes place from input suppliers to consumers through different actors. Product and ownership flow of inputs and vegetables in this chain is presented in Figure C.2. Farmers

![Diagram](image-url)

**Figure C.2 Product and ownership flow in the fresh vegetable supply chain originating from Sarketari**
get inputs from the cooperative and private input dealers. The Cooperative Chairman reported that farmers bring around 40 percent of the total vegetables produced in the area to the cooperative and sell the remaining amount directly to local retailers. The cooperative sells almost all the collection to a wholesaler from Putalibazaar and negligible amount to retailers and consumers of nearby markets. The cooperative prefers to sell vegetables to the wholesaler as he purchases all the vegetables that are collected in the cooperative but prices vary according to quality. The wholesaler who purchases vegetables from Sarketari also purchases vegetables from other markets. After collecting vegetables from different places, he separates the vegetables according to size, shape and colour. The separated vegetables are then supplied mainly to local retailers and the contractors of institutional consumers, like hospitals, schools, Army and Police according to their requirements. These retailers further sell the vegetables to consumers of their surroundings.

In this chain, the ownership of goods is transferred when they are sold from one actor to another as described in the product flow. The cooperative does not take the ownership and just mediates between producers and the wholesaler. Therefore, the ownership of vegetables supplied through the cooperative is transferred from producers to the wholesaler directly.

**C.2.3 Assessment of Demand and Supply Situation**

The demand for vegetables produced in Sarketari is high due to three reasons: distance to markets, location of production area and season of production. Sarketari is located on the side of the Siddhartha Highway\(^{33}\). The Highway links Sarketari to Putalibazaar and Pokhara, which are two nearby big markets situated in opposite directions from the cooperative at a distance of 18 km and 15 km respectively. While travelling from Sarketari to Putalibazaar, there are small rural markets, like Phedikhola, Khadketari and Naudanda on the roadside. The vegetables produced in Sarketari can be supplied to all these markets but the demand of Pokhara and Putalibazaar is fulfilled mainly by the supply from other chains.

The production area of this chain lies in the subtropical region and the vegetables produced in this area are preferred over the vegetables produced in the tropical region. So, the vegetables produced in Sarketari can displace vegetables supplied in these markets from the tropical region especially in the winter season.

Farmers said that vegetables are produced in Sarketari mainly from September to February and April to June. They do not produce anything from February to March and very little in

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\(^{33}\) The Highway (181 km) links Pokhara, the Regional Headquarter of Western Development Region, to Sunauli a border point adjoining to India.
rest of the months. The wholesaler said that vegetable demand is high in September to February due to festivals and tourist season in Pokhara, and supply remains low generally in September – October. Similarly, the demand is high in April to June since this is the rainy season, when vegetables are difficult to produce in the tropical region.

Although the demand for vegetables produced in Sarketari is high, the volume of production is insufficient even to fulfil the demand of the wholesaler. So, the wholesaler has to buy vegetables from wholesale markets of Pokhara and Butwal to fulfil the local demand, except in the main production season. Also, in the main season, he can get the required volume of certain items from Sarketari, and then needs to buy the rest of the vegetables from other markets. The Cooperative Chairman explains the overall supply of this chain in 2008/09:

"The cooperative sold around 340 tons of vegetables last year (2008/09), which worth about NPR 392,000. This is less than 50 percent of the total production in the area. Farmers approximately sell the vegetables worth NPR one million every year."

The discussion suggests that there is a big gap between the demand for vegetables in nearby markets and the supply that passes through this chain. This is a motivational factor for farmers to increase production, which they could then supply through this chain.

C.2.4 Import and Export

The chain actors associated with this chain are not involved directly in imports or exports of vegetables. However, the wholesaler and retailers do transact a few vegetable items imported from India to fulfil consumers’ demand. The wholesaler said that he purchases imported vegetables generally from the wholesale markets in Pokhara or Butwal. He also said that the vegetables which are imported from India are either not produced at all (like onion and pointed gourds) or not produced to required specifications (like big sized tomatoes) in Sarketari.

Similarly, vegetable items which are produced in Sarketari are not exported directly. The SADO said that the tomatoes produced in the hills of Syangja including Sarketari in June – July (rainy season) are exported. Tomato production is not possible in this season in the tropical plain of southern Nepal, but this is the main season in Sarketari and adjoining areas. Therefore, tomatoes are supplied from different parts of Syangja including Sarketari to the markets in the southern plain, like Butwal and Bhairahawa in Nepal and informally to border markets in India.
C.2.5 Marketing Activities and Practices

Farmers said that harvesting of the crop at the appropriate stage is the key to marketing. From their involvement in vegetable production over a few years, farmers have gained sufficient experience in identifying the appropriate harvesting time of crops. They also receive training from GOs and NGOs on this matter periodically. They observe the maturity and harvest vegetables at appropriate stages. Harvesting time of day depends on the quantity they are harvesting, types of customers they are selling, and distance from the farm to collection centre or retailers' shops. If the quantity to be sold is small, the farm is located at a distance of one hour or less from the market, and the customer is a retailer, farmers harvest the crop just before selling. To sell through the cooperative, they harvest the crop late afternoon on the previous day so that they can allocate time to clean, sort, pack and dispatch the vegetables to market early next morning. Some of the farmers bring all of their vegetables to the cooperative for sale whereas many others bring the amount, remained after selling what they could from home.

The Cooperative Manager said that the collection centre and satellite centre collect vegetables from farmers on every Tuesday and Friday. The Sarketari collection centre collects vegetables generally from 7.00 – 9.00 am on these days. However, farmers have flexibility to bring their vegetables to this centre till the collected vegetables have not been further sold to other buyers. This centre has some resources, like weighing machines, store rooms and packing materials required for vegetable collection. Since the Jausidanda satellite centre does not have such resources, it stops collection slightly earlier than 9.00 am and transports the collected vegetables to Sarketati as soon as possible. Also, the volume of collection is insufficient to sell separately from the satellite centre.

The Cooperative Manager said that the cooperative staff inspect vegetables when farmers bring them to the collection centre. The cooperative staff remove (or ask farmers to remove) any off-type or damaged vegetables. The Cooperative Chairman said that this inspection and sorting in the collection centre discourages farmers from mixing these poor quality vegetables with higher quality vegetables that they are bringing for sale. After sorting out any off-type or damaged vegetables, remaining vegetables are weighed and the cooperative maintains a record of the type and quantity of vegetables brought by farmers. Then, farmers get a receipt for the deposited vegetables and return home. They will get the money of their produce when they visit the cooperative next time.
The Cooperative Chairman said that the vegetables collected in this cooperative are sold mainly to a wholesaler from Putalibazaar and very little to retailers from different markets. In his own words:

"The highest amount of vegetables collected in this cooperative is sold to a wholesaler from Putalibazaar, Syangja. We sometimes sell small quantity of good quality produce to Pokhara. Local retailers from Phedikhola, Khadketari and Naudanda also come to buy vegetables. Generally, these retailers buy directly from farmers rather visiting the cooperative."

The Cooperative Chairman said that the wholesaler visits the cooperative at around 11.00 am with his packing materials. The wholesaler inspects the vegetables and price setting takes place between him and the cooperative staff. After setting prices, the cooperative staff weighs and hands over the vegetables to the wholesaler. With this, the responsibility of vegetables is transferred from the cooperative to the wholesaler. The wholesaler packs the vegetables in his own packing materials. He generally pays for the vegetables on the same day. The wholesaler said that he transported the vegetables from Sarketari to Putalibazaar in empty trucks or on bus roofs. Occasionally, the wholesaler asks the cooperative staff to send the vegetables to him. In this case, price setting is done by telephone and the cooperative uses its own packing materials which will be returned by the wholesaler later. Whether the wholesaler comes to buy or asks the cooperative staff to send the vegetables, he bears all the costs incurred in packing, loading, and transporting.

The wholesaler said that he sells vegetables mainly to retailers in different markets of the District in the afternoon. These vegetables are transported to retail stores quickly to sell them to consumers on the evening of the same day or on the morning of the following day. Thus, the vegetables harvested on Monday late afternoon reach consumers on Tuesday evening.

The farmers who sell vegetables from home are in contact with the retailers of local markets. Farmers and retailers contact each other by phone, and express their interest in buying or selling vegetables. They determine the quantity of sale and prices by telephone. Generally, farmers assemble the vegetables before retailers arrive at the farmer's place. Sometimes, farmers themselves take the vegetables to retailers' stores. These transactions between farmers and retailers can take place at any time and at any day of the week. Since the vegetables pass through only one step between producers and consumers, they reach consumers quickly and in fresh condition.
C.2.6 Pricing

Pricing is done when the ownership of vegetables is transferred from one actor to another. For the vegetables which are collected in the cooperative, prices are set for the first time between the cooperative staff and wholesaler. The cooperative staff conducts price setting on behalf of all farmers who assemble their vegetables at the cooperative. Farmers said that they fully trust the cooperative staff and believe that their vegetables are sold at the highest possible prices.

The Cooperative Chairman said that the cooperative staff evaluate the prices offered by the wholesaler on the bases of market prices in Putalibazaar, Pokhara and local markets. The current supply, market demand and vegetable quality are also taken into consideration while setting the prices. If cooperative staff think the offered prices are appropriate after this evaluation, then they accept. Otherwise, they bargain for higher prices. The Chairman said that the wholesaler is aware of the process that is followed, and the prices offered by him are usually reasonable. Since the wholesaler never discards vegetables even if they are of inferior quality, the cooperative staff do not bargain much with him during price setting.

The wholesaler said that he sells vegetables to retailers as soon as possible in order to get good prices. The wholesaler sets the prices for retailers by considering purchase prices, quality of vegetables, transaction costs incurred from buying to selling, and profit margin. The wholesaler does not calculate these cost items one by one, but uses his experience to add the transaction costs and profit margin to his purchase prices. The wholesaler gave an example which represents the process of setting prices for almost all vegetables:

"I set the prices of vegetables on lump sum basis. For example; I bought these asparagus beans (showing) in NPR 30 per kg and I am selling them in NPR 40 per kg. From my experience, I can recover the costs and make some profit if I can sell them on this price. Out of this NPR 10, which is added on purchasing price, I allocate NPR six for the whole marketing costs including losses, NPR one for plastics (packing materials) and NPR three for profit margin."

When farmers sell their vegetables to retailers, they set prices on the basis of retail prices in the market, selling prices to the wholesaler at the Sarketari collection centre, and the wholesale prices in Putalibazaar. Since farmers supply fresh and selected vegetables to retailers, the prices set between farmers and retailers are slightly higher than the prices set between the wholesaler and the cooperative. Since transactions between farmers and retailers avoids the costs and profit margin incurred in transferring vegetables from farmers to wholesalers, the prices paid by retailers to farmers are still cheaper than they need to pay to wholesalers for the same vegetables. However, buying vegetables directly from farmers is
time-consuming and more difficult than buying from the collection centres, or wholesalers as retailers need to visit more than one farm to get the required vegetables.

Retailers add transaction costs and profit margin to purchase prices to set the selling prices for consumers. Since vegetables are stored in natural condition, their shelf life is short and the proportion of loss is high. Therefore, retailers estimate marketing costs by considering the loss percentage accordingly.

The wholesaler and retailers said that they need to revise prices if they cannot sell their vegetables on the same day or the next day. They follow a price reduction strategy to clear the stock when vegetables become older.

C.2.7 Logistics Activities and Practices

Logistics activities, like packing, repacking, storing, loading, unloading and transporting from farmers' fields to consumers are undertaken to conform the requirements of customers. The actors try to undertake these activities efficiently to promote the quick flow of vegetables and associated information from one actor to another.

Logistics activities are required to be carried out from farmers’ fields to retail outlets. Packing of vegetables on the farm is the beginning of such activities. Farmers clean and sort vegetables properly before packing them into *dokos*, sacks or crates. Vegetables are then packed into these containers loose (cucumbers, cauliflowers, cabbages, and tomatoes) or by making bundles (radishes and broad leaf mustards). The filled *dokos*, sacks or crates are stored in a cool place at home before selling or taking them to the collection centre. These activities help to maintain the quality and reduce the loss percentage during transport and handling of vegetables. Despite these efforts, farmers’ lose around five percent of the vegetables between packing on farms to selling them to the wholesaler in the cooperative.

If farmers sell their vegetables from home, they weigh and transfer the vegetables to the retailers' packing materials. Since the quantity of such vegetables is small, retailers generally transport the vegetables from farmers’ homes to the road-head on their back or by hiring a porter. They transport the vegetables mostly on bus roofs from the road head to their shops.

Transporting is generally done on the back of family members from home to the collection centre if farmers want to sell their vegetable through the cooperative. The Cooperative Manager said that the collection centre stores the vegetables in a cold room before handing over them to the wholesaler. The wholesaler usually comes himself to buy vegetables. He
buys and packs the vegetables and stacks up them on the roadside. Then he stops a bus or truck going to Patalibazaar and loads them on the bus roof or inside the truck. These vegetables are unloaded at his store that lies on the roadside at Patalibazaar. The wholesaler said that he starts selling these vegetables to his customers soon after transferring them to his store. In this process, he loses around 20 percent of the vegetables from the point of buying in the collection centre to selling from his store.

Retailers transport vegetables to their stores themselves or by using porters, passenger jeeps or buses. They start selling vegetables to consumers as soon as they transfer the vegetables to their stores. Although these retailers do not want to store vegetables for long duration, they find that they need to do it for at least overnight, and even up to two to three days.

C.2.8 Value Addition

Actors said that production and marketing practices have been changed over time. The changes are focussed mostly on satisfying consumers’ needs by addressing their quality concerns, continuity of supply and in reducing transaction costs to reduce the prices. These changes ultimately add value for consumers.

Various methods have been adopted in production and marketing practices to address the quality concerns of consumers. Minimizing the use of chemical fertilizers and pesticides through the use of IPM and IPNS techniques is one such practice. The Cooperative Chairman said that the vegetables produced from ‘low’ or ‘no use’ chemical fertilizers and pesticides are considered good quality vegetables by consumers. Harvesting vegetables at the stage when they are most preferred by consumers is another important method of maintaining quality. Adjustment of harvesting time is another method adopted by farmers to supply fresh and good quality vegetables to consumers. This practice keeps the gap between harvesting and selling as short as possible. Proper cleaning, sorting, and packing of vegetables before sending them to market are also associated with improving the quality of vegetables.

Availability of different varieties of the same vegetable enables farmers to produce them in different seasons of the year. Farmers said that they grow different varieties of the same crop in different seasons and supply them to the market for longer duration. Some of them grow tomatoes and cucumbers inside plastic tunnels during the off-season and in natural condition in the main season. This helps farmers to increase the continuity of supply of these vegetables in the market.
Farmers are gradually increasing the area under vegetable production and more and more new farmers are attracted to this business in the Sarketari area. The Cooperative Chairman said that increased farm sizes helps to reduce the cost of production. Similarly, farmers have changed harvesting, cleaning, sorting, packing and transporting practices which help them to reduce the transaction costs by reducing wastage, volume loss and transport cost. However, factors, such as landslides, floods, strikes and road closure, unavailability of quality seeds and fertilizers, and the tendency of farmers to market the produce individually to retailers, all make it difficult for chain actors to reduce the production and transaction costs. Despite these difficulties, improvements made in production and marketing activities keeps production and transaction costs at a level that enables actors to supply vegetables at competitive prices to consumers.

Although farmers have improved several practices to add value for customers, they have yet to focus on other potential aspects of value addition. Such potential ways to add value would be increasing production to fulfil market demand, reducing difficulties in production and marketing practices in order to supply vegetables at more competitive prices, and transforming the produce through processing and preservation to make them available to consumers in more ready to use form, and to cater for different tastes.

**C.3 Summary of Chain Description**

The formation of the Sarketari chain, the activities undertaken by the actors in different stages of this chain, and the contribution of these activities in satisfying consumers were described in this section. The formation of the producers’ cooperative, and the marketing of vegetables through it, plays a valuable role in linking Sarketari to a vegetable wholesaler in Putalibazaar. This linkage provides marketing assurance to farmers, although the majority of them are still selling their vegetables directly to retailers from their farms. The activities undertaken in linking producers to markets affects the external environment, information structure and coordination of this chain, and these factors are discussed in Chapter 7.
Appendix D
Chain Description, Harthok

D.1 General Description of the Chain

The production area for the Harthok vegetable supply chain occurs in Bhairabsthan, Khasyauli and Deurali VDCs. Farmers from these three VDCs bring their vegetables to the collection centre operated by Harthok Agricultural Multipurpose Cooperative Ltd. for sale. The collection centre is located in Harthok of Khasyauli VDC, Palpa. The location of collection centre in the map of Palpa District is presented in Figure D.1. This collection centre is in operation since the formation of the cooperative in 2003.

![Map showing the location of collection centre in Harthok, Khasyauli VDC, Palpa District, Nepal](image)

The Cooperative Chairman said that the cooperative was formed by amalgamating the members of 24 producers’ groups from the three VDCs. Ninety five members of these groups joined the cooperative. However, some of the members of these groups were not involved in
the amalgamation process and stayed outside the cooperative. The cooperative began the process of registration on the day of its formation; however, it took almost six years to complete the formalities and it was registered in early 2009 in the DCO, Palpa. The purpose of cooperative formation and registration was to bring the members of different groups together to increase production and gain access in the vegetable market. The Cooperative Chairman said:

"The initial purpose of forming the cooperative was to increase production and collect marketable volume of vegetables in the same place, and to operate a farmer managed production and marketing cooperative."

Supplying inputs, like seeds, fertilizers and pesticides and collecting vegetables are the two main functions of this cooperative. Since the cooperative is relatively new, it is working with the minimum of infrastructure and facilities. The office space and store are maintained in a rented building. The vegetable collection centre is also operated in the same building. The cooperative has manual weighing machines and few crates. The rural information centre, which is a component of this cooperative, is operated in a separate rented building and equipped with computers, printers, phones, faxes, photocopiers and the internet. According to the cooperative staff, they are not acquainted with the use of these things and the responsibility of handling these things is assigned to a staff member. Still, the facilities are not utilized properly. There are two new buildings under construction; one for the cooperative and another for the rural information centre.

The farmers associated with this chain reported that they started producing vegetables for the market in 1999. The DADO, Nepal SIMI and Small Farmers' Development Project (SFDP) motivated them to undertake commercial vegetable production and marketing. The DADO and Nepal SIMI are still providing production and marketing technologies to them. Farmers depend equally on the cooperative and private input dealers for production inputs but rely mostly on the cooperative to sell their produce. They produce mainly tomatoes, cauliflowers, cabbages, cucumbers, beans, chillies, leafy vegetables, okras, radishes, pumpkins, gourds, eggplants, and capsicum. Almost all farmers in this area produce ginger but the process of ginger production and marketing is different from other green vegetables and is not covered in this study.

Not only the cooperative members, but also the non-member farmers, sell their vegetables through the cooperative. The Cooperative Chairman said that 422 farmers (95 members and 327 non – members) from those three VDCs sell their vegetables through the cooperative.
These farmers assemble their vegetables in the collection centre established by the cooperative in Harthok on every Monday and Thursday for sale. The cooperative collects the vegetables from 2.00 pm onwards and supplies them to the market primarily through a Tansen based wholesaler and local retailers of Harthok on next morning. In the main season, it also supplies some of the vegetables to Butwal.

Harthok is a small rural market. It lies at the junction of the Tansen – Tamghas Road and the Harthok – Chahara Road. Harthok is connected to Tansen from the Tansen – Tamghas Road and to Butwal via the Siddhartha Highway from Tansen. Tansen, which is bigger than Harthok, and Butwal, which is bigger than Tansen, are located at a distance of 10 km and 50 km respectively from Harthok.

The Cooperative Chairman reported that the cooperative collects and sells almost 95 percent of the vegetables produced in Bhairabsthan, Khasyauli and Deurali VDCs. Although vegetable sale through the cooperative is not mandatory, farmers are motivated to sell through it. Since farmers produce small quantity of vegetables, they find it easy to sell such small quantity through the cooperative rather to sell individually to buyers. When farmers bring vegetables to the cooperative, they weigh them and hand them over to the cooperative staff. The cooperative sells these vegetables on behalf of farmers mainly to a wholesaler from Tansen but also sell a small volume to retailers of Harthok. It is difficult for the cooperative to sell all the vegetables to Tansen and Harthok in the main production season due to increased supply from different parts of the district.

The effects of increased supply are less in Butwal due to its bigger size and link to several other markets. Vegetables are supplied to other markets including the border cities of India from Butwal. Because of this reason, the cooperative also supplies vegetables to Butwal in the main production season.

D.2 Chain Activities and Practices

D.2.1 Input Supply, Production Activities and Practices

Seeds, fertilizers and pesticides are the main inputs required for farmers to produce vegetables. The Cooperative Manager reported that farmers prefer to use hybrid seeds but the prices of some of these seeds are very expensive and they are often not available on time. The sale of Amrit mal (an organic fertilizer) through the cooperative is high as it is extensively used in the area. The Cooperative Chairman reported that farmers themselves prepare and use
plenty of farm yard manure (FYM). They also prepare organic pesticides and use these for spraying their vegetables.

Farmers said that they buy seeds, fertilizers and pesticides from the cooperative and private input dealers in Tansen. They buy seeds and fertilizers mostly in groups, but buy pesticides individually. The cooperative normally sells those inputs which are cheap and in high demand by farmers. The Cooperative Manager said that the cooperative is new and not in a position to bear financial risks by investing in costly inputs. Chemical fertilizers and hybrid seeds are usually scarce in the markets and farmers have difficulty getting them sometimes. The Cooperative Chairman said that the Government has reintroduced subsidies for chemical fertilizers from 2008/09 after a period of unsubsidized marketing for more than 10 years. The Agriculture Inputs Company Ltd. (AICL) is assigned by the Government to import and distribute the subsidized fertilizers, but they are not available in the local depot. Private dealers have stopped selling fertilizers thinking that they cannot compete with the AICL if it starts selling subsidized fertilizers. The issue of hybrid seed is price related and the input dealers do not want to indulge in risk by purchasing costly seeds without order. In addition, the supply of both of these inputs depends on import, which is relatively difficult.

Irrigation is another limiting factor for vegetable production in the area. Due to the scarcity of irrigation water, farmers grow vegetables particularly in the rainy season when they do not need to irrigate the crops. However, a few farmers have constructed rain water harvesting structures, like open ponds\textsuperscript{34} or closed jars\textsuperscript{35} to irrigate the standing crops in other seasons of the year. Some of them use micro drip or sprinkler sets to efficiently use the water collected in such ponds or jars. Organizations like the DADO and Nepal SIMI support farmers in establishing these irrigation systems. Since the water harvested in small ponds or jars is not sufficient to irrigate a big area, the quantity of vegetables produced in other seasons of the year is small.

Farmers said that they receive appropriate technologies required for producing vegetables in this region from the DADO, ASC, Nepal SIMI and the cooperative. These organizations are motivating farmers to produce vegetables in open fields in the main season and inside plastic tunnels in the off-season. Due to this reason, the construction of temporary plastic tunnels is gaining popularity but this technology is introduced recently and yet to produce visible effects.

\textsuperscript{34} To protect water leaching from such ponds, the ponds are paved either with cement or big plastic sheets. \textsuperscript{35} Required numbers of cement jars from 1000 – 10,000 litre capacity are constructed which protect water both from evaporation and seepage loss.
The Cooperative Chairman said that almost all vegetable producers of the Harthok area are smallholder farmers. On an average, a farmer produces vegetables in two ropanies of land but the area under vegetable cultivation can range from one half to five ropanies. Vegetables are produced in individual farms but the group or cooperative maintains the record of who is growing what in how much area. Most of the farmers produce vegetables on their own land and only around 15 percent of the farmers of the Harthok area are producing vegetables in rented land. One farmer who does this is cultivating land in return of taking care of the owner’s property. According to her, other farmers are also renting in land in a similar manner and paying nominal rent.

Farmers prefer to use family labour in vegetable production. However, family labour is not sufficient for commercial producers. According to the Cooperative Chairman, such producers employ around 40 percent of the labour on hire or on a mutual exchange basis. The Cooperative Chairman said that these farmers manage the capital required for vegetable production from their own savings and loans from different organizations. To fulfil the capital requirements, some of them borrow loans from group savings and banks. In addition, some of them get production inputs from the cooperative in credit which they can payback in few weeks’ time.

D.2.2 Product and Ownership Flow in the Chain

Product and ownership flow takes place from input suppliers to consumers. The flow of goods and ownership in this chain is presented in Figure D.2. The cooperative and private input dealers supply production inputs to farmers. According to the Cooperative Chairman, farmers prefer to buy inputs from the cooperative as they are better assured on the quality of the inputs supplied from it. The input supplying capacity of the cooperative is small and only a few things are available. Therefore, farmers are required to visit the input dealers in Tansen to buy the inputs, which are not available in the cooperative.

The vegetables produced by farmers are sold mainly through the cooperative. Almost 95 percent of total vegetables produced in the area are assembled in the cooperative on two collection days. The rest of the vegetables are sold directly to retailers generally from Harthok. The cooperative sells around 75 percent of the vegetables to wholesalers. Out of this, most of the vegetables are sold to a wholesaler from Tansen, and a negligible amount to wholesalers from Butwal. The cooperative sells the remaining products to local retailers. If anything is left after selling to all these parties, the cooperative sells them directly to consumers. The quantity sold directly to consumers is negligible. The wholesaler who
receives vegetables from Harthok sells most of the vegetables to retailers and only a small amount to consumers. Finally, retailers sell the vegetables to local consumers.

The ownership of goods is transferred from one actor to another in every step of the chain except assembling. The cooperative assembles vegetables from farmers but does not take ownership. The cooperative sells those vegetables to wholesalers or retailers on behalf of farmers. Therefore, the ownership of 75 percent of the vegetables is transferred from farmers to wholesalers and the remaining 25 percent to retailers.

**D.2.3 Assessment of Demand and Supply Situation**

Changes in general consumption pattern can increase the overall demand for vegetables. Chain actors said that the proportion of vegetables has increased in everyday meals. Increased consumption of green leafy vegetables, salad, noodles and dumplings, and the use of tomatoes as a condiment in most vegetable curries, enhance the demand for broad leaf mustard, tomatoes, cucumber, carrots and cabbages. Tomatoes, cabbages and spring onion are required
while preparing noodles and dumplings. In contrast, the demand for some vegetable items is going down. A wholesaler gave an example of beans. He said that consumers are reluctant to buy beans in the Tansen area these days.

Vegetable demand of a market is influenced by the population size of the town or city where it is located and further supply from this market to other towns and cities. Harthok, Tansen and Butwal are the current markets for the vegetables produced in the Harthok area. Vegetable demand is very low in Harthok because of its small size. Tansen is a larger town but vegetable demand in this town is just for local consumption. This town receives vegetables from different sources but it does not supply any vegetable to other markets. Butwal is an even larger town, with high local consumption. In addition to its own consumption, Butwal also supplies vegetables to different parts of Nepal as well as to the border markets of India. Therefore, market demand is highest in Butwal in comparison to the other two markets.

Butwal receives vegetables from various sources. A Butwal based wholesaler said that this market depends on Kapurkot for tomatoes for four months and Palung for cabbages and cauliflowers for 3 – 4 months. Kapurkot and Palung are at a long distance from Butwal and the wholesaler is looking at the possibility of substituting the vegetable supply from these places with production from nearby areas like Harthok. Therefore, there are ample possibilities of increasing the supply to Butwal from this cooperative.

Farmers said that they have a seasonal advantage of producing vegetables in the rainy season (May – September) and supplying to the tropical plain. The Harthok area lies in the subtropical region and is suitable for producing vegetables in the rainy season due to sufficient rainfall, easy drain out of the excess water from sloping land and comparatively low temperature. On the contrary, vegetable production is difficult in the tropical plain due to high temperature and high humidity in this season. Despite this advantage, vegetable production in the Harthok area is currently not enough to influence the markets located in the tropical plain like Butwal. So, farmers have been adopting different strategies to increase production. The Cooperative Chairman said:

"The cooperative is very young and the production and collection is low. Therefore, we have problem of low collection. We are not yet able to fulfil the market demand. Due to the establishment of Market Information Centre in the cooperative, producers and traders from different parts of the country come here to observe our activities. These visitors also want to see the production farms and collection in the cooperative. We have not got opportunity to show them our
big production blocks and collection in the cooperative. We are trying to overcome it by setting annual target of area increment."

The approach that farmers have adopted to increase vegetable production is: gradual increase in area, motivating more and more farmers towards this business, construction of temporary plastic tunnels and rain water harvesting structures, and the introduction of high yielding varieties. To save the already produced vegetables, they pay attention in harvesting, packing and transporting. Technical and material support provided by the DADO, RIU and the cooperative also help farmers in conducting these activities.

D.2.4 Import and Export

To fulfil the requirement of customers, wholesalers import some of the vegetable items from India. One of the wholesaler said that he sells imported onions, pointed gourds, chillies, bitter gourds and okra. They are required to be imported as Nepalese farmers produce onions, pointed gourds and chillies in negligible volume and bitter gourds and okra only for a short duration.

Because the volume of production is small, vegetables produced in this particular chain are not exported. However, the wholesalers associated with this chain confirmed that they do export vegetables on occasion as part of their business. A wholesaler said that formal export to India is difficult for him but he sells two tons of Nepalese vegetables every week for three months to an Indian buyer who transports it informally to India. The DADO officials said that Nepalese tomatoes are exported to India every year particularly in the rainy season.

D.2.5 Marketing Activities and Practices

Marketing activities begin with the harvesting of vegetables. Farmers reported that they observe the maturity of crops and harvest at the appropriate stage. Since harvesting and post harvest operations are done manually, and care needs to be exercised, farmers prefer to use family labour. If they need to use hired labour, they give clear instructions on the methods of harvesting/picking prior to deploying them in the field.

Normally vegetables are harvested and taken to the market on the same day. Harvesting is done on the previous day if the volume to be harvested is big. Some of the vegetables are harvested in buckets, dalos or crates and some are heaped up in clean plastic sheets. Then these vegetables are cleaned and sorted. Asparagus beans and radishes are bundled. Grading is not common but a few commercial farmers separate vegetables, like tomatoes, cabbages, cauliflowers, cucumbers and bitter gourds manually into big, medium and small grades to sell
them separately in different prices. After conducting these post harvest operations, vegetables are packed in crates, sacks or dokos and kept in shed before they are transported to the collection centre established by the cooperative in Harthok.

Vegetable assembling begins from 2.00 pm onwards on the collection days but farmers are still allowed bringing vegetables to the cooperative early next morning before the collected vegetables are sold. Farmers generally sell directly to retailers from Harthok, if they need to harvest vegetables other than the collection day. Direct transaction between farmers and buyers is uncommon as farmers prefer to sell their vegetables through the cooperative on the collection days. Farmers said that some of the retailers and wholesalers contact farmers personally and offer a relatively high price when vegetables are scarce in the markets. The majority of farmers, being cooperative members, do not pay attention to such offers, and sell through the cooperative. Another important reason that farmers prefer to sell through the cooperative is that they want to establish a contact with permanent buyers as they have to sell their vegetables regularly for long duration.

The cooperative staff reported that wholesalers or retailers, who are interested in buying vegetables, visit the cooperative or contact its staff on Tuesday or Friday morning. Since local retailers buy small volume of vegetables, the regular wholesaler and the cooperative allow them to buy first. The cooperative then sells the remaining amount to its regular wholesaler who generally visits the cooperative himself. He occasionally brings other retailers or wholesalers with him, if the collected volume is high. Sometimes, he asks the cooperative staff by telephone to send a negotiated quantity of vegetables. In such cases, the cooperative sends the vegetables in jeep or bus roofs using their own packing materials. The wholesaling to Butwal is done normally during the main season of a particular crop. The cooperative also sells a negligible volume to consumers but local retailers expressed their dissatisfaction with this practice. They suggested that the cooperative should only undertake assembling and wholesaling functions.

The regular wholesaler said that he sells vegetables to retailers mostly in the same morning. Retailers usually purchase fresh vegetables from the wholesaler on alternate day and sell them to consumers.

**D.2.6 Pricing**

Pricing is done when the ownership of vegetables is transferred from one actor to another. Prices are set between the cooperative and wholesalers or retailers at the first step. The
Cooperative Chairman said that the prices offered by wholesalers are normally reasonable and the cooperative staff do not need to bargain on them. Wholesalers estimate the prices on the bases of existing market prices, current demand and supply situation and the quality of vegetables available for sale. The Chairman also said that the cooperative has urged all vegetable producers to inform it of the type and quantity they are going to bring for sale at least a day before the collection day. This enables the cooperative to set the prices not only by relying on wholesalers but also by enquiring about the prices of similar commodities in different markets. This allows the cooperative to tell farmers the price they have negotiated when they bring vegetables for assembling. In cases of new vegetables of the season, the cooperative is unable to set the prices in advance and farmers just leave their vegetables to sell at the negotiated prices between the cooperative and buyers.

The wholesaler said that he adds the costs of transporting, handling and volume loss, and his profit margin on purchasing prices to set the selling prices for retailers. Generally, he sells around half of the vegetables to retailers as soon as he transfers them to his store, and he stores the remaining vegetables until the same evening or next day. Volume loss is high in stored vegetables and this is taken into account when setting the prices for retailers. Retailers follow the same procedure as the wholesaler when setting the prices for consumers.

In general, all actors consider the prices they pay, transaction costs and profits while fixing the prices of vegetables. Although the actors want to make profit from the sale of all items, the fluctuating market demand and supply does not allow them to do so. The practice followed by a Butwal based wholesaler represents how the actors set prices in a fluctuating demand and supply situation:

"Sometime we sell nine items in loss and recoup that from the 10th item. In some cases, we should sell all the items in loss hoping to recover it from next days’ sale."

D.2.7 Logistics Activities and Practices

Logistics activities, like transporting, packing and handling, and storing are conducted by chain actors with a view to supply good quality vegetables to customers. Farmers said that they want to supply their vegetables fresh to the cooperative. They harvest vegetables, undertake post-harvest operations and transport them to the market as quickly as possible. Vegetables which require multiple harvesting like tomatoes, gourds, and chillies are picked up in the morning and taken to the market within 5 – 6 hours. Vegetables like cabbages, cauliflowers, and radishes need to be prepared and cleaned before sending them to the market.
So, these vegetables are harvested, cleaned, sorted and packed a day before, and the packed vegetables are stored in a cool place before they are transported to the cooperative.

Farmers said that vegetables are usually transported to the cooperative on the back of their family members. A farmer who does not have a family labour force hires labour to transport vegetables. Bulky vegetables, like cauliflowers, cabbages, and pumpkins are transported in jeeps from the nearest road head if the quantity is large. Whatever means are used, it is the responsibility of farmers to transport vegetables from farm to market and bear the transport cost and loss during transportation and handling. Farmers generally do not repack, which reduces the frequency of loading and unloading. In the main season, some of the farmers do not unload vegetables in the cooperative once they are loaded in the vehicle and transport directly to big markets to reduce the loss and transport cost. Despite these efforts, farmers experience around 10 percent loss in volume from vegetable harvesting to selling. Among different vegetables, the loss percentage is highest in tomatoes, where it can reach 30 percent.

The Cooperative Manager said that cooperative staff inspect produce when farmers bring vegetables to the cooperative. In most of the cases, they are accepted but in rare cases these vegetables are further cleaned and sorted out before weighing. Vegetables are weighed in front of farmers and the types and quantities are recorded. The cooperative then mixes similar types of vegetables in one place. When wholesalers and retailers buy, these vegetables are weighed and repacked into their own packing materials. Wholesalers load packed vegetables into trucks, jeeps or bus roofs and transport to markets. They reserve whole trucks or jeeps in the main season and transport on the roof of jeeps or buses in other seasons. Loading and unloading of vegetables is done by the cooperative staff and the wholesaler.

The regular wholesaler said that he does not want to store vegetables and sells them as quickly as possible. However, he cannot sell the whole quantity at once, and stores the remaining vegetables in a room which is colder than others. He spreads tomatoes in the floor usually in summer months to protect them from rotting. Retailers also sell vegetables to consumers as quickly as possible.

**D.2.8 Value Addition**

The actors reported that they are continuously changing and improving their production and marketing practices to satisfy the needs of customers. These practices add some value to customers and increase benefits for all chain actors. The first value adding activity is variety selection. Farmers reported that consumers prefer to buy cauliflower and cabbage heads of a
particular size, and tomatoes that have a long shelf life. To fulfill this requirement of consumers, they select cauliflower and cabbage varieties which produce heads of around one kilogram, and tomato varieties which have thick shell.

The second value adding activity is minimizing the use of chemical fertilizers and pesticides to address the safety concerns of consumers. The SADO reported that some of the consumers have started enquiring about the last date of pesticide application to determine whether the vegetable is safe to consume or not.

The third value adding activity is the adjustment of harvesting time. Farmers said that they harvest chillies when they are green, tomatoes normally at the stage when they are turning towards red, cucumber and gourds before reaching the maturity stage, and so on. These practices help to fulfill consumers' requirements and to increase the shelf life of vegetables. Harvesting is also timed to ensure that the vegetables are fresh when they reach the consumers' hand. One farmer (a group leader) explained the harvesting practices adopted by farmers:

"Normally we harvest vegetables on the same day on which we take them to the collection centre. We enter the farm at around 2.00 pm, harvest vegetables and take them to the collection centre at around 4.00 pm. If we cannot harvest vegetables ourselves in such a short time, we hire labour for short duration."

Proper cleaning, sorting and packing of vegetables can be said the fourth initiative which adds value by addressing the quality concerns of customers. The DADO, Nepal SIMI and the cooperative has trained and motivated farmers through formal and informal means to adopt appropriate post harvest operations. The Cooperative Chairman said that these organizations are also motivating farmers to grade their vegetables but farmers are yet to adopt this practice.

The methods adopted for value addition are focussed mainly on satisfying the quality and safety concerns of customers. The actors have yet to consider other possible value adding strategies, such as fulfilling the market demand by increasing production, producing all the year round to maintain continuity of supply, and reducing production and marketing costs to reduce the price.

D.3 Summary of Chain Description

The formation of this chain, the important role of the cooperative in encouraging production and performing marketing functions, the contribution of these functions in information and material flows, and the relationship between actors have been introduced in this section. The
changes adopted by the chain in its production and marketing activities have also been discussed. Through changes in production and marketing activities, actors are attempting to supply vegetables to consumers in such a way that all parties benefit. Such activities influence the information exchange and coordination patterns, which are described in Chapter 8.
Appendix E
Interview Schedule for Producers

This interview is completely a voluntary process. If you do not want to take part on it, you may withdraw your participation at any time. You also deserve the right not to answer any of the questions that will be asked during our conversation.

However, if you complete this interview, it will be understood that you have consented to participate in the research. The information you provide will remain confidential and will not be disclosed to anybody without your prior consent. The information will be used to undertake the research and to produce research publications from the analysis and results.

In this interview, I am going to ask you some questions about you, your group/cooperative/committee and the involvement of your group/cooperative/committee in vegetable production and marketing. It is expected that you will represent your group/cooperative/committee during our conversation. The purpose of this interview is to find out how information exchange takes place in the vegetable supply chain on which you are involved and how information exchange strengthen or weaken the relationship between actors.

To start, I would like to record some basic facts about you and your group/cooperative/committee.

Section 1: General Information
Section 2: Production and Marketing
Section 3: Information Flow and Decision Making Process
Section 4: Buyer-Supplier Relationships
Section 5: Costs and Prices
Section 6: Coordination Problems
Section 7: Vertical and Horizontal Coordination
Section 8: Public, Private Support and Miscellaneous

Interview Date / Time :
Interview Location :
Respondent’s Name :
Position : 
Contact Details : 
Name of the Group / Cooperative / Committee: 
Address : 
No of General Members : 
Total: Male: Female: 
Date of Group / Cooperative / Committee Formation: 
No. of Employees (if any) : 

Section 1: General Information
Q 1.1 Type of group / cooperative / committee 
Q 1.2 Describe main businesses of the group / cooperative / committee. 
Q 1.3 Share of vegetables in overall businesses? 
Q 1.4 Is your group / cooperative / committee a registered organization? 
Q 1.5 If yes, when and where was it registered? 
Q 1.6 Who encouraged you to organize into group / cooperative / committee? 
Q 1.7 What was the purpose in the beginning to come together? 

Section 2: Production and Marketing
Q 2.1 What are the vegetables that you grow in your group? 
(If possible, allocate the proportion of main vegetables in volume) 
Q 2.2 How many households of your group / cooperative / committee produce vegetables for the market? 
Q 2.3 How long have you (all vegetable growers) been involved in the business? (History) 
Q 2.4 What is the current situation of vegetables in your group / cooperative / committee? 
   a. Average size of the farm 
   b. Total area covered 
   c. Total production (quantity and revenue) 
   d. Comparison with the past 
Q 2.5 What are your resources for production and marketing? 
   a. Land 
   b. Labour 
   c. Capital 
Q 2.6 Describe the logistics arrangement for your produce.
a. Harvesting, picking
b. Storing (leave in the ground, store in a suitable place)
c. Sorting, grading
d. Packing
e. Average time lag from harvesting to selling
f. Transportation arrangement (transportation means, frequency, are they transported with other goods, who should pay, etc.)
g. Loading, unloading
h. Wastage in quantity or percentage (from harvesting to selling)

Q 2.7 How much difficulty did you face in the beginning?

Q 2.8 Where do you sell your produce (mention each crop) now?
(Markets, commission agents, haat bazaar, local retailers, processors)
a. Name
b. Distance from production site
c. Average weekly sale (crop wise volume and revenue)
   (Weekly sale may differ for seasons, try to quantify them for peak, lean and average production period)
d. From when are you selling to these markets?
e. Does the quantity sold vary over time (mention the past trend)?

Q 2.9 Where does the buyer inspect your produce?

Q 2.10 Where is your responsibility handed over to the buyer?

Q 2.11 Could you please allocate your last year’s sale in percentage, if you supply the produce to more than one place?
   (Get records of the previous years, if available)

Q 2.12 What are the reasons of supplying highest quantity to a particular trader?

Q 2.13 From where do you get better price?
   (From which trader)

Q 2.14 Do you have any plan to sell more to the trader who offers you better price and less to others?

Q 2.15 Do you sell all the produce that you grow for the market? If not why?

Q 2.16 What do you do with the produce that is not sold?

Q 2.17 You must have been experiencing difficulties sometime in selling your produce to the markets?
   a. What were the difficulties you faced in the past?
   b. What lessons do you learn from them?
Q 2.18 Does your produce go for processing, drying or preservation?
(Directly from you or from other means)

Q 2.19 Do you know the consumer preferences and how did you find out?
*Probe if producers are doing value addition on the goods and materials they are selling.*

Q 2.20 What measures do you follow to maintain the quality of your produce?

Q 2.21 What are the changes and improvements you have made over time in production and marketing practices?
   a. Changes?
   b. Purpose?

Q 2.22 Do you produce any niche product (like organic vegetables which are not commonly produced everywhere) in your group / cooperative / committee? If yes, please specify?

Q 2.23 What is the marketing arrangement for such product?

Q 2.24 Could you please tell me something about your future programmes on production and marketing of vegetables?

I would like to talk about the flow of information along the chain. I am particularly interested to know the type, quality and frequency of information exchange. It would be better, if we could concentrate our discussion to explore the effects of information exchange in developing relationship between chain actors.

**Section 3: Information Flow and Decision Making Process**

Q 3.1 What market information do you get for your produce?
   a. What information (like price; quantity required; attributes – variety, colour, size, shape, grade, taste, shelf life, free from marks and damages, and others; specifications)?
   b. Are they all that you need?
   c. If not, what may be the reasons that you are not getting them?
   d. From where do you get them?
   e. Do you maintain the records and update them?
   f. What communication tools are used?
   g. How worthwhile are the information?

Q 3.2 Are you satisfied with the information that you are receiving?
Q 3.3 How reliable are the information? Do they differ occasionally when you check?
Q 3.4 Do you have any information about your competitors? If yes, what are they?
Q 3.5 How do you get the information about your competitors?
Q 3.6 How do you decide which crop to grow in your field?
   (Tastes and preferences of consumers, high market price, your technical knowhow, easy to get market, easy inputs availability, business contract, and easy to grow, harvest and market)
Q 3.7 What is the decision making process in your group / cooperative / committee?
Q 3.8 What are the information that you require to take production and marketing decisions?
   (Consumer preferences, quantity demanded, market conditions, market opportunities, capacity of other producers, and production and marketing costs, market prices)
Q 3.9 How much difficult is it for you to get information in taking production and marketing decisions?
Q 3.10 Who in your group / cooperative / committee is responsible to receive and disseminate the information?
Q 3.11 Do you prepare production plans to get better price in the market(s)?
Q 3.12 How often do you discuss and review the production plan and price of your produce?
   a. Frequency?
   b. Who takes initiatives?
Q 3.13 How much importance do you give to;
   a. Types of information (operational – price, demand, supply, stock, sources of market arrival; behavioural – trust, commitment, attitude, skill)
   b. Quality of information (reliability, completeness, easy to use)
   c. Frequency (at what interval)
   d. Communication means
   e. Information sources and destination
Q 3.14 How do they enable or disable you to observe the outcomes and making decisions?
Q 3.15 Do you need to invest for market information services?
   (Like telephone, cell phone, fax, internet, email, data purchasing, purchasing books, booklets, advertisement, training people)
Q 3.16 Do you share the information that you have with others?
   a. What information do you share and what not?
   b. Why do you share them and why not others?
   c. How often do you share them?
Q 3.17 What is your view in sharing the information? Will it increase or decrease competitive advantage to your firm?

Q 3.18 What are the factors that affect you share or not share the information?
(Belief, group culture, behaviour of the people - desire and willingness, information sharing mechanism, use of ICT)

Section 4: Buyer-Supplier Relationships

4.1 Products Supplied by Your Suppliers to You (Product Attributes)
Q 4.1.1 What are the inputs you require to grow vegetables?
Q 4.1.2 Who are your input suppliers? Could you please name them?
Q 4.1.3 How easy is it for you to get the inputs?
Q 4.1.4 How do you place orders to your suppliers?
Q 4.1.5 In the past, did you face any difficulty in getting inputs?
   a. Difficulties?
   b. When did you face?
   c. What lessons do you learn from them?
Q 4.1.6 Do you need to inform your supplier in advance about the specifications of goods and services that you want to buy?
Q 4.1.7 Do your suppliers supply inputs according to your requirements (time and specifications)?
Q 4.1.8 How reliable are your suppliers?
Q 4.1.9 What happens, if they do not meet the specifications (one or more)?
Q 4.1.10 Is there any provision of providing compensation by the suppliers, in case the production is hampered by the supply of inferior quality inputs?
Q 4.1.11 If you know the quality of inputs before use and reject it, what would you do with the rejected inputs?

4.2 Products Supplied by Your Suppliers to You (Behavioural Issues)
Q 4.2.1 Do you purchase same inputs from different suppliers at different times? If yes, why do you do so? Why can’t you rely on the same suppliers?
Q 4.2.2 Is there any role of the suppliers for you to get into the business and continue it?
Q 4.2.3 Does your line of thinking towards attaining the goals and objectives match with the suppliers?

Q 4.2.4 Do you receive any form of assistance from your suppliers? If yes, please describe.

Q 4.2.5 How much confident are you with your suppliers?

Q 4.2.6 What are your obligations to the suppliers (assets, resources, personnel)?

Q 4.2.7 Do you make any form of contract agreement with the suppliers for the goods? If yes, what do you need to do in advance to make a contract?

Q 4.2.8 What is the mode of payment?

Q 4.2.9 How is your relationship with key suppliers?
  a. State and bases of the relationship
  b. Does the relationship change over time?
  c. Causes of the change

Q 4.2.10 Could you please describe the behaviour of key suppliers which produce positive and negative effects to your business?

Q 4.2.11 Do you integrate your business activities with suppliers? If yes, what functions are integrated?

Q 4.2.12 How are the activities integrated?

Q 4.2.13 Do your suppliers exchange product information with you? If yes, what types of information do you get from them?

Q 4.2.14 Do you consider the information provided by your suppliers while using the inputs?

4.3 Products Supplied by You to Traders (Product Attributes)

Q 4.3.1 How do you find out what buyers want from you?

Q 4.3.2 Could you please describe your relationship with the buyers in each market?
  a. How do they buy the produce from you?
  b. Do they have some set of established relationship with you?
  c. Do you enter into a contract with them?

Q 4.3.3 How do you satisfy and fulfil the expectations of your customers (value creation) from your produce?

Q 4.3.4 What are the general specification requirements of your customers?
  (If there are more than one attributes, mention attribute wise specifications)
  a. When do you receive such specification requirements?
  b. How difficult is it to fulfil the requirements?
  c. What obstacles should you face in fulfilling the requirements?
d. What will you do to overcome the obstacles (monitoring, control, testing)?

Q 4.3.5 How strict are your customers on the variation in specifications by certain amount? How do they deal the situation within and beyond your control?

Q 4.3.6 If specifications are partially met (say three out of four), what will be the effects on customers’ perception, marketing of the produce and price of goods? (trade-off in quantity, quality and price)

Q 4.3.7 How do you coincide the harvesting time of the crop with the markets?

Q 4.3.8 Describe the structures you have developed to store, handle and transport the produce in good condition?

Q 4.3.9 How often do you have to incur loss by producing the product below standard?

4.4 Products Supplied by You to Traders (Behavioural Issues)

Q 4.4.1 Do you have any pre-sale arrangement for your produce?
   a. Form of contract
   b. With whom?
   c. Features of contracts
      (Duration, quantity to be supplied, price determination, payment procedures, recovery of advances, product specifications, and delivery arrangements)

Q 4.4.2 What is the mode of payment?

Q 4.4.3 Does your line of thinking towards attaining the goals and objectives matches with the traders?

Q 4.4.4 Do you receive any form of assistance from your customers? If yes, please describe.

Q 4.4.5 How much confident are you with your customers?

Q 4.4.6 What are your obligations to your customers (assets, resources, personnel)?

Q 4.4.7 How do you describe your relationship with the customers?
   a. How is the relationship?
   b. Bases of it?
   c. Does it change over time?
   d. Causes of the change?

Q 4.4.8 What are the behaviours of customers that have positive and negative effects on your business?

Q 4.4.9 Have you integrated business activities with the traders? If yes, what activities have been integrated?
Q 4.4.10 Do you receive market information of other levels of the supply chain through traders? If yes, what sort of information do you receive from them?

Section 5: Costs and Prices

Q 5.1 Do you calculate and keep records of production and marketing costs?
Q 5.2 Are you informed about marketing margins?
Q 5.3 What are the costs of transporting and marketing?

[Sorting, grading, transportation costs (porter, local transport, distant bus/truck), handling (load unload), packing, storage, octroi, donation, tax, market fees, unofficial expenses, loss volume]
Q 5.4 Among the costs, which one is the most important and why?
(Costs more, occurs most frequently, that cannot be bypassed)
Q 5.5 In your view, what are the measures of reducing these costs?
Q 5.6 Where is the price of your produce determined? What are the bases of price setting?
Q 5.7 How frequently do you update the price information to sell your produce?
Q 5.8 If you have to rank the crops according to return, how do you rank them?

Section 6: Coordination Problems

Q 6.1 Are you facing the problems like supplying more when the demand is low and supplying less when the demand is high?
  a. How often?
  b. Causes?
  c. How to address them?
  d. Lessons learnt from the past efforts
Q 6.2 How much confident are you that you will receive profit by selling your produces? What is the basis for this?
Q 6.3 Have you incurred losses while selling your produces in the past?
  a. Scale of the losses?
  b. Impacts?
  c. Causes?
Section 7: Vertical and Horizontal Coordination

Q 7.1 What are the current businesses of your group / cooperative / committee? (Level of integration)
   Production:   What:         How much:
   Marketing: Assembly, Wholesale or Retail
   Transportation:
   Livestock:
   Community Forestry:
   Health and Sanitation:
   Others:

Q 7.2 Does the formation of group / cooperative / committee strengthen your capacity?
   How?

Q 7.3 Does the formation of group/cooperative/committee increase coordination and linkages with other agencies (chain actors, Government agencies, non-governmental organizations, financial institutions, etc.)?

Q 7.4 Which type of coordination is important for you and why?

Q 7.5 How do you describe the horizontal relationship among members? Do they all have similar goals and objectives, and working spirits?

Q 7.6 What will be the treatment to your members, if anybody of you is not able to supply the produce of required standard?

Q 7.7 Have you developed a network with other producers and traders? Why do you form a network?

Q 7.8 Are the business activities changed after the formation of group / cooperative / committee? If yes, please specify?

Q 7.9 Nepalese market is dominated by spot market transactions of vegetables. What do you think are the reasons of such transactions?

Section 8: Public, Private Support and Miscellaneous

Q 8.1 Do you have any idea about the Government policies, rules and regulations which affect your business? (SPS, fumigation, quarantine, PRA)

Q 8.2 What are the supports that you get from GOs and NGOs? Please specify.

Q 8.3 What further supports do you expect from the Government and other agencies to become success in the business?

Q 8.4 In your view how is the prospect of vegetable industry in Nepal?
Q 8.5  Do you have anything more to share with me that we left in our discussion?

I would like to thank you for your valuable time and the information you have provided. The information is of great worth to my research. Could you please permit me to contact you in future by any means, if I need further clarification on the answer you have given during the interview?

Thanks

NAMASKAR
Appendix F
Interview Schedule for Buyers

This interview is completely a voluntary process. If you do not want to take part on it, you may withdraw your participation at any time. You also deserve the right not to answer any of the questions that will be asked during our conversation.

However, if you complete this interview, it will be understood that you have consented to participate in the research. The information you provide will remain confidential and will not be disclosed to anybody without your prior consent. The information will be used to undertake the research and to produce research publications from the analysis and results.

In this interview, I am going to ask you some questions about you and your involvement in vegetable marketing. The purpose of this interview is to find out how information exchange takes place in the vegetable supply chain on which you are involved and how information exchange strengthen or weaken the relationship between actors.

To start, I would like to record some basic facts about you and your business.

Section 1: General Information
Section 2: Information Flow and Decision Making Process
Section 3: Buyer-Supplier Relationships
Section 4: Costs and Prices
Section 5: Coordination Problems
Section 6: Vertical and Horizontal Coordination
Section 7: Public, Private Support and Miscellaneous

Interview Date / Time :
Interview Location :
Type of trader :
Respondent’s Name :
Address :
Contact Details :
No. of Employees (if any) :
Section 1: General Information

Q 1.1 How long have you been involved in vegetable trading?

Q 1.2 Is this your sole business or you are involved in other businesses too? If you are trading other goods and commodities, what proportion is covered by vegetables?

Q 1.3 What is the role of market in establishing you as a vegetable trader?

Probe on increasing or decreasing size of the business after the involvement in vegetable trading.

Q 1.4 What are the goods or commodities that you are normally selling now? Did you change the items over time? If yes, why?

Q 1.5 What is your average weekly transaction (quantity and revenue)?

Probe if traders are doing value addition on the goods and materials they are selling.

Q 1.6 What infrastructure have you developed for the business?

Q 1.7 Do you transform the produce to satisfy and fulfil the expectations of your customers (value addition)? If yes, what do you do?

Q 1.8 What are the changes or improvements you have made over time in marketing practices?

a. Changes or improvements?

b. Purpose of the changes?

(Increasing benefits, improving quality, fulfilling consumer interests)

Q 1.9 Describe the logistics arrangements for your produce.

a. How and where do you buy vegetables?

b. How much time does it take between harvesting and receiving the produce by you?

c. How do you transfer the produce to your store?

d. Do you need to do repacking of vegetables?

e. If you purchase the produce from different suppliers, do you mix them?

f. What are the arrangements for reducing the damage during loading/unloading, packing/repacking and transporting?

g. How do you maintain the quality of the produce?

h. What packing materials do you use?

i. How do you transport (use your own or hire vehicle) the produce?

j. On an average, how much wastage occurs from purchasing to selling (percentage and quantity)?
I would like to talk about the flow of information along the chain. I am particularly interested to know the type, quality and frequency of information exchange. It would be better, if we could concentrate our discussion to explore the effects of information exchange in developing relationship between chain actors.

Section 2: Information Flow and Decision Making Process

Q 2.1 What market information do you exchange to your suppliers and customers?
   a. What information (like price; quantity required; attributes – variety, colour, size, shape, grade, taste, shelf life, free from marks and damages, and others; specifications)?
   b. Are they all that you have?
   c. From where do you collect them?
   d. Do you maintain the records and update them?
   e. What communication tools are used?
   f. How worthwhile are the information?

Q 2.2 How reliable are the information you received from others? Do they differ occasionally when you check?

Q 2.3 Do you have any information about your competitors? If yes,
   a. What are they?
   b. How do you get the information?

Q 2.4 How much importance do you give to;
   a. Types of information (operational – price, demand, supply, stock, sources of market arrival; behavioural – trust, commitment, attitude, skill)
   b. Quality of information (reliability, completeness, easy to use)
   c. Frequency (at what interval)
   d. Communication means
   e. Information sources and destination

Q 2.5 How do they enable or disable your capacity to observe the outcomes and making decisions?

Q 2.6 What are the types of information required for you as a trader?
   (Location specific prices, demand and supply situation, and marketing costs)

Q 2.7 Are you getting information related to market conditions, market opportunities (what is scarce in which market), and marketing costs in any form?

Q 2.8 Do you need to invest for market information services?
(Like telephone, cell phone, fax, internet, email, data purchasing, purchasing books, booklets, advertisement, training people)

Q 2.9 What is your view on sharing the information? Will it increase or decrease competitive advantage to your firm?

Q 2.10 What are the factors that affect you share or not share the information?
[Belief, culture, behaviour of the people (desire and willingness), information sharing mechanism, use of ICT]

Section 3: Buyer-Supplier Relationships

3.1 With Producers or Other Suppliers

Q 3.1.1 From whom do you purchase goods?
   a. Name of production area or groups or other suppliers
   b. How long have you been working with these parties?
   c. How reliable are the parties?

Q 3.1.2 Do you prefer to buy vegetables from individual farmers or group of farmers?

Q 3.1.3 Could you please mention the reasons for preferring individual farmers or group of farmers?

Q 3.1.4 About your suppliers:
   a. How frequently do you change your suppliers?
   b. Why do you need to change them?

Q 3.1.5 What attributes do you consider while buying vegetables from your suppliers?
   a. Variety
   b. Size
   c. Shape
   d. Colour
   e. Taste
   f. Grade
   g. Shelf life
   h. Free from marks and bruises
   i. Others

Q 3.1.6 Do you have set specifications for these attributes? If yes, mention the specifications for each attribute (in some situations it may be able to do all attributes at once)?
Q 3.1.7 What do you do, if the goods supplied by the suppliers are not according to the specifications (one or more)?

Q 3.1.8 What are your obligations to the suppliers (assets, resources, personnel)?

Q 3.1.9 Do you have any contract agreement with the suppliers? If yes, what do you need to do in advance to make a contract?

Q 3.1.10 Do you sell some vegetables which are imported?

Q 3.1.11 What may be the reasons of imports?
   a. Price
   b. Inadequate domestic production
   c. High quality of imported goods
   d. Others

   *Probe on how import of vegetables affects the production and marketing of goods produced locally. Also explore how the flow of goods and materials from other countries affects the domestic supply chain.*

Q 3.1.12 How is your relationship with your suppliers?
   a. State of relationship
   b. Bases of the relationship
   c. Does the relationship change over time?
   d. What are the causes of the change?

Q 3.1.13 Could you please describe the behaviour of key parties which produce positive and negative effects to your business?

3.2 With Customers

Q 3.2.1 Where do you normally sell your vegetables?
   (Name and percentage allocation, if possible)

Q 3.2.2 How do you know the preferences of your customers?

Q 3.2.3 Do you notice any changes in the preferences of your customers over time?
   a. What may be the reasons of these changes?
   b. What do you do to satisfy the changing preferences of the customers?

Q 3.2.4 Do you supply the produce for processing, drying and preservation? (Directly from you or from other means)

Q 3.2.5 What are the general specification requirements of your customers? If there are more than one attributes, mention attribute wise specifications.
   a. When do you receive such specification requirements?
b. What do you do to fulfil the requirements?
c. What are the difficulties in fulfilling the requirements?
d. How to overcome the difficulties?
   (Monitoring, control, testing)
Q 3.2.6 If specifications are partially met (say three out of four), what will be the effects on customers’ perception, marketing of the produce and price of goods?
   (Trade-off in quantity, quality and price)
Q 3.2.7 Do you export vegetables to foreign markets? If yes, what do you export at what quantity at what interval?
Q 3.2.8 How do your customers assess the quality of goods? Do they sometimes reject the goods from you?
   a. What do you do with the rejected goods?
   b. Does this affect your relationship with the customers?
   c. Your experience till date
Q 3.2.9 Do you have any pre-sale agreement with your customers?
   a. Form of contract
   b. With whom?
   c. Features of contracts
      (Duration, quantity to be supplied, price determination, payment procedures, recovery of advances, product specifications, and delivery arrangements)
Q 3.2.10 What are your obligations to your customers (assets, resources, personnel)?
Q 3.2.11 How do you describe your relationship with the customers?
   a. State of relationship
   b. Bases of the relationship
   c. Does the relationship change over time?
   d. Causes of the change
Q 3.2.12 What are the behaviours of customers that have positive and negative effects on your business?
Q 3.2.13 Do you have to add anything else on the changing customer requirements which have affected your relationships with suppliers?

Section 4: Costs and Prices
Q 4.1 Do you calculate and keep records of marketing costs and margins?
Q 4.2 Among the costs, which one is the most important and why?
Q 4.3 What are the costs of transporting and marketing?
[Sorting, grading, transportation costs (porter, local transport, distant bus/truck),
handling (load, unload), packing, storage, octroi, donation, tax, market fees,
unofficial expenses, loss volume]
Q 4.4 In your view, what are the measures of reducing these costs?
Q 4.5 How do you set the price of goods?

Section 5: Coordination Problems
Q 5.1 Are you facing the problems like supplying more when the demand is low and
supplying less when the demand is high?
   a. How often?
   b. Causes of such problems
   c. How to address them?
   d. Lessons learnt from the past efforts
Q 5.2 How is demand and supply situation?
   a. Are you getting the produce for sale on time?
   b. What do you do, if you do not get them on time?
   c. How does it affect on your supply to your customers?
   d. What are the underlying causes of this imbalance on demand and supply?
   e. What do you do to cope with the demand and supply uncertainties?

*Probe more on demand and supply uncertainties by asking questions on whether the
suppliers deliver goods on time or not and the chain of effects created by it.*

Q 5.3 Have you incurred losses while selling your products in the past?
   a. Scale of the losses?
   b. Impacts?
   c. Causes?

Section 6: Vertical and Horizontal Coordination
Q 6.1 Does your line of thinking towards attaining the goals and objectives match with
other chain actors?
Q 6.2 How do you coordinate with other actors in your business?
Q 6.3 Which type of coordination is important for you and why?
Q 6.4 Do you integrate your business activities with other actors of the chain? If yes, what functions are integrated and how are they integrated?
Q 6.5 Nepalese market is dominated by spot market transactions of vegetables. What do you think are the reasons of such transactions?

**Section 7: Public, Private Support and Miscellaneous**

Q 7.1 Do you have any idea about the Government policies, rules and regulations which affect your business? (SPS, fumigation, quarantine, PRA)
Q 7.2 Do you get any support from GOs and NGOs? What are they?
Q 7.3 What support do you expect from the Government and other agencies?
Q 7.4 In your view how is the prospect of vegetable industry in Nepal?
Q 7.5 Do you have anything more to share with me that we left in our discussion?

I would like to thank you for your valuable time and the information you have provided. The information is of great worth to my research. Could you please permit me to contact you in future by any means, if I need further clarification on your answer you have given during the interview?

Thanks

NAMASKAR
Appendix G
Checklist for Service Providers

1. Formation and management of organization
2. General objectives and goal of the organization
3. Business activities of the organization
4. Scope of the business and future vision
5. Availability of inputs, technologies and infrastructure
6. Costs and price structures
7. Behaviour of chain actors and their interrelationships
8. Logistics arrangements for the produce
9. Value creation and marketing
10. Information flow and decision making process
11. Vertical and horizontal coordination
12. Problems, issues and problem solving mechanisms
13. Public and other support
14. Miscellaneous