Value chain of sweet potato: a sociological analysis

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Abstract. This study analyzes the existing value chain of sweet potatoes in the Partido District of Camarines Sur, the Philippines. A combination of surveys and participant observation was utilized in the study. Four sociological perspectives were used in the interpretation and analysis of the data, such as new economic sociology, symbolic interactionism, role theory, and exchange network theory. Six components of the value chain were evaluated, such as (a) agents, roles, and links; (b) inputs, outputs, and activities that generate transformation; (c) value addition and value allocation; (d) final products or a group of final products; (e) power relations and governance mechanisms; and (f) problems and opportunities shared by all agents. The study found four major links involving five actors – farmers/producers, middlemen or wholesalers, retailers, processors, and end consumers. Analysis of the sweet potato value chain shows that sweet potato production has great potential to improve the well-being of participants. Sweet potato production gave farmers an 81% net profit margin and contributed to 39% of their livelihood. However, there remain general production and utilization challenges and post-harvest and by-product processing issues. The study established the significance of embeddedness and the wider social structure for the sweet potato agribusiness and provided policy inputs for the development of the sweet potato value chain in the district.

1. Introduction
The sweet potato (Ipomoea batatas L.) is the 7th most important crop in the world and the third most important crop in the Philippines after rice and maize [1]. The agriculture department of the country classifies sweet potatoes as a high value crop and encourages investments and consumption as they are believed to play a major role in food sufficiency [2]. The country's production of sweet potatoes is primarily based in the provinces of Bicol, in the central and eastern Visayas regions. In 2019, the records of the Philippine Statistics Authority (PSA) show that the Bicol Area was the top producer in the country. Nevertheless, given the potential of this variety, the Philippine sweet potato industry is not moving processing development to the farm level. Additionally, the postharvest system is one of the main issues in sweet potato farming that leads to losses for farmers [2].

To address this issue, there is a need to look into the activities involving farming, distribution, processing, and selling the commodity through value chain analysis. This strategic tool is one approach to adding productivity to the agricultural sector [3], which can solve the issues of marginalization among smallholder farmers due to the detrimental impact of food supply chain commercialization and transformation [4]. This also means that the weakest industries in the chain are gaining the advantages of agricultural penetration into the economy.

This study carried out a value chain analysis of the sweet potato industry from a sociological perspective. Sociology as an important discipline in value chain analysis is defined as the scientific
study of society, including trends in social relations, social action, and culture [5]. Thus, sociology is an important discipline in the understanding of the experiences and interactions of different agents, from the production of commodities to their final disposition. To enrich the use of sociology in the analysis of the value chain in agribusiness, this study uses different sociological perspectives, such as new economic sociology, symbolic interactionism, role theory and exchange network theory.

New economic sociology is described as the use of the structure of variables, and modes of sociological reasoning in dynamic practices linked to the production, delivery, trade and use of scarce resources and services [6]. This theory explains how interaction and social structure affect economic players in ways other than their preferences. Symbolic interactionism is a sociological lens that focuses with face-to-face interactions between people of society [7]. It interprets the central role of the social symbols of the various actors involved in the production and consumption of sweet potatoes. Role theory emphasizes the complement of role-taking, the role-making process, whereby individuals produce both conscious and unconscious expressions as they aim to build and create their own roles vis-à-vis other situations - specific roles [8]. It assesses the actors' structural and functional roles in the chain as indicated by the social structure. Exchange network theory emphasizes that it is the nature of relationships rather than the properties of actors that are subject to theorizing [9]. It examines the exchange dynamics that operate and revolves around the forms of relationships generated by power inequalities.

Hence, the conduct of value chain analysis for sweet potatoes offers an explanation of the actors' complexities and their position in the value chain. Therefore, it provides crucial policy insights for the country's sweet potato production in the Partido district of Camarines Sur. In doing so, the objectives of the study are (1) to describe the value of the chain in terms of actors, their role and links in the value chain, and the relationship dynamics among key actors; (2) analyze the cost and return of sweet potato production and marketing as well as the value added in the different stages in the value chain; and (3) evaluate the constraints and opportunities in the chain.

2. Materials and methods
The study used a mixed method following convergent parallel design. A combination of surveys and participant observations were undertaken to collect data from 62 farmers, 2 middlemen, 10 retailers and 5 processors. A total enumeration was employed as a sampling technique for the farmers based on the list of two main sweet potato producer municipalities. Purposive sampling was employed to other agents. The location of the study is in the municipality of the 4th district of Camarines Sur, with a significant number of sweet potato farmers, traders, processors, and consumers. It is also one of the producers and suppliers of agricultural commodities in the province. These are Tigaon and Sagnay for farmers, and Goa and Tigaon for middlemen, traders, and processors. Descriptive statistics and cost and return analysis were used to analyze quantitative data, while value chain mapping and narrative analysis were used to analyze quantitative data. In general, it follows six components of value chain: (a) agents, roles, and links; (b) inputs, outputs, and activities that generate transformation; (c) value addition and value allocation; (d) final products or groups of final products; (e) power relations and governance mechanisms; and (f) problems and opportunities shared by all agents [10].

3. Results and Discussion
3.1. Actors and their roles and link in the sweet potato value chain map
The actors who engage in value-added activities are at the heart or core of the value chain definition [11,12]. Correspondingly, the value chain map of the sweet potato industry in the 4th District of Camarines Sur has four (4) major links involving five (5) actors – farmers/producers, middlemen or wholesalers, retailers (market vendors), processors and end consumers.

3.1.1. Sweet potato value chain actors and their roles. Farmers, middlemen, retailers, processors, and consumers are the main players in the district’s sweet potato value chain. Sixty-two (62) farmers served as participants of this study. It was found that after 6 weeks to 7 months of planting (average of 4
3 months), sweet potatoes are readily sold to consumers or to the market. They sell an average of 87% of their crop production to various actors, with the remaining 13% used for family consumption or livestock feeding. In most cases, some farmers are also engaged as middlemen, retailers, and processors of sweet potatoes. Farmers’ willingness to play multiple roles within the chain is a result of their desire to earn a living from their cultivars and the absence or low demand for other players.

There are no specialized middlemen in the study area for sweet potatoes. The merchants are middlemen who collect locally produced vegetables. During the sweet potato harvest season, they come to different locations (towns in the Partido District) and buy sweet potato tubers at the farm gates. Retailers, on the other hand, are usually the sellers or merchants in the town market. In the study area, there is no sweet potato processing company. Most sweet potato processors are small-scale businesses or itinerant vendors.

3.1.2. Sweet potato value chain map. The value chain map of the sweet potato as shown in Figure 1 shows the flow of the commodity. This process involves the distribution of products across the value chain, which aims to manage the delivery of the desired commodity to consumers. The primary channel involves two actors, with 51% of farmers selling directly to consumers. These consumers are typically associated with the network of social ties of farming households, which include gemeinschaft by blood (kapamilya, kapatid, kamag-anak), of place (kapitbahay), and of mind (kaibigan, kompadre, komare). Since farmers reside in a rural community, a well-defined social network of ties exists, and they are engaged in the "unity of plurality".

![Sweet potato value chain map](image)

**Figure 1.** Sweet potato value chain map in Partido District.

Before the product reaches the end consumers, the other three major channels involve other actors such as middlemen (wholesalers), retailers, and processors. The supply chain of sweet potatoes in the Partido District revealed that the farmers transact only with people whom they know personally or whom they have had past or previous transactions with. This finding supports Granovetter’s [13] claim that people make decisions based previous interaction with others and continue to deal with those they trust. In his theory – the embeddedness theory, he recognizes that the on-going networks of social relationship between people deter wrongdoings. Farmers are hesitant to transact with people they do not know personally as they are afraid of being a victim of malfeasance. The networks connecting the farmers within a chain can be considered embedded because of the substantive social trust that binds the farmers to each other via interpersonal relationships. The common social solidarity that exists among actors is kinship, which builds a cognitive marker around which actors can construct trust relations. As a result, to transact with farmers, it is necessary to establish personal relationships with them.
Aside from the main actors, facilitating institutions also contribute to the chain. These include microfinance institutions (for credit and finance), and the DA-Municipal Agriculture Office for training, technical, grants and other government support. For financial concerns, most farmers rely on informal ties, and they learn from informal groups. Moreover, facilitating services also helps the chain actors in the performance of their livelihood.

The governance mechanism of sweet potatoes in the district is a market-based relationship. The transactions are negotiated based on the market price, following the supply of and demand for sweet potatoes. There is little information exchange and learning from interaction and little formal cooperation among participants.

3.2. Cost and return of sweet potato production and marketing and the value added in the different stages in the value chain.

Value assessment is one approach to the agribusiness value chain. The goal here is to calculate value: how much value it generates, which actors produce more value within the chain, and how this value is transmitted [10]. Table 1 shows that the farmers have the highest net profit margin in the Partido District’s sweet potato industry. The Net Profit Margin (NPM) is a financial ratio used to analyze profitability using net profit and sales. Farmers earned 81% NPM from sweet potato production, meaning a farmer generates 81 cents for each peso sold. However, among the actors in the chain, farmers devote the most time to production. Farmers spend an average of four (4) months growing sweet potato tubers before they can be harvested and sold. Farmers earned an average of PhP 13,584 in sales and PhP 10,423 in net income per season, for a total of PhP 113 per day of sales and PhP 89 per day of net income. Despite having the highest profit margin, farmers have the lowest daily income. A recent study confirmed that farmers in the study area lag in the agricultural asset dimension of well-being [14]. This finding, however, is lower than the reported return on investment of the Philippine Statistical Authority in 2020, which involves non-small farm holders in the country [15].

Table 1. Profitability of the sweet potato according to actors in the chain.

| Parameters              | Farmers n = 62 | Middlemen n = 2 | Retailers n = 10 | Processors n = 5 |
|-------------------------|----------------|-----------------|------------------|-----------------|
| Average revenue         | 18.00          | 25.00           | 30.00            | 60.00           |
| Average cost            | 3.35           | 19.43           | 20.82            | 45.46           |
| Average income          | 14.65          | 5.75            | 9.18             | 14.54           |
| Net profit margin       | 81%            | 23%             | 31%              | 24%             |
| Rank                    | 1              | 4               | 2                | 3               |

The middlemen have the lowest net profit margin among the actors. An average 23% net profit margin means that each peso sold by the middlemen can generate 23 cents. Although they got the lowest NPM, they spent the shortest period in the chain - a day to a week. The quantity of every transaction is also in bulk. This margin means that for every 10 sacks of transactions, they earned a net profit of more than PhP 4,000. The retailer’s net profit ranked second with a 31% NPM. This margin translates to an average of 31 cents per peso sold of sweet potato tubers. Retailers can sell three to five sacks of sweet potato tubers during the peak season. Their crucial problem is the proper storage of tubers. If not sold, the tubers will deteriorate or spoil.

Processors receive an average of 24 centavos for each peso sold. Sweet potato processing in the study area is lagging. Despite the utilization of sweet potato in the food industry, such as in the form of purees, flour, starches, beverages, and canned products [16], its uses in the district are limited only to household consumption, animal feed and small-scale snack product processing. Aside from the NPM, this study also presents the price distribution of the sweet potato tuber per channel. Except for the primary channel, most farmers' prices are PhP 18. Channel 1 end-consumers are neighbors and are connected by blood, so the price is fairly small. Farmers, on the other hand, raise their prices when they take on the role of

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retailers. Most retailers add PHP 10 – PhP 12 per kilo, while the middlemen add PhP 7 – PhP 12 per kilo. Figure 2 also depicts the advantages of processors trading directly with farmers. Because of the added value of sweet potatoes, processors have created greater added value. However, if processors risk taking low-input but high-value new products, they may bring higher added value.

**Figure 2.** Price distribution for every channel.

### 3.3. Challenges and opportunities in the chain

This section discusses the constraints, challenges, and opportunities in the chain. This is divided into different sub-sections, such as socio-cultural, environmental, political, and economic, to provide an organized approach to understanding the challenges and opportunities.

#### 3.3.1. Socio-cultural challenges and opportunities

The community of farmers, usually kinship related, has their own collection of pagtubod (a belief system) identified with the location, astrological signs and ancestral history passed down from generation to generation [17]. Indigenous knowledge enables practices to be a response to several agricultural problems. Farmers use this indigenous knowledge in a variety of ways, including land planning, planting material collection, soil quality management, insect and weed control, harvesting and post-harvest management.

Despite modernization and innovations in agriculture, sweet potato farmers are still left behind. According to the study's findings, 94% of farmers still use traditional methods. In addition, farmers are practicing staggered harvesting. In this practice, only the marketable-sized roots are collected in the first three harvest stages before the vines are finally removed and ploughed out [1]. Staggered harvesting is common in areas with less harvesting and local market destinations [1]. This affects farmer’s productivity and income. In addition, the harvest of sweet potato is generally too low to supply other markets.

Besides indigenous knowledge and practices, the need to incorporate science-based sweet potato farming can increase farmers' production volumes and maintain land planning, planting resources, soil fertility management, pest and weed control, harvesting and post-harvest management in a productive and successful manner.

The sweet potato's main products, kamote cue and kalingking, remain a cottage industry. Consumers' preference for fried banana items over sweet potatoes often influences the selling of such goods. It is preferable to equate potato items, potatoes, or French fries to sweet potato fries, because pop culture influences them. When market demand shifts, it influences the purchase and selling of locally manufactured goods.

#### 3.3.2. Environmental constraints and opportunities

Almost half of the farmers who plant sweet potatoes do so because they are resistant to climatic changes, require few inputs, and yield a high return. A quarter of the farmers said it was because there was a high demand for the products, both the camote flesh (edible roots) and the camote leaves, which are a good source of extra income. Similarly, one in
every four people believes that growing cassava is a healthy alternative to a staple food. Interestingly, a few of them consider the plant as a medicine to cure some illnesses.

Climate change impacts sweet potato production. The region is geographically located in a high-risk area for typhoons, droughts, and floods. Extreme weather, farmers suffer losses because of changes in the texture, size, and shelf life of sweet potatoes. Similarly, in the worst-case scenario, farmers claim that pests have a 50% effect on their farms. Ulalo (grub), bukbok sa kamote (sweet potato weevil), and mice are the most prevalent pests.

3.3.3. Economic constraints and opportunities. Farm gate prices among farmers are varied and sometimes extreme. The highest price reported for sweet potatoes is PHP 50, while the lowest price is PHP 4 (sold in bulk). The farm gate typically results in lower incomes for the farmer since the rates given to the farmer are lower and flexible. They attribute high costs to the failure to access scales for weighing products and the lack of market awareness. Farmers and traders have also noticed that the price of sweet potatoes is not steady in the market. Some reasons given are the occurrence of typhoons, the use of bananas instead of sweet potatoes, the unstable supply and price variability and the control of buyers. On the other hand, farmers claim that the production of sweet potatoes contributes to 39% of the total sources of income. The revenues from the production of sweet potatoes are used for food (72%), medicine (8%) and emergency funds (4%).

3.3.4. Political constraints and opportunities. The government has provided sturdy support for sweet potato production. The Department of Agriculture (DA) has a program called Food Staples Sufficiency Programs (FSSP) 2011-2016 that aims to increase the incomes of sweet potato farmers throughout the country. This is in line with the country’s goals of having enough food and changing people’s eating habits to include sweet potatoes instead of rice and corn. In the study area, the local government provides training, seeds, tools and financial assistance to some farmers, and provision for a place where they can display their produce. More intervention, however, should be provided to farmers and processors so that they can produce more products and add more value and income to the farmers and processors.

4. Conclusions
Analysis of the value chain of sweet potatoes reveals that the production of sweet potatoes has a tremendous ability to boost the well-being of actors. Sweet potato production gave farmers an 81% net profit margin and contributed to 39% of their livelihood. However, widespread growth and consumption problems, such as lower returns, use of native cultivars, use of conventional or indigenous methods, and field diseases and pests, and issues of post-harvest storage, survival, usage, and distribution remain.

The sweet potato supply chain in the Partido District reveals that farmers only deal with individuals they meet or have prior dealings with. As a result, developing personal relationships with other farmers is a requirement for trading. This type of networking, however, limits the opportunity for farmers to offer their harvests at a higher price to other agents. Hence, it is essential to widen the social circle of sweet potato farmers by forming associations and cooperative enterprises dedicated to the development of the sweet potato value chain.

There is also a need to maximize the role of social institutions to stabilize and improve the chain. Parson [17] called it ‘dynamic equilibrium’ where all parts work together properly. Specifically, the government has a major role to play. Interventions are necessary, especially in sweet potato processing and mechanization (with respect to indigenous knowledge and practices). Educational and research institutions may be tapped to facilitate agricultural extension and education as well as the conduct of studies on product development and the integration of indigenous practices and science-based approaches in sweet potato production.

Moreover, with the growing competition because of the penetration of the global economy into the local market, there is a need to intensify the promotion of sweet potato indigenous products and integrate them into the tourism industry. More varieties may be introduced to farmers to accommodate the cultivar's higher commercial potential.
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