



*International Food and Agribusiness Management Review*  
Volume 15, Issue 4, 2012

## **Segmenting Consumers to Inform Agrifood Value Chain Development in Nepal**

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### **Abstract**

The Nepalese government is piloting agricultural projects that are described as taking a value chain approach to development. Although consumer value lies at the core of value chain management principles, none of these projects adopts a consumer perspective. This is an example of a more widespread gap in both the literature and practice as to how consumer perspectives can be used in the development of agrifood value chains in developing countries. This paper addresses this gap by surveying consumers of tomatoes in Nepal, segmenting them using cluster analysis and demonstrating how consumer segmentation can provide strategic direction for value chain development. The research identifies four distinct segments of tomato consumers in Kathmandu. The high value consumer segment, which is also the largest segment, places most importance on credence-based attributes that cannot be ensured unless a whole-chain effort is employed, indicating that developing value chains would be necessary if this need is to be met, and that such effort would pay off. An analysis of existing supply chains shows discrepancies between consumer expectations and the delivery of value, suggesting improvement opportunities to develop these chains.

**Keywords:** value chain, consumer segmentation, agrifood, developing countries, Nepal

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## **Background**

In Nepal, both the government and donors have put concerted efforts into developing fresh vegetable value chains through a series of donor funded projects within the last five years (World Bank 2009; Shrestha 2010). Tomato, the most widely used fresh vegetable in Nepal, is identified in most of these projects as having high potential for value chain development (Full Bright Consultancy 2008).

The value chain concept has been described as a shift in mindset from a conventional producer-focused supply-push approach to a consumer-oriented demand-pull approach (Collins 2009; Fearn 2009). Thus, in principle, value chain development should take into account consumer perspectives and should be guided by value as defined by consumers themselves.

The lack of a consumer perspective in chain development could negatively impact both the development objectives of government and donors, and the business objectives of commercial actors in the chains. Past development efforts without a value-based perspective have resulted in problems such as oversupply or lack of response to market needs. At the same time, when consumerism has driven agribusiness actors to align their business strategies and structures to ensure greater consumer value (Boehlje 1999, Moser, Raffaelli, and Thilmany-McFadden 2011), agrifood value chains that are more responsive to consumers become more effective, and thereby more competitive (Trienekens 2011; Soosay, Fearn, and Dent 2012).

In spite of this evidence in the literature, a review of the Nepalese projects referred to above showed no evidence of the adoption of a consumer perspective in the development of value chains. In 2008, the Commercial Agriculture Development Project carried out a 'Product Chain Study' for ten different agricultural commodities (including tomato) to explore value chain development opportunities (Full Bright Consultancy 2008). None of these included consumers in the analysis. Similarly, no other consumer-based study with a value chain development perspective can be found in Nepal.

Therefore, this paper uses tomato as a case study crop to demonstrate how knowledge from consumer research can be used in the development of fresh tomato value chains. First, the paper segments consumers of tomato to explore value preferences for different segments of consumers. Second, the structures and processes of existing tomato chains are examined. Then, implications of the value preferences of different consumer segments are used to identify development opportunities for existing chains.

## **Objectives**

The broad objective of this paper is to identify needs and opportunities of value chain development in the agrifood industry of Nepal using tomato as a case study crop. The specific objectives are to segment consumers of tomato according to their characteristics and value preferences, and to explore improvement opportunities in existing tomato chains based on knowledge about consumer value. To guide the research process, these specific objectives are expressed in the form of the following three research questions:

1. What are the different segments of tomato consumers in Kathmandu and their characteristics and value preferences?

2. What are the structures and processes of existing tomato chains that cater for these consumers?
3. What are the implications of these analyses for tomato value chain development in Nepal?

## Research Approach I: Consumer Segmentation

A two-pronged methodological approach was used in this research. First, a consumer survey was conducted to identify segments of consumers and their preferences on the attributes of tomato. Second, the structure and processes of existing chains that cater to the surveyed consumers were examined to identify the improvement opportunities.

The following sections highlight the methods used to understand segmentation of consumers and their preferences.

### *Questionnaire Design*

A checklist of product and process-based attributes of agrifood products in general and tomatoes in particular was drawn from literature (Johansson et al. 1999; Sun and Collins 2002, 2007; Kennedy et al. 2008; Collins 2009). Two focus group discussions were conducted amongst tomato consumers in Kathmandu, the nation’s capital city, to identify relevant attributes for use in the research design. As a result, eighteen product and process-based attributes were included in a questionnaire (see Appendix 1) whose purpose was to identify the relative importance that consumers attach to these attributes in their tomato purchasing decisions. Attributes included 12 intrinsic and six extrinsic product attributes, or 10 search, three experience and five credence attributes (Ford, Smith and Swasy 1988; Grunert et al. 2005; Moser, Raffaelli and Thilmany-McFadden 2011) (Table 1). Consumers’ attitudes and perceptions towards these 18 variables were measured using a 5 point rating scale where 4 = very important, 3 = important, 2 = less important, 1 = unimportant and 0 = do not know. The questionnaire also included questions about consumers’ socio-demographic characteristics.

**Table 1.** Taxonomy of Variables Used in the Analysis

<b>Attribute</b>	<b>Search</b>	<b>Experience</b>	<b>Credence</b>
Intrinsic	Color	Shelf-life	Freshness
	Size	Cooking quality	Pesticide residue
	Ripeness	Taste	Production location
	Presence of peduncle <sup>1</sup>		Organic production
	Pest-free		
Extrinsic	Price		Traceability
	Packaging		
	Pack size		
	Shopping location		
	Display in shop		

<sup>1</sup> The stalk that supports the tomato fruit

### *Primary Data Collection*

Data was generated by market intercept consumer surveys conducted in May and June 2010 in Kathmandu. Using a replacement lottery method (Kalton 1983), samples were drawn from the pool of 51 representative retail outlets until 423 individual shopper samples had been allocated to the respective outlets. In each selected outlet, consumers were interviewed randomly by selecting the first and subsequently available tomato buyers whom the enumerator met at the exit of the store. Out of the total 423 random samples drawn, 394 questionnaires were completed (see Appendix 2).

### *Method of Segmentation*

There is little research on segmentation techniques to guide value chain development in any sector in developing countries, and especially little that relates to the agrifood sector (Cunningham 2001). By comparison, in developed countries, consumer segmentation approaches have been frequently used in marketing to devise customized strategies (Smith 1956; Dickson and Ginter 1987; Bock and Uncles 2002; Flint, Woodruff and Gardial 2002; Palmer and Millier 2004; Verbeke, Vermeir and Brunsø 2007; Zhang et al. 2008; Zhang et al. 2010). Segmentation was used in this research to develop value chain strategies focused on meeting the differing needs of discrete segments among tomato consumers. A cluster analysis (CA) approach was used, as it is a well-established method of multivariate analysis for consumer segmentation (Kettenring 2006).

In a heterogeneous market, CA segments consumers into homogeneous sub-groups (Hair et al. 2010) based on the variables used to classify them. CA is used in this research for the exploratory purpose of developing a taxonomy of fresh tomato consumers and profiling them in terms of their value preferences and socio-demographic characteristics. Such an approach has two implications. First, it establishes baseline consumer value profiles in the Kathmandu fresh vegetable market for comparison against future segmentation studies. Second, it demonstrates that consumer segmentation studies can contribute to customized value chain strategies, thereby contributing to value chain development among the actors and stakeholders of the system.

### *Design Issues in Cluster Analysis*

Research design issues relevant to CA have been identified as adequate sample size, detection of outliers, selection of similarity measures, and standardization of the data (Hair et al. 2010). Addressing these issues is important in increasing the robustness of the analysis. The sample size of 394 was large enough to draw valid conclusions since a minimum of 100 observations is sufficient to perform segmentation using CA (Hair et al. 2010). An agglomeration schedule, which is an output of CA, was used to detect outliers and no sample was found to have any role in destabilizing outputs. A squared Euclidean distance measure was used as the measure of distance. Standardization of the data was not needed since the unit of measurement was the same for all variables.

A bivariate Pearson's correlation coefficient ( $r$ ) analysis revealed that three pairs of attributes, namely packaging and pack size, taste and cooking quality, and organic production and production location, were correlated ( $r > 0.5$ ) (Allen and Bennett 2010). To reduce the effect of

multicollinearity, three attributes with low rating values in each set, i.e. pack size, cooking quality and production location, were dropped in the final analysis.

Hierarchical cluster analysis was used initially to identify the appropriate cluster size (Everitt et al. 2011). Because hierarchical cluster analysis can provide as many cluster solutions as the number of cases, the agglomeration schedule and dendrogram were used to derive a potential range of appropriate cluster sizes. The agglomeration schedule revealed that a four or five cluster solution maximized between-cluster heterogeneity without a large decrease in intra-cluster homogeneity. The shape of the dendrogram supported this result since a slight shift along one axis reduced cluster numbers from nine to five, a further small shift reduced cluster numbers to four, but a shift of almost twice that distance was required to reduce cluster numbers to three. Thus both the agglomeration schedule and the shape of the dendrogram supported either a four or five cluster solution.

In the next stage, non-hierarchical cluster analysis using the k-means technique, which is more robust (Pena, Lozano and Larranaga 1999; Hair et al. 2010; Everitt et al. 2011), was used to segment consumers based on four and five-cluster alternatives. K-means analysis minimizes the variance within clusters by continuing to reassign cases to the cluster whose centroid lies closest to the case (Punj and Stewart 1983). It also fine tunes existing cluster solutions derived from the hierarchical algorithm (Hair et al. 2010) and segments observations relatively evenly. Table 2 summarizes the distribution of cases for four and five-cluster solutions.

**Table 2.** Cross-Tabulation between Clusters for Four and Five-Cluster Solutions

		Cluster Number of Cases (Five-cluster solution)					Total
		1	2	3	4	5	
Cluster number of cases (Four-cluster solution)	1	1	3	67	0	86	157
	2	49	0	0	0	1	50
	3	0	1	10	111	0	122
	4	0	52	13	0	0	65
Total		50	56	90	111	87	394

In this research the four-cluster solution was selected because from a management perspective, a solution with fewer clusters would be preferred for ease of interpretability (Trocchia and Janda 2003) and parsimony in strategic implementation (Hair et al. 2010).

## Results of Consumer Segmentation

### *Cluster Characteristics*

Clusters are characterized by analyzing the pattern reflected in the mean and mean-centered values for each cluster as shown in Table 3, Figure 1 and Figure 2.

### *Cluster 1*

Cluster 1 contains 40% of the observations and is distinguished by relatively high means for the credence attributes of freshness, presence of pesticide residue, traceability, and organic production. This cluster has above average ratings for all attributes except packaging. A distinguishing feature of this cluster is the lowest mean value for price, indicating that this group values quality over price. Members of this group appear to be discerning consumers who look for premium products. Being the largest cluster and attaching such importance to credence attributes, this cluster has strategic significance from a value chain development perspective.

### *Cluster 2*

Cluster 2 contains 13% of the observations and is most distinguished by the lowest mean value for the presence of pesticide residue. Consumers in this group are more concerned about extrinsic attributes, primarily the shopping location and the overall look of the product, and are less concerned about credence and process-based attributes, such as traceability and organic production. This group of consumers may be relatively unresponsive to health and food safety initiatives.

### *Cluster 3*

Cluster 3 comprises 31% of total observations and is the second largest. Its most distinguishing feature is that consumers in this cluster place the highest importance on price compared with other clusters and have the highest mean values for physical product attributes such as color, size, shelf-life and ripeness and the lowest means for credence attributes such as traceability and organic production.

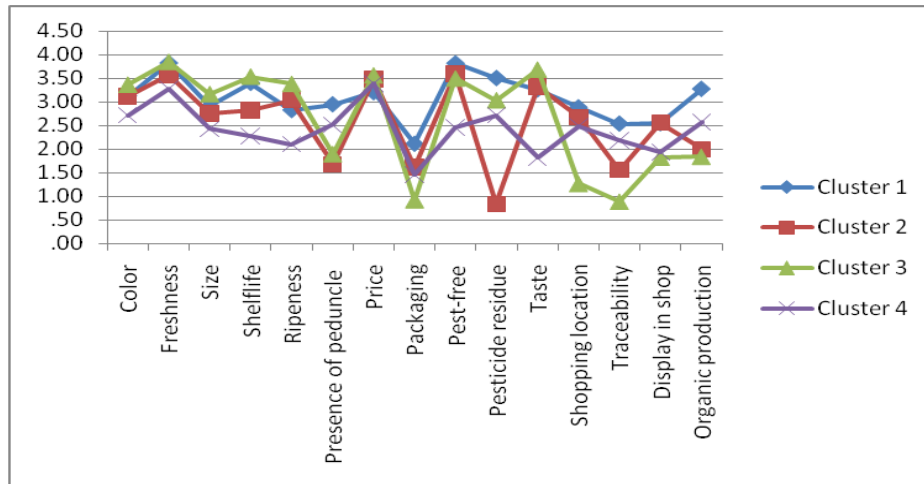
### *Cluster 4*

Cluster 4 contains 16% of total observations. The distinguishing feature of this cluster is that it has the lowest means for product external and physical attributes such as color, size, ripeness and pest free status. Although consumers in this group gave below average ratings for most other attributes, they are second to cluster 1 in their preferences for presence of the peduncle, traceability and organic production, which are considered important features associated with health and food safety. Thus the most notable feature of this cluster is that its consumers seem concerned about features that add value to health and food safety, while being below average on preferences for other attributes.

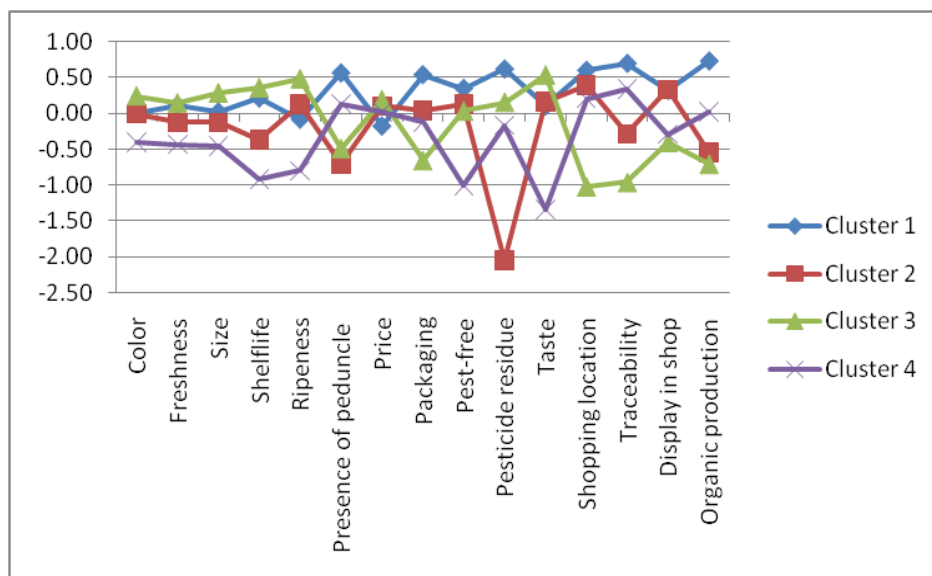
The underlying structures of these observations reveal that cluster 1 consists of consumers who place importance on most of the product and process-based attributes and are less concerned about price compared to other attributes. Cluster 2 comprises consumers who have the least concern about pesticide residues and more concern about where they shop and the physical appearance of the product. Consumers in cluster 3 are relatively sensitive to physical attributes, less concerned about production related processes, and most concerned about price. Consumers in cluster 4 are below average for most attributes but are highly concerned about product features that are associated with food safety and health.

**Table 3.** Means Values and Mean-Centered Values from K-Means Cluster Analysis

Variable	Mean Values				Mean-Centered Values				F	Sig	Total
	Cluster Number:				Cluster Number:						
	1	2	3	4	1	2	3	4			
<b>Importance of the attribute</b>											
Color	3.13	3.12	3.37	2.72	0.00	-0.01	0.24	-0.41	9.359	.000	3.13
Freshness	3.82	3.58	3.85	3.28	0.11	-0.13	0.14	-0.43	18.089	.000	3.71
Size	2.91	2.76	3.17	2.43	0.02	-0.13	0.28	-0.46	12.590	.000	2.89
Shelf life	3.40	2.82	3.54	2.28	0.21	-0.37	0.35	-0.91	44.916	.000	3.19
Ripeness	2.83	3.04	3.39	2.11	-0.08	0.13	0.48	-0.80	33.898	.000	2.91
Presence of peduncle	2.95	1.68	1.90	2.52	0.56	-0.71	-0.49	0.13	37.173	.000	2.39
Price	3.20	3.48	3.57	3.40	-0.18	0.10	0.19	0.02	6.252	.000	3.38
Packaging	2.11	1.62	.93	1.46	0.53	0.04	-0.65	-0.12	53.941	.000	1.58
Pest-free	3.82	3.60	3.50	2.46	0.35	0.13	0.03	-1.01	73.216	.000	3.47
Pesticide residue	3.50	.84	3.04	2.72	0.61	-2.05	0.15	-0.17	152.224	.000	2.89
Taste	3.26	3.32	3.69	1.82	0.10	0.16	0.53	-1.34	96.034	.000	3.16
Shopping location	2.89	2.68	1.27	2.49	0.60	0.39	-1.02	0.20	95.207	.000	2.29
Traceability	2.54	1.56	.89	2.18	0.69	-0.29	-0.96	0.33	84.546	.000	1.85
Display in shop	2.55	2.56	1.83	1.94	0.32	0.33	-0.40	-0.29	19.623	.000	2.23
Organic production	3.27	2.00	1.84	2.57	0.72	-0.55	-0.71	0.02	69.189	.000	2.55



**Figure 1.** Distribution of Mean Values of Clustering Variables in Four-Cluster Solution



**Figure 2.** Distribution of Mean-Centred Values of Clustering Variables in Four-Cluster Solution Consumer Profiles

Having characterized the clusters on the basis of consumers’ responses to product and process-based attributes, they can be characterized by the socio-demographic profile of their membership to examine underlying relationships between the preferences to attributes and the socio-demographic profiles of their consumer members.

Table 4 presents a result of Chi-square tests that compare clusters against gender, education, family structure, preferred shopping location and income. Education, family structure, preferred shopping location and income were statistically significant in explaining variations in the preferences of consumers, a result that supports the distinctiveness of the clusters.



**Table 4.** Chi-Square Test of Consumer Segments against Socio-Demographic Variables

	Value	df	Asymp. Sig. (2-sided)
Gender	5.942	3	.114
Shopping location	64.545	15	.000
Education	60.625	12	.000
Family Income	59.364	15	.000
Family composition	12.860	3	.005

Chi-square ( $X^2$ ) =  $p < .05$

Further, a cross-classification of clusters based on the socio-demographic features by which the clusters differ significantly (shopping location, education, family income, and family composition) provides a profile of each consumer segment. Based on the cross-classification analysis, the four resulting segments of consumers are labeled as high-value discerning consumers, low-value institutional consumers, price-centric non-informed consumers and low-value rational consumers.

#### *High-Value Discerning Consumers*

Consumers in this cluster are discerning individuals who value premium products over price. Their main concerns are about process and credence attributes such as freshness, organic production, traceability and pesticide residue. Approximately 85% of consumers in supermarkets fall into this category, indicating that supermarket consumers have greater concerns about food safety and health. About 50% of consumers who purchase tomatoes in corner shops are also in this category. Since prices are usually more expensive in supermarkets and corner shops when compared to other outlets, the expressed low concern of these consumers about price in favor of other attributes is consistent with their actions. Almost 75% of these consumers come from higher income brackets and 90% of them are either high school or college graduates. At the household level, 47% of consumers whose family size is less than 4 are in this cluster. This cluster therefore represents consumers who are educated, have higher incomes, prefer to shop in specific permanent locations such as supermarkets and corner shops, and seek and are willing to pay for a premium product. Thus they are labeled 'high value discerning' consumers.

#### *Low-Value Institutional Consumers*

The most striking feature of the consumers in the second cluster is their lowest rating for concern about pesticide residues and highest rating for product display in the shop. Combined with their major concern for low price and ripeness, it is possible that the importance they attach to display in the shop is associated with being able to buy ripe fruit for a low price. Based on observations during the survey period, consumers in this cluster are institutional buyers who were purchasing over-ripe tomatoes towards the end of each day at low prices. The local vegetable market is the preferred buying location for 46% of these consumers, and none of them shop at supermarkets. Educationally, around half of them are high school graduates and only 8% have a university degree. More than 80% of them are in the middle income bracket. Interestingly, no respondent

who earns less than NRs5,000 (USD59.44<sup>2</sup>) per month (the low income bracket) is in this cluster. This group also has the largest family size of any cluster.

Data reveals that many consumers in this cluster are consumers who operate institutions such as low-standard hotels and catering services. They buy over-ripened tomatoes at low prices but their preferred shopping locations do not include street vendors and pedestrian markets, which are low value markets in the Nepalese context. They want regular suppliers who can consistently supply very ripe tomatoes, so they choose wholesale and local vegetable markets because of the high volumes transacted and the associated high levels of over-ripeness and waste. Thus they are labeled in this analysis as ‘low-value institutional’ consumers.

#### *Price-Centric Non-Informed Consumers*

Consumers grouped in cluster 3 are very price-sensitive and most concerned about the product’s external physical attributes. While they express some concern about pesticide residues, they show low levels of concern for health and food safety related credence attributes. Given that informed consumers tend to place high importance on credence attributes (Verbeke, Vermeir and Brunsø 2007), consumers in this group appear to have little knowledge of, or concern for, the attributes about which today’s more informed consumers are most sensitive. In terms of education, this cluster contains diverse membership. Among consumers with no formal education, 45% are in this cluster, yet half the cluster’s members are university graduates. A little more than half (52%) of the consumers in this cluster are in the income bracket of NRs10,000-20,000 (USD118.88-237.76) per month, which is below the poverty line in Nepal for a family of four members or more. Most of them (57%) prefer shopping in local vegetable markets, where they get a wide range of choices on price. In this cluster, 58% have a relatively large family size of more than 4 members. This group of consumers is labeled as ‘price-centric non-informed’ consumers.

#### *Low-Value Rational Consumers*

Consumers in cluster 4 express below average ratings for all variables except presence of the peduncle, shopping location, traceability and organic production. Their ratings for intrinsic attributes of the product, such as color, freshness, size, shelf-life, ripeness, and taste, and extrinsic attributes such as packaging, are the lowest among all clusters. However, their rating for traceability and organic production is higher, and for price is lower, than ‘low value institutional’ consumers and ‘price-centric non-informed’ consumers. Their higher rating for health and safety related attributes, traceability and organic production, and low rating for price demonstrates a level of rationality at a time when consumers are becoming very sensitive to these issues.

A distinguishing socio-demographic characteristic of this group is that around 80% of them are low income earners. In spite of this, they do not believe that price is the most important attribute in buying tomatoes and they place greater importance on products’ credence attributes than physical attributes. With a low ability to pay high prices, yet high value attached to credence attributes, these consumers are labeled as ‘low-value rational’ consumers.

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<sup>2</sup> Dollar equivalence is based on an NR100:USD1.18 exchange rate of as at 17 January 2012 (Source: www.oanda.com)

## **Implication for Value Chain Development**

The segmentation analysis shows that the largest segment of consumers place value on credence attributes such as freshness, pesticide residue, traceability and organic production. These are attributes that can only be delivered and guaranteed by a whole of chain approach. Individual firms must play a role, but no firm in isolation can guarantee freshness, food safety, traceability, freedom from residues, and so on. Zero tolerance for pesticide residues, mandatory systems for food safety and product traceability and increasing interest in organic production are becoming common features of food retailing (e.g. Gil, Gracia and Sanchez 2000; Porter, Baker and Agrawal 2011). As similar concerns among consumers become evident in the analysis, the need to adopt value chain approaches becomes more obvious. Delivering these attributes requires more aligned processes, more reliable information and greater collaboration among chain members – the building blocks of value chain management. Further, this analysis demonstrates that value chains that are responsive to consumers can generate more income. The ‘high value discerning consumer’ segment places less emphasis on price and more on the product’s credence attributes, suggesting that these consumers would pay a premium price for credence attributes. These findings, therefore, could be useful in stimulating value chain development among actors wishing to target higher value consumers, the largest segment of the consumer population in this study and the segment which places greatest importance on credence-based attributes. The next section examines the structures and processes of tomato chains which catered for the population of consumers from which the survey samples were drawn.

## **Research Approach II: Examining Tomato Supply Chains**

The following sections examine the structures and processes of existing tomato chains which serve consumers in Kathmandu. Results are based on interviews with 27 actors in existing tomato chains and observations of the chains’ operations. Fieldwork was carried out between April and September 2010. These case study chains originated from Kavre and ended in retail outlets in Kathmandu. Kavre is one of the major tomato growing districts, and Kathmandu is the most populated city in Nepal. Checklist-based observations during value chain walks, in-field observations and semi-structured interviews with the actors of the chains, and additional memos generated during data collection and analysis, constitute the sources of data.

### *Structures*

The purpose of the analysis was to identify improvement opportunities within existing chains through the lens of consumer value. Chains that are guided by a knowledge of consumers become more responsive, effective and competitive (Bonney et al. 2007; Collins 2009; Soosay, Fearn and Dent 2012), with the potential to become value chains. A value chain is a relationship-based governance structure, focused on value creating activities (Boehlje 1999) which bring a product or service from its origin to its end use (Kaplinsky and Morris 2001) in such a way that the process efficiently and effectively delivers value as defined by the consumers (Collins 2009). The tomato chains in this study comprised of actors in five different roles: farmers, commission agents, wholesalers, wholesaler cum supplier, and retailers. Chain processes start from farmers who have been producing tomatoes commercially for more than two decades. They supply the product to wholesalers either directly or through commission agents who collect and assemble the product from farmers and deliver to wholesalers. Wholesalers are individual traders operating

at the country's largest fresh produce wet market. They link chain activities between the upstream and downstream actors, supplying products to the retailers.

Consumers buy tomatoes mainly from retailers, and occasionally from wholesalers. There are five different categories of retail outlets: supermarkets, vegetable corner shops, local vegetable markets, pedestrian markets, and street vendors. Supermarkets and vegetable corner shops are characteristically similar and are considered as high end retail market for fresh vegetables, generally targeted by convenience and quality seeking consumers. Local vegetable markets are wet markets where a number of retailers operate side by side. This is the preferred shopping location for bargain seeking consumers with no time constraints. Pedestrian markets and street vendors are considered low end retail markets. Pedestrian markets are roadside markets with a less hygienic market environment. Street vendors purchase low quality or low priced product from wet markets and offer door to door services to consumers.

Depending on the types of retail outlets involved, the product reaches consumers through three different types of chain: one that serves retailers in the local vegetable markets, one that serves supermarkets/vegetable corner shops and another that serves pedestrian markets or street vendors. Except for the chain that involves supermarkets in which a wholesaler-cum-supplier links between the wholesalers and the supermarket, the structures are similar across these chains. Although the majority of actors in these chains are engaged in continuous transactional relationships, there is no evidence of collaboration at any stage of the chain. Each actor is structurally and functionally independent.

With respect to the volumes of product and future growth prospects, chains that lead to local vegetable markets and supermarkets are significant. The majority of tomato production flows through local vegetable markets. Although the supermarket share of total volume was negligible at the time of data collection, it was growing rapidly. There was only one supermarket which had fresh vegetables as a product line in 2010. This supermarket had two retail outlets with a daily volume of transaction around 100 kg from each outlet. The number of outlets increased to five within the two years between 2010 and 2012. With a growing middle income population in the country, the potential for supermarket growth seems high. Therefore, these two chains are included in the further analysis.

### *Processes*

The matrix presented in Table 5 summarizes the main processes of the tomato supply chains related to product flow (column 1), major activities within each process and their relative importance (column 2), and improvement activities (column 3). Based on their impact on creating or adding value to the final product, activities in column 2 are further sub-divided into value-adding activities, necessary but not value-adding activities and waste activities (Bonney et al. 2007). An activity that adds value to the final product is defined by the consumer as value-adding. This activity relates to final product attributes that consumers value. Necessary but not value-adding activity is activity that does not directly add value to the product but which cannot be removed under the prevailing state of technology. Waste is activity that either reduces product value or is unnecessary, and which can be removed without compromising the value of the final product. Improvement activity is that activity which, if incorporated in the existing process, can improve the efficiency or effectiveness of the chain.

**Table 5. Product Flow Processes: Important Activities and Improvement Opportunities**

Processes	Relative importance of prevailing activities			Improvement opportunities	
	Value-adding activities	Necessary but not value-adding	Waste	Incorporating value-adding activity	Reducing waste
Input management	Managing seed	Managing fertilizer, irrigation and pesticide		Managing post-production activities	
Production	Selecting variety and producing tomato, Staking during production	Nursery, transplanting seedling, mulching, fertilizing, irrigating, harvesting	Using excessive amount of pesticides	Sorting and grading, applying proper harvesting timing and technique such as picking in time and with stalk	Reducing unnecessary use of pesticides
Logistics	Transporting product in time	Managing crates, collecting product from field, loading in vehicle, and unloading	Transferring into crates, over filling into crates, putting other vegetables on top of loaded crates while transporting	Using specialized vehicles such as refrigerated van and improvising vehicles to transport plastic crates	Allowing stop-free movements of vehicles with fresh vegetables by government
Wholesale		Selling product early in morning	Assembling tomatoes from different sources, transferring from crate to crate thereby increasing handling and reducing quality, consuming more labor and time	Establishing traceability mechanisms to assure credence attributes	Assembling products according to quality, establishing channel to redirect quality product directly to retailers
Supply to Supermarket		Collecting required quantity on search quality, sorting, delivering to supermarket		Buying product directly from farmers having capability to supply quality products	
Retail: local vegetable market		Displaying and transacting		Grading and labeling with credence attributes	Channeling to right consumer segments
Retail: supermarket		Grading, packaging, displaying in clean environment, delivering quality based on search attributes		Promoting credence attributes, labeling products with credence attributes, supplying fresh product	

**Source.** Field Survey 2010

The matrix shows that the chains' processes are not aligned so as to assure consumers that the products are fresh, pesticide free, traceable and organic, leading to a mismatch between the expectations of the highest value consumer segment and the delivery of product attributes by existing supply chains. This could be a reason for tomato being a low value commodity across the chains. These chains' processes, however, are delivering the majority of the value for other segments of consumers. The chains measure the quality of the products based on search attributes of product such as size, color and pest damage. Segmentation analysis reveals that the other segments of consumers generally value these search attributes in tomatoes.

### *Support Functions*

Government and development partners have long been important stakeholders of agricultural development in Nepal (Mellor 1995; NPC 2007; Shrestha and Adhikari 2010). Generally they support farmers on technology transfer and social mobilization, and traders on market infrastructure development and management support. Farmers in these chains have not yet received any direct support from government. Indirectly, one government policy has helped these farmers to buy some fertilizer from a semi-government institution. Similarly, the market where these wholesalers operate was developed by the government with support from the United Nation's Capital Development Fund. Established by a government regulation, a market development board manages the wholesale market's operations. Except for these examples of indirect support, no actors in these chains have received any support from government or development partners that would help them to develop value chains.

Indirect support from government also does nothing to add specific value to the product as defined by high value discerning consumers. Rather, some of the government regulations have created wastage. Vehicles carrying fresh vegetables are allowed to enter the wholesale market only between 6 p.m. and 7 a.m. Despite carrying perishable products, they are not exempt from non-stop movement on the highway. If a vehicle cannot enter the market before 7 a.m. due to stoppage at a checkpoint or an incident on the highway, the lead time for vegetables to reach consumers increases, leading to waste creation in the chain.

### *Results from the Analysis of Chains*

The research suggests that existing chains are responsive to the value attributes of all consumer segments other than the largest segment, which contains high value discerning consumers. These chains are incapable of meeting the expectation of the most valued consumers for the following reasons.

First, the chains are lengthy. A longer chain increases the lead time of product flow to the consumer. This also increases the frequency of handling of the product, and thus increases the chances of product damage. In this case, the longer the chain the lower its efficiency. Further, it becomes more difficult to establish the product's credence attributes in a longer chain.

Second, stages in the chain after production are not adding significant value to the product, though they capture a large proportion of the product's retail value. Since there is little value addition after production, tomato is traded as a commodity throughout all retail outlets. Having identified different segments of consumers with different value preferences and multiple uses of

the product, the analysis shows that tomato has untapped potential for product differentiation. Not even the supermarket, a high end retail outlet, has added value to the product according to the preferences of its consumers. For example, it is sourcing tomatoes from wet markets where traceability disappears.

Third, government and development partners are providing indirect support at the production and marketing stages, but there is no direct support and no chain-wide support. The product flow matrix shows that government policy can add to, or therefore reduce, wasteful activities. The analysis offers the following managerial and policy implications with respect to improvement in existing chains so as to cater for the needs of high value consumer segments.

### **Managerial Implications for Actors in the Chains**

The findings offer prospects for improvement both in chains that are significant from a growth perspective (supermarkets) and a volume perspective (wet markets). Chains involving supermarkets can target high value consumers and there is some prospect of shortening these chains. Few actors are involved in creating or adding consumer value, most of which is determined in the production stage. Findings provide a rationale for chain members to engage in shorter but more collaborative value chains to deliver attributes that high value consumers will pay for. Shortening the length of chains also reduces lead time, improving freshness, and improves the assurability of credence attributes.

The brand image of supermarkets requires vigilance in offering products that are safe and healthy. Supermarkets can quickly lose market share if there is food safety incident, thus they stand to benefit by engaging with their supply chains. Likewise, upstream actors aspire to develop value chains with supermarket to gain access to high end retail outlets and their high value consumers. Unfortunately, developing chain relationships with supermarkets is challenging, and actors must demonstrate their ability to reliably deliver a quality product. Greater collaboration with government and development partners may help upstream actors develop these abilities. Since these stakeholders are committed to developing fresh vegetable value chains through funded programs, commercial actors have an opportunity to develop the necessary attitudes, skills and resources to re-orient themselves to value chain ways of doing business. Therein lies shared value for all. By delivering higher value to consumers and by reducing costs, the value chain development objectives of government and development partners can be achieved. At the same time, actors would become more competitive and consumers would receive greater value.

Chains that involve wet market retailers can improve their chain performance by reducing the waste at each stage. These chains are already delivering the majority of the attributes identified by other segments of consumers, but could do so more efficiently. Lowering costs improves competitiveness.

### **Policy Implications for Stakeholders of the Chains**

Although the government is offering competitive grants to develop fresh vegetable value chains, the actors in chains have not benefited from these opportunities. Findings from consumer segmentation suggest that the greatest payoff from value chain development will come from efforts to target high value discerning consumers. Since these consumers will pay for value that is

largely created at the production stage but must be delivered and guaranteed at modern retail outlets, future support from the government and donors may be targeted at building examples of such chains.

Relatively small interventions from the government can also address wastage and inefficiency (Adhikari 2008) such as injudicious use of pesticides, actors' dependence on input-suppliers for technical knowledge, losses during transport due to use of inappropriate transport materials, and increased transport times.

Furthermore, segmentation analysis reveals that 'low value institutional consumers' are acting with a level of ignorance. Having knowledge that such a segment does exist, government can devise policies that minimize such moral hazards, in partnership with development partners who can implement awareness programs targeting these consumers. During data collection, it was observed that consumers were buying tomatoes with visible traces of pesticides and later confirmed that they lacked knowledge about the dangers of pesticide residues. Thus consumer awareness of credence attributes could become a strategic objective for public stakeholders in fresh produce value chain development.

## **Conclusion**

In earlier sections, findings from consumer segmentation established a need for value chain development in the context of this study. The results show that tomato consumers in Kathmandu clearly differ in their preferences and characteristics. Perhaps surprisingly, high value consumers represent the largest segment, which provides an incentive for chain actors to change their practices. As these consumers seek attributes that can only be delivered through whole of chain efforts, a value chain approach applied to this segment might serve as a demonstration of the benefits of such an approach more widely in the agrifood sector of Nepal.

Findings from the segmentation analysis, along with the analysis of existing chains, reveal gaps between the expectations of consumers and the ability of actors to deliver desired product attributes. This gap is most prominent in the high value consumer segment and in chains servicing high value retail outlets. Consumer segmentation analysis identifies value expectations of consumers, while chain analysis guides where and how value attributes can be created.

With growing knowledge among consumers, more awareness by stakeholders and actors in agri-food chains, a growing middle income population, and more supermarkets in developing countries, the numbers of consumers who attach value to credence attributes are expected to increase in the future. At the same time, even in a least-developed country such as Nepal, more strict food safety and quality regulations are expected to be enacted in response to incidences of food borne diseases in Nepal and elsewhere. Greater knowledge from consumer segmentation, as shown in this study, when combined with these forces driving food safety and quality, will enhance opportunities for value chain development in Nepal. This is an approach that government and development partners are promoting in the country as a means of achieving commercialization in agriculture, but limitations in existing programs where consumer value is not taken into account, must be addressed, as shown in this study.



## **Limitations, Future Research and Contributions**

### *Limitations and Future Research*

Yankelovich and Meer (2006) argue that the three constraints that limit the benefits of segmentation are distraction from production features to consumers' identity, little emphasis on actual consumer behavior, and undue emphasis on technical features of segmentation rather than on practical implication. This study addresses the first and third constraints by using product and process-based attributes for segmentation, and applying simple and frequently used methods of segmentation. Taking Yankelovich and Meer's (2006) perspective, this study does not account for consumers' actual purchase behavior directly, but by conducting surveys in actual market settings immediately after consumers' purchase actions, it was expected that their survey responses were a close reflection of their actual behavior. A design that could have included both perceptions and actual behaviors may have further strengthened the study's validity.

This study has used variables related to consumers' preferences for product benefits as the basis for segmentation because the objective of the study was to identify different consumer value profiles. Choice barriers, which refer to consumers' inability to maximize their utility due to lack of knowledge (Bock and Uncles 2002), were not used as a basis for segmentation in this study. Verbeke et al. (2007) argue that consumers who are involved with product quality and have greater confidence to evaluate that quality, tend to place higher value on credence-based attributes than search attributes. This implies that ratings for credence-based attributes such as traceability, food safety and responsible production systems, would be higher for more informed consumers. The lower importance attached to some of these attributes in this study by a majority of consumers suggests a possible choice barrier among Nepalese tomato consumers. Future research may include choice barriers as a basis for segmentation to further refine the analysis. Also, the roles of different stakeholders such as government and development partners in reducing choice barriers could be explored.

Further research might also explore similarities and differences among the actors and stakeholders in agrifood chains in terms of their understandings of consumer value preferences and the impacts these differences have on partner selection and collaboration in value chain development.

### *Contribution*

This study contributes to the segmentation literature by including both product and process-based attributes specific to tomato consumers in Nepal, a developing country. The study also demonstrates how consumer research can be useful in developing or improving value chains for a fresh agricultural product. The approach adopted in this study would provide a basis for developing value chain management strategies in similar country and industry contexts. Most importantly, this study is among the first to link consumer segmentation to value chain development in a developing country.

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## **Appendix 2**

### **Distribution of Samples According to Market Outlets**

<b>Market Outlets</b>	<b>No. of Samples</b>	<b>% of Samples</b>
Supermarket	13	3
Local vegetable corner shop	84	21
Vegetable wholesale market	33	8
Local vegetable market	182	46
Pedestrian market	53	13
Street vendor	29	7
Total	394	100