A Systematic Literature Review on Agricultural Value Chain Analysis

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Abstract

Value chain analysis is extensively used as a diagnostic tool to identify and tackle complex challenges throughout value chains in the context of agricultural development. Although, the method is mainly qualitative and static, offering limited capacity to capture the dynamic interactions and connections between components from production to consumption within a complex system. We carried out a systematic literature review through PRISMA Methodology to synthesize the fundamental reasons for applying system dynamics in value chain analysis to identifying the value chain functions, actors, efficiency, constraints, and to assess the value added along the value chain, explore how it has been implemented. Based on the reviews of various studies related to the agricultural value chain and the key insights identified, the following important factors contribute to the development of the value chain and market performance of agricultural: Strengthening the connections between value chain actors is essential to enhance the efficiency of the chain. This linkage allows the actors to learn from each other and share experiences about market conditions, especially when these connections are sustained throughout the chain. Most studies have used Data Envelopment Analysis (DEA) to assess the efficiency of distribution channels and actors, offering a strong comparative perspective on their performance. Building on this, the paper highlights gaps in existing agricultural value chain research: 1) The integration of the SCP analysis framework with other approaches is lacking; 2) There has been little investigation into the causes of mark ups through actors or their market power.

Keywords: Value chain, Agricultural, Efficiency of Actors

1. Introduction

A value chain is a system or process of activities that make up a product or deliver a service to consumers or customers. It mainly entails manoeuvring around production or manufacturing processes, which include the overall transformation of a product from an initial stage all the way to its final and

deliverable stage. This process traces the value addition in each production phase, and this is very essential in sustaining the demand of the product in the market.

Value chain is a central theory to evaluate and cognize the operations within a product or service chain. It employs both qualitative and quantitative instruments to trace the flow of goods along the chain of activities and capture information in monetary and quality perspectives. Michael Porter, in his book, Competitive Advantage: Creating and Sustaining Superior Performance, brought out this concept in the 1980s. Porter has defined value chain as a network or chain of interdependent systems or activities linked by linkages **(Porter, 1990)**. VCM is concerned with developing added value at every stage of the chain, thus giving the businesses a sustainable competitive advantage. **Porter (1985)** identifies differentiation of activities at each stage of the value chain as a way of creating value, and this may translate into products and services that are either cheaper to the buyer or more efficient.

The value chain analysis divides the operations of a company into the primary and supportive ones. The activities that are related to production are categorized as primary, and the rest, such as the human resource administration, are background activities that offer the structure that is needed to allow the organization to run in an effective and efficient way. Originally, value chain literature was based on management literature. But, in the last twenty years, it has acquired a different outlook in the sphere of development economics, especially in the sphere of agricultural economics. The sociologists and economists, as well as the international organizations like In its studies, assessments (including businesses, industries, and nations), initiatives, and intervention programs, the Food and Agriculture Organization (FAO) and non-governmental organizations (NGOs) have incorporated and applied value chain theory and methodology, including global commodity chains **(Mandinga Bonfim et al., 2019)**.

Value chain analysis has, therefore, been widely applied in agricultural and developmental initiatives in emerging and developing economies **(Pietrobelli and Staritz, 2017)**. In farming, every stakeholder that goes through the process provides value to the commodity throughout the production to the final consumer. The value chain development in the agricultural sector, especially in horticulture, is very important in the successful marketing of crops and ensuring that the demand remains in the market. Value addition, therefore, becomes a very important element in the entire process of the crop going through the chain **(Anic & Nusinovic, 2005; Dolan and Sutherland, n.d.; Naqash, 2018)**.

The value chain analysis is also concerned with the necessity that agricultural producers should increase their sustainable functioning through the incorporation of social and environmental factors into the analyses. In line with the Sustainable Development Goals (SDG) agenda, sustainability is not only about economic aspects. In other instances, it is not sufficient to evaluate the alleviation of poverty. Inclusion of the social and environmental elements in a value chain analysis will offer a competitive edge because unfair gains will be distributed equally among the stakeholders of the chain. This broadening is comprised of aspects of environmental economy, value chain activities involving cost-benefit analysis, and the evaluation of production modes **(Mandinga Bonfim et al., 2019)**.

Value Chain versus Supply Chain

The development of supply chain management (SCM) can be traced back to the 1980s when it developed as an entire process of managing the entire chain of goods supply to final consumers **(Feller et al., 2006)**. This method expanded as time went by to bring in a large scope of supply chain business processes. In 1982, Keith Oliver coined the phrase "supply chain management" to develop an all-encompassing inventory management system that balances the level of inventory and customer service goal achievement. Supply chain management (SCM) initially aimed at controlling the supply chain as a cohesive entity as opposed to a group of independent functions with the major goal of dealing with inefficient inventory and capacity development that was occasioned by conflicts among various functional units within a corporation **(Beth et al., 2003)**.

2. Materials and methods

Systematic literature review (SLR)

The SLR is a technique of searching, appraising, and analyzing all studies that are presently available on a particular research topic or phenomenon of concern **(Keele, 2007)**. In this research, we opted to adopt systematic literature review (SLR) due to its structured method of selecting and aggregating a database of the review, which is open and reproducible as well as transparent. The strategy of the process was the PRISMA (Preferred Reporting Items to Systematic Reviews and Meta-Analyses) Statement (Moher et al., 2009), as well as the methodologies that were described by **Hanvold et al. (2019)** and **Hoque et al. (2017)**. The reviews were conducted in accordance with Figure 1. Document Research: Three available scholarly electronic databases, Google Scholar, Scopus, and Web of Science, were searched to find the required literature on the topic of apple production and value chain analysis.

Methods of Data Synthesis and Analysis:

Thematic analysis was employed to organise the results into the categories of identified challenges and opportunities and to perform the data synthesis. This procedure enabled identifying patterns, similarities and differences that existed across the researches. A narrative synthesis was then implemented to give a detailed summary of the findings against the research questions and objectives of the review.
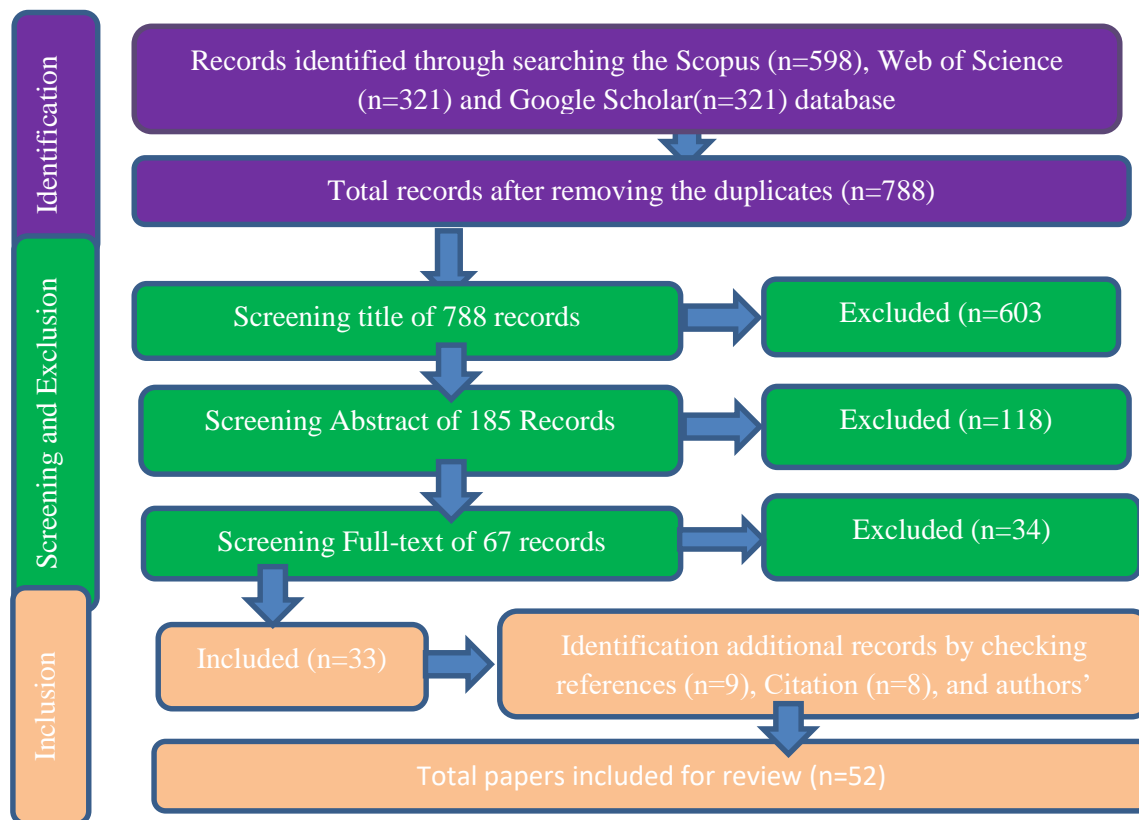
Figure 1: Flow diagram illustrating the methodical procedure used to find pertinent papers for review

To be able to be consistent and complete, data extraction was conducted with the help of a standardized template. The data that was extracted was that of the author(s), year of publication, research title, objectives, research methodology, key findings regarding challenges and opportunities in the horticulture supply chain and recommendations to stakeholders. This organized study allowed analyzing and synthesizing the results comprehensively.

3. Results and discussion

Agricultural marketing

Agricultural marketing refers to the scope of services that is used to take agricultural products from farms and deliver them to the consumers. This process involves activities, which are interrelated and include production planning, cultivation, harvesting, grading, packing, transportation, storage, agro- and food processing, distribution, advertising, and sales. According to the literature that exists on the marketing of agricultural commodities, the marketing of agricultural products is a complex process and involves activities such as production planning to final sales. Agricultural marketing is an integrated approach that involves the supply of inputs, production, transportation, storage, and policy analysis. Efficient information exchange and financial resources are crucially important to it, as revealed by the works of **Acharya and Agarwal (2004)** and **Vadivelu and Kiran (2012)**. The studies concerning the production of apples in regions like Jammu and Kashmir and Himachal Pradesh prove that the marketing is a challenging process in terms of operation and finance. Even though initial studies (**Thakur and**

Johl, 1967; Sidhu and Kahlon, 1969) showed that selling to the customers directly is not a problematic endeavor, growers have often faced problems like fluctuating prices, inappropriate storage, and inadequate transportation facilities. It was proposed that cooperative organizations and superior marketing channels were to be created in order to obtain more producer returns **(Rana et al., 1983; Swarup et al., 1985)**. Later studies demonstrated that the share of the producer to the consumer price fluctuated often due to inefficiency and the use of middlemen. The small farmers were particularly hit **(Sikka and Nadda, 1989; Mehta et al., 2013)**. The cost structure revealed that although the initial investments incurred in planting orchards were very high, the mature plantations were very profitable **(Kanwar, 1987; Sikka and Vaidya, 1987)**. Recent studies have also been allocated to the enhancement of marketing systems with the aim of minimizing intervening processes, enhancing infrastructure, and providing solutions to cold storage issues to increase producer **prices (Mir et al., 2019; Sharma and Guleria, 2020; Wani et al., 2021). Bharti et al. (2023)** pointed out that even though farmers in Himachal Pradesh preferred regulated pricing channels, such persistent problems as low road connectivity and labor shortages still impeded the best marketing performance. Individually, these research studies support the idea of efficient and producer-oriented marketing channels, cooperative support, and infrastructural development as a means of improving agricultural marketing systems and making farmers sustainably profitable.

Supply Chain

The Supply Chain Management (SCM) concept came into the picture in the 1980s as a combined strategy of managing the complete chain of materials all the way to the final consumers **(Feller et al., 2006)**. This strategy was then developed to cover an extensive amalgamation of business procedures across the supply chain. Supply Chain Management was a name that was coined by Keith Oliver in 1982 to come up with an extensive inventory management system that ensures a trade-off between the inventory management and customer service targets. Initially, SCM was to concentrate on the supply chain as an entity as opposed to a combination of individual functions, and the aim was to solve suboptimal inventory and capacity development due to conflicts among various functional groups in a company **(Beth et al., 2003)**. **Hertz (2001)** has defined a supply chain as part of a network that provided a particular product between its raw material and customer. It encompassed a complete commercial chain that is integrated within the network that has a shared goal of efficiency and effectiveness. **Perreault and McCarthy (2002)** used the term "supply chain" to indicate the entire collection of firms, facilities, and logistical functions that had been engaged in getting raw materials, converting them to either intermediate products or finished products, and distributing them to the customers. According to the supply chain, **Rajoo (2002)** explained that the whole network or chain of links connecting the farm to the consumer of the final product is the supply chain. According to **Chase et al. (2005)**, the supply chain was defined as the network of organizations (suppliers, manufacturers, distributors, and customers). As described by **Chopra and Meindl (2005)**, the parties involved in the supply chain are those that are directly or indirectly involved in the satisfaction of a customer. This includes all the producers, suppliers, carriers, storage facilities, merchants, and end users, and all the activities needed to complete an order of a customer. According to **Mentzer (2005)**, the supply chain is a network of three or more businesses that are directly linked by one or more information, money, goods, and services flows between the supplier and the consumer. **Kanaka (2007)** points out that a supply chain is a complex network of organizations that are either directly or indirectly engaged in the production, distribution, and

consumption processes. Such organizations are farmers, pre-harvest contractors, local merchants, commission agents, wholesalers, processors, exporters, retailers, and consumers. These actors required additional exposure and training because they were not certain about the role they played in enhancing the value chain. **Jensen (2010)** defines supply chains as the conversion, processing, and transportation of the products between raw materials and the finished products. The study has found that the supply chain of banana farming includes the processing, conversion, and transportation of bananas, as produced by farmers through the input suppliers and market intermediaries to the final consumers. The article by **Wani et al. (2015)** titled Supply Response of Horticultural Crops: Based on Secondary Data, The Case of Apple and Pear in Jammu & Kashmir observed the period of 1981-2013. The Nerlovian model was used to estimate the supply response, while the long- and short-term dynamics were estimated with the engagement of the Engle-Granger test and the Vector Error Correction Model. They noted that the price of apples is more variable than the price of pears. They also determined high coefficients of determination (R^2 = 95) and own-price elasticities of 0.32 (short-run) and 0.33 (long-run) with apples and 0.03 (short-run) and 0.28 (long-run) with pears. Also, their results demonstrated that the price of pears has a positive and significant effect on the price of apples, which is indicated by their coefficients. The price correlation of the apple and the pear show short-run as well as long-run relationships between the commodities of the apple and the pear. They concluded that consumers may use pears as an alternative crop when the price of apples increases.

Value chain analysis

Value Chain Analysis (VCA) refers to a tool that is employed to determine the possible sources of economic advantage to the companies by disaggregation of the activities of the firm to comprehend cost systems, value addition, and differentiation. The analysis concerns the interaction of a firm value chain with the ones of the suppliers, customers addition, customers, and competitors so that companies can have a competitive advantage by doing such activities more cost-efficiently or more differentiated. The value chain involves all the activities that are involved in taking a product or a service, through customers, service through production, delivery, and ultimate disposal (**Kaplinsky and Morris, 2001**). Value chain is also understood as a chain of relationships between the actors of productive activities service through activities, the objective of which is to add some value at every stage of the process. The strategy fosters the vision being held by actors, activities, actors, thereby assisting them to find out what they have in common, risks, benefits, and leverage resources to meet common objectives (**Richard and Besigye, 2005**). To **Handfield and Nichols (2005)**, VCA is one way of understanding what is going on in the chain in order to undertake them more effectively and in a cost-effective way. **Baker (2006)** also defines it as a method of tracking the flows of products, some of the most important actors', and their relations. The value chain has become relevant actors, relevant, especially in the process of agriculture, relevant, whereby products are modified in form, colour, or other characteristics in order to enhance the value of the product (**Savita et al., 2006**). according to **Bammann (2007)**, the value chain refers to the network of actors, including the suppliers of inputs, and the ultimate consumers and consumers, who collaborate to create an item and take it all the way to the end. **Capon (2008)** describes the value chain as a paradigm used to analyze how the organizational resources are organized in order to create value at the minimum cost and an advantage over the competition. In this respect, the current research utilizes the value chain analysis of consumers, of the apple and determines the value added in each step of the chain in order to carry out the activities in a more effective and cost-saving manner. **Miller and Jones (2010)**

expand the idea by incorporating all the activities and parties involved in the transportation of agricultural products to consumers. In the analysis of the value chain, **Sanogo (2010)** puts the focus on the identification of actors, firms, services, and institutional support. Value addition, as pointed out by **Reddy et al. (2010)**, includes product differentiation using variables, such as quality or size, and more efficient after-harvest processing, including trimming, cleaning, sorting, grading, and packing. Value-addition technologies have become more significant as the commercial needs of fruits and vegetables have been increasing and the focus has been on improving the quality and attractiveness of the produce **(Padma and Rathakrishnan, 2011)**. **Getahun et al. (2018)** conducted a study of the apple value chain in Ethiopia and established that the direct value chain participants were input suppliers, producers, traders, and consumers, with different net marketing margins throughout the chain. On the same note, **Roy and Hazari (2023)** conducted research on the agricultural value chain of Northeast India, discussing issues and suggesting ways of expanding agribusiness and improving the value chain in the area.

Efficiency of Actors in the Value Chain;

Data Envelopment Analysis (DEA) is a mathematical programming technique which is applied in measuring the productive efficiency of firms and other decision-making units. It determines the extent of using resources in a firm to generate outputs by comparing it with the most efficient firms, hence determining the areas where there is a need to improve **(Farrell, 1957)**. Economic efficiency is looked at as a factor of both technical and allocative efficiency to minimize costs per unit of output, where both the technical efficiency (optimal use of inputs) and the price efficiency (optimal input prices) can be achieved **(Yotopoulos and Lau, 1973)**. **Banker et al. (1984)** also refined the DEA model to assume variable returns to scale (VRTS), which states that when decision-making units (DMUs) are not operating at an optimal scale, then it is possible to confound efficiency measures using the constant returns to scale (CRTS) model. VRTS specification enables one to understand more clearly what technical efficiency is since it is free of the scale effects. **Sexton and Lewis (2003)** offered a two-stage chain model into DEA, which enables the better understanding of the decision-making unit (DMU) performance in stages, that is, it consumes inputs and gives outputs using intermediate products. **Lu (2006)** used a two-stage DEA model in a study of vegetable marketing in Nanjing; the overall efficiency of the vegetable supply chains was found to be 74%, with direct marketing the least effective and the wholesale market chains the most effective. The transaction costs were also identified to be one of the biggest impediments to efficiency in the local tomato supply chains, and a reduction in the cost may lead to farmers increasing the intensity of resource utilization, enhancing their productivity, and eventually raising the income **(Ruben et al., 2006)**. When **Banerjee (2010)** compared the cost of cultivating bananas organically and inorganically, he discovered that the cost of cultivating organic bananas was lower, yet health-conscious consumers were willing to pay more premiums to organic farmers, which made the organic farmers make more profits in the long term. On the same note, **Biswas (2010)** studied high-density banana planting and proposed that a planting density of 4444 tissue culture plantlets per hectare is a good planting density to achieve high yields and profits. **Charyalu (2010)** used DEA in estimating the technical efficiency of organic input units, and the technical, allocative, and economic efficiency were low under the DEA-CRS model but higher under the DEA-VRS model. **Kuah et al. (2010)** applied DEA to determine the efficiency of quality management and indicated that ineffective management practices may be enhanced through specific strategies. Stochastic frontier production and

cost functions were also used by **Asogwa et al. (2011)** to test the technical and allocative efficiency of the Nigerian rural farmers by focusing on the need to operate at the right size to enhance efficiency. **Sathya (2011)** applied the DEA to analyze the technical and scale efficiency in tomato production in drip and conventional irrigation with a 46 percent and 47 percent potential increase, respectively. In his research, **Odemero (2013)** examined the combination of factors that were efficient in banana production in Nigeria and established that the labor, fertilizers, price, and education were important in determining output. He advised that more labor and fertilizers be put in use, coupled with the availability of credit facilities and better methods of production, to boost output. The paper by **Ebiowei et al. (2013)** examined the allocative efficiency of banana and plantain production in Nigeria, where there is inefficiency in the use of family and hired labor and plantain suckers. They argued that better allocation of resources could be evaluated with the help of government and non-governmental organizations through things like credit assistance, enhancement of rural infrastructure, better sucker varieties, and development of extension services. Finally, **Guleria et al. (2022)** studied the efficiency of marketed apples in Kullu District, Himachal Pradesh, and found that there were three primary marketing channels, with the most effective being the producer-retailer-consumer channel. Most growers employed the producer-wholesaler-retailer-consumer channel in marketing their apples.

Conclusion

Based on the discussion above, it can be argued that a value chain approach in business could enhance profitability and the quality of products that will be placed in the business, and all the stakeholders in the chain will benefit, including the consumers. The vast majority of the studies have applied Data Envelopment Analysis (DEA) to the evaluation of the efficiency of distribution channels and actors, which provides a powerful comparative approach to the assessment of their performance. Nevertheless, as the perceptions of the farmer towards the various distribution channels were studied, most of them viewed commission agents and wholesalers as the best channels. According to an overview of different studies on agricultural value chains and the main lessons that are observed, several essential aspects are noted to strengthen the relationships between the actors of the value chain to achieve better efficiency since by establishing constant links, this enables the actors to learn new experiences about one another and the market conditions, as well as share them with others. As well, strengthening cooperation systems in the agricultural value chain is critical towards enhancing integration and allows actors to engage well in value chain activities. The advocates of the agricultural value chain must not give up but concentrate on farmers to enhance production and market presence, and ultimately, producers must enjoy the benefits of the value chain activities. Moreover, the studies on supply chains have shown that the efficiency of supply chains and losses can be minimized through the integrated management of different stages of the process steps that include farm and consumer. Value chain analysis has also enabled potential value addition, and this is especially through product differentiation, enhanced post-harvest processing, and embracing enhanced market linkages. Although most studies have evaluated marketing channels in agricultural marketing, limited studies have examined the factors that drive the participation in the different agricultural marketing value chain channels, a gap that is a major research gap. One methodological gap that is discernible in the literature on value chain analysis of agricultural marketing is that the evaluation of efficiency and performance of various stages of the value chain does not have

standardized methods. The available literature tends to rely on various methodologies, and it is hard to compare the findings and come to general conclusions. More rigorous and consistent research in the agricultural marketing value chain would be improved by creating a standardized methodology that is appropriate to the special features of the value chain.

Scope of study:

I. The analysis of markups and market power: The cause of markups and market power is not well explored even though a number of studies examine the pricing, value added, and profitability among value chain participants. To explain pricing differences and provide suggestions to increase equity and effectiveness in the value chain, a study may be based on determining how and why specific players in the market have market power, which may be used to explain price differences and offer suggestions on how to increase fairness and effectiveness in the value chain.

II. Uniformity in methodology: Lack of a clear methodology on how to assess the effectiveness and performance of the different phases of the agricultural marketing value chain is a serious gap in the literature that is currently under publication. To facilitate more precise cross-comparisons and better understanding of the dynamics of the value chain, future studies would focus on the development of consistent and replicable methods in the context of agricultural marketing that would make it possible to perform more reliable cross-comparisons and develop a more in-depth understanding of the dynamics of the value chain.

III. Analysis of Dynamics of Distribution Channels: Since agricultural products are perishable, distribution strategies play a critical role in the agricultural marketing value chain. Despite the fact that efficiency and performance have been the primary issues of past research, scanty information exists concerning the variables influencing the choice of distribution channels. To identify the most efficient distribution strategy to enhance productivity and minimize loss, the future study may focus on the choice and perception of the producers towards distribution channels, especially concerning the use of commission agents and wholesalers, with the aim of finding out the most effective approaches to distributing products to maximize the productivity and minimize the losses.

IV. Market Linkages and Post-Harvest Processing: It may be further researched to look into the possibilities of value addition by enhancing post-harvest processing and enhancing market linkages. Research may be directed towards new ways of product differentiation and the contribution of the marketing channels towards value creation for both consumers and producers.

V. Stakeholder Engagement and Participation: There is not much information regarding the variables that influence the stakeholders' participation in the different channels of the Apple value chain. Further studies could be done to identify the decision-making process of different stakeholders like farmers, merchants, processors, and consumers to better understand their motives and their involvement in value chain activities.

VI. Effects of Technological Development: Future research ought to be conducted on how technology can enhance production of apples, post-harvest processing, and distribution efficiencies, considering the rate at which technology is evolving. Inclusion of new technology

may go a long way in addressing the inefficiencies and improving the overall performance of the value chain.

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