
# Value chain analysis of vegetables in the humid tropics of Cameroon

Bidogeza, JC; Afari-Sefa, V. ; Endamana, D, Tenkouano, A, Kane, GQ

***Invited paper presented at the 5th International Conference of the African Association of Agricultural Economists, September 23-26, 2016, Addis Ababa, Ethiopia***

# Value chain analysis of vegetables in the humid tropics of Cameroon

Bidogeza, JC[1]; Afari-Sefa, V[2]. ; Endamana, D[3], Tenkouano, A[4], Kane, GQ[5]

[1]AVRDC – The World Vegetable Center West and Central Africa, Liaison Office, Cameroon
[2]AVRDC – The World Vegetable Center Eastern and Southern Africa, Tanzania

[3] International Union for Conservation of Nature (IUCN), B.P. 5506 Bastos, Yaoundé, Cameroon
[4]AVRDC – The World Vegetable Center West and Central Africa, Samanko Research Station, BP 320, Bamako, Mali
[5] University of Yaoundé II, Faculty of Economics and Management, P.O. Box 18 Soa, Cameroon.

Abstract to be submitted to the 5th African Association of Agricultural Economists Conference, Addis Ababa, Ethiopia, September 23-26, 2016 (http://www.aaae2016.org/)

Corresponding author's E-mail: victor.afari-sefa@worldveg.org

# Value chain analysis of vegetables in the humid tropics of Cameroon


## Abstract

Vegetables have high farm gate values and their consumption can alleviate malnutrition. A study was conducted to analyze vegetable value chains in selected locations of Cameroon. Data were collected from key vegetable value chain actors and stakeholders using structured questionnaires customized for 162 producers, 65 traders, 12 exporters, 30 processors and 29 transporters in the humid tropics of Cameroon. The analysis included value chain mapping, detailed description and quantification of value chains, and economic evaluation of value chains. Most vegetable crop value chains are relatively simple, and involve only five main groups: producers, transporters, traders, processors and exporters (for traditional leafy vegetable value chains); input suppliers are a sixth category for standard vegetable chains. Vegetables are produced under different production systems adapted to the agroecological and climatic conditions of various regions. Most vegetable farmers generally have poor access to input and output market support services, including agricultural credit; this lowers their capacity to invest in their farms. What limited credit is available is typically obtained through the informal credit system, which tends to be more easily accessible by men than women. This may explain the fact that men who are engaged in vegetable farming earn much higher incomes than women. Our economic analysis of the value chain shows a benefit-cost ratio > 1 for vegetable production, processing and marketing. This indicates the vegetable sector is generally profitable for all actors along the chain, although there are wide disparities in earnings as different actors are subject to site-specific market conditions, constraints, and circumstances.



**Keys words:** Value chain mapping, Marketing efficiency, Horticultural value chains, African traditional vegetables, commodity value chains, human nutrition

## 1. Introduction

The agricultural sub-sector represents 75 % of the primary sector and employs about 60% of the labor force in Cameroon (INS, 2010). Despite the contribution of agriculture in enhancing food security, alleviating malnutrition, and providing rural employment in Cameroon, the contribution of agriculture to GDP declined from 45.4 % in 2004 to 19.9 % in 2011 (Fongang, 2012). The government has initiated Cameroon Vision 2035, a national program with the objective of attaining emerging economy status by 2035. The program's new rural sector development strategy aims to ensure food and nutrition security and self-sufficiency at both the household and national levels; increase incomes of rural producers; improve the living conditions of the rural population; and ensure better use and sustainable management of natural resources as a production base (IMF, 2010). However, the strategy gives much attention to traditional export crops and carbohydrate-rich staples despite the growing recognition of the economic and nutritional importance of vegetables.

In Cameroon, trade in vegetables is increasing due to rising urban demand and the growing importance of intra-regional markets with neighboring countries Gabon, Equatorial Guinea, Republic of Congo, Chad, Central African Republic, and Nigeria. Achancho (2013), for example, estimated an annual growth rate of 5.5 % for vegetables. Bokagne and Bouba (undated) showed that vegetables represent approximately 22.9 % of the total agricultural production in Cameroon, with an annual growth rate of 2.7 % per year. Since 2004, okra (*Abelmoschus esculentus*) production has increased by an annual rate of 2.4 % (AGRI STAT, 2010). Vegetables provide 64 % of the final production value of fruits and vegetables with a financial value of 98.5 billion CFA (IRAD, 2010). The same source indicates that the dominant vegetables are onions (*Allium cepa)* (30 % of annual production) and tomato (*Solanum lycopersicum)* (27 %), followed by traditional leafy vegetables (11%)

More than one million people have been directly or indirectly involved in vegetable production, processing and marketing activities (Okolle, 2014). Yet key stakeholders in the vegetable value chains in Cameroon have not been clearly identified and characterized. No study has been conducted in Cameroon to analyze vegetable crop value chains that include all chain actors. The vegetable value chain is under-researched and needs to be well understood.

Analysis of the value chain is needed to obtain knowledge that can be applied to upgrade value chain activities. Several scholars have recognized that more attention is required to upgrade agricultural value chains to increase quality-based competitiveness of domestic agricultural produce, thereby improving food security and contributing to poverty alleviation (Demont and Maimouna, 2015; FAO, 2014). FAO (2014) defined a food value chain as "the full range of farms and firms and their successive coordinated value-adding activities that produce particular raw agricultural materials and transform them into a particular food product that are sold to final consumers and disposed of after use." The actors typically found in a value chain include input suppliers, farmers, processors, transporters, collectors, wholesalers, retailers and the final consumers. These operators in the chain are linked by a series of trade relationships that take the product from producers to final consumers. A well-functioning value chain where actors mutually support themselves is capable of improving competitiveness of the entire value chain, from the time the produce leaves farm gate until it arrives to the hands of a satisfied consumer (BIT, 2011). Given the important role vegetable value chains play in alleviating poverty and improving nutritional status, there is a need to objectively assess the potential and critical bottlenecks of specific nodes in the chains to identify upgrading strategies that will maximize the net benefits of all actors. The objectives of the study are to (i) map and describe the vegetable value chain; (ii) identify opportunities and constraints of vegetable value chains; and (iii) identify appropriate policy interventions. The paper is structured as follows: in the next section, the methodology used to analyze the horticultural crop value chain is described. The following section presents the results and discussion. The paper concludes with suggestions for policies to overcome the identified constraints, with the aim of improving and developing Cameroon's vegetable sector.

## 2. Materials and methods

### 2.1 Description of the study area

The study was conducted in the humid tropic zones of Cameroon. The study sites were grouped into three regions according to their similarities in agroecological characteristics. The designation

'Region' throughout the text should not be confused with the designation 'Region', the highest level of administrative subdivision in Cameroon. 'Region' that is implicit with the study site is numbered throughout the text. The study sites were: Region I includes parts of the South and East Regions, which is an area of humid forest with bimodal rainfall; Region II includes the Southwest Littoral Regions and small parts of the South Region, which is an area of humid forest with monomodal rainfall; and Region III includes the Northwest and West Regions, the highland areas in Cameroon. Agricultural produce from Region I, Region II and Region III goes to the urban markets of Yaoundé, Douala, and Yaoundé and Douala cities, respectively. The specified study sites correspond to three out of the five agroecological zones in Cameroon. The characteristics of the study sites are summarized in Table 1.

**Table 1: Characteristics of the study areas**

| Region I | Region II | Region III |
|---|---|---|
| • Forest zone bimodal<br>• Area: 165,770 square km<br>• Population density: 24 inhabitant per square km<br>• Rainfall: 1500 – 2000 mm/year with two different seasons<br>• Climate: The average annual temperature is 25 °C with an amplitude of 2.5 °C<br>• The soils are mostly red or yellow lateritic, acid clays depending on the length of the rainy season with low nutrient retention ability and high susceptibility to leaching losses<br>• Main crop: cassava, traditional and exotic vegetables, cacao, palm oil, banana, pepper<br>• Main market: Yaoundé | • Coastal and forest monomodal zone<br>• Area: 45,658 square km<br>• Population density: 51 inhabitants per square km<br>• Rainfall: 2500 – 4000 mm/year<br>• Climate: equatorial with abundant and regular rains as well as constant high temperature (26 $^{o}$C on average)<br>• Volcanic slopes of Mount Cameroon<br>• Rocky soils and soils with sediment origin along the coast<br>• Soils are mostly very fertile nitosols<br>• Main crop: cacao, palm oil, banana, traditional and exotic vegetables, cassava<br>• Main market: Douala | • High land zone (Savannah)<br>• Area: 31,192 square km<br>• Population density: 83 inhabitant per square km<br>• Rainfall: 1500 – 2000 mm/year 180 days of rain<br>• Climate: High elevations, moderate to high relative humidity<br>• The soil is very fertile and suitable for agricultural activities<br>• Soils have traces of enriched volcanic materials<br>• Main crops: Traditional and exotic vegetables, common beans, potatoes, banana<br>• Main market: Yaoundé and Douala |

*Data collection*

Data sampling was designed to analyze each actor along the vegetable value chain and their interactions, and identify factors that are likely to affect vegetable value chains. Participatory and iterative methods were used in data collection. Preliminary observations and unstructured interviews with selected traders in purposively targeted vegetables markets were conducted in Yaoundé city (Region I) and Buea town (Region II). Thereafter, data collection was conducted in three selected administrative divisions in each of the study sites based on their accessibility and the commercial importance of vegetables. The selected administrative divisions are listed in the Table 2.

**Table 2: Administrative divisions involved in the study**

| | **Region I** | **Region II** | **Region III** |
|---|---|---|---|
| **Divisions** | Lekie<br>Mefou et Akono<br>Mefou et Afamba | Fako<br>Meme<br>Moungo | Bamboutos<br>Menoua<br>Ngoketunjia<br>Mezam<br>Momo |

A structured questionnaire was designed for each of the key vegetable value chain actors. Different questionnaires were prepared for quantitative one-on-one interviews and qualitative group discussions. Individual questionnaires were administered to vegetable producers, exporters, processors, and transporters, while focus group discussions were administrated to market retailers and primary producers in the villages.

The questionnaire for traders elicited information mainly on the type of vegetables marketed, seasonal availability of short and long cycle of produced vegetables on the market, financial profitability, the volume of vegetables traded, the origin of vegetables, vegetable prices, taxes and other charges by merchants, organizational structure of merchants, customers, support for traders' organizations, and the constraints and opportunities of vegetable marketing. The producers'

questionnaire mainly focused on collecting data on characteristics of farming systems, agricultural services provision, vegetable prices, access to rural financial services, producer group organization structure, access to market support and information systems, agronomic practices and vegetable productivity, labor type and usage, household socioeconomic characteristics, vegetable marketing channels and sales procedures, and vegetable production constraints and opportunities.

Questionnaires for exporters elicited information on the types and quantities of vegetables exported, recipient countries, the export process, and constraints and opportunities for the export of vegetables, while the questionnaire for processors emphasized the types of processed vegetables, the source of raw materials, marketing outlets for processed produce, processing capacities, constraints and opportunities for processing vegetables, and related benefits and costs. The transporters' questionnaire collected data on main collection points and packing vegetables for market, estimated volumes of transported vegetables, related transaction costs, and constraints encountered in transporting vegetables. A village questionnaire served as a complementary survey instrument to collect aggregate data on characteristics of the village, vegetable farmers, types of vegetables grown, the production system used for vegetables, use of inputs, vegetable buyers, producers' organizations, income generated from vegetable production, constraints and opportunities in vegetable marketing, marketing flow, proximity of support institutions, services provided from institutions, the qualities and quantities of inputs used by producers, and access to financial services.

*Data entry and value chain analysis approach*

Table 3 summarizes the number of vegetable value chain actor per study site. Data were entered in an MS Excel spreadsheet and a codebook was developed. Computation of averages and frequencies of selected variables to be used in the economic analysis of the value chain was done using IBM SPSS Version 18.

**Table 3: Number of vegetable value chain actors interviewed per region**

| Actors | Region I | Region II | Region III | Total |
|---|---|---|---|---|
| Producers | 41 | 44 | 77 | 162 |
| Traders | 22 | 34 | 9 | 65 |
| Exporters | 6 | 3 | 3 | 12 |
| Processors | 8 | 12 | 10 | 30 |
| Carriers | 6 | 9 | 14 | 29 |
| **Total** | **83** | **102** | **113** | **298** |

The value chain analysis approach was done in sequence following three stages: value chain mapping, describing the value chain in detail, and the economic performance at each stage of the value chain. *Value chain mapping* means drawing a visual representation of the value chain system. Maps identify business operations (functions), chain operators and their linkages, as well as the chain supporters within the value chain. *Quantifying and describing value chains in detail* includes attaching numbers to the basic chain generated by the value chain mapping exercise, such as the number of actors, the volume of produce, the market share, interactions between value chains actors, and flow of produce and revenues. *Economic analysis of the value chain* focuses on the assessment of the value added along each stage of the chain. Value added is the total value of sales from which the transactions and intermediate costs are deducted (BIT, 2011).

## 3. Results and Discussion

### 3.1 Vegetables in the livelihoods of smallholder producers in the humid tropics zone of Cameroon.

*Commonly grown vegetables*

Table 4 provides a list of vegetables that are mainly cultivated in the humid tropics zone of Cameroon. There is wide diversity in terms of the species of vegetables cultivated in the study regions. Region III has the highest number of different vegetable crops (30 species in all), followed by Region II (24), and Region I (14).

**Table 4: An inventory of commonly grown vegetables in the study sites**

| | Traditional vegetables | Exotic vegetables |
|---|---|---|
| Region I | Eggplant (*Solanum macrocarpon)*<br>Okra (*Abelmoschus esculentus)*<br>Okra leaf (*Abelmoschus esculentus)*<br>Cocoyam leaf (*Colocasia esculenta)*<br>Cassava leaf (*Manihot esculenta)*<br>Melon leaf (*Citrullus lanatus)*<br>Folong (*Amaranthus* ssp.)<br>Bitter leaf (*Vernonia amygdalina)*<br>Nkea (*Solanum macrocarpon* L.)<br>Hot pepper (*Capsicum* L.)<br>Water leaf (*Talinum fruticosum)*<br>Zom (*Solanum scabrum; S. villosum)* | Sweet pepper (*Capsicum annuum)*<br>Tomatoes (*Solanum lycopersicum)*<br>Jute mallow (*Corchorus olitorius* L.) |

| | | |
|---|---|---|
| Region II | Anchia (*Solanum macrocarpon*)<br>Bitter leaf<br>Cabbage (*Brassica oleracea* var. *capitata*)<br>Cassava leaf<br>Eru (*Gnetum africanum)*<br>Melonleaf, Folery, Huckleberry (*Solanum scabrum; S. villosum)*<br>Sweet bitterleaf *(Vernonia hymenolepis)*<br>Okra<br>Nkea (*Solanum macrocarpon* L.)<br>Jute mallow (*Corchorus olitorius* L.)<br>Water leaf, Water melon (*Citrullus lanatus)*<br>Zom | Carrot (*Daucus carota* subsp. *Sativus*)<br>Green cabbage (*Brassica oleracea*)<br>Fluted pumpkin (*Telfairia occidentalis*)<br>Pumpkin leaf (*Telfairia occidentalis*)<br>Ginger (*Zingiber officinale*)<br>Pepper (*Capsicum annum*)<br>Tomatoes<br>Garden egg (*Solanum melongena*) |
| Region III | Anchia<br>Beetroot (*B. vulgaris* subsp. *vulgaris*)<br>Bitter leaf<br>Cabbage<br>Green beans<br>Huckleberry (*Solanum scabrum; S. villosum)*<br>Okongobong (*Cucurbita moschata)*<br>Okra<br>Water leaf | Basil (*Ocimum basilicum)*<br>Beet<br>Carrot<br>Celery (*Apium graveolens)*<br>Cabbage (*Brassica oleracea* var. *capitata)*<br>Cucumber (*Cucumis sativus)*<br>Squash (*Cucurbita pepo*)<br>Cowpea (*Vigna unguiculata*)<br>Fraise<br>Garden egg<br>Garlic (*Allium sativum*)<br>Lettuce (*Lactuca sativa)*<br>Onion leaf (*Allium cepa)*<br>Pepper<br>Persil (*Petroselinum crispum)*<br>Leeks (*Allium porrum)*<br>Sweet pepper<br>Radice<br>Finouille |

Smallholder producers typically prioritize the importance of the vegetables grown based on their perceptions. Producers classify vegetables into four categories based on four criteria. These are ‘market demand’, ‘own-consumption’, ‘ease of cultivation’, and ‘yields higher returns’ (Table 5).

**Table 5: Four categories of the importance of vegetables as perceived by producers**

| | Market demand | Own-consumption | Ease of cultivation (short –cycle) | Yields higher returns |
|---|---|---|---|---|
| Region I | Nightshade, Cassava leaves, Tomatoes | Folong, Okra, Bitter leaf, Hot pepper, Jute mallow, African nightshade | Folong, Okra, Bitter leaf, Hot pepper, Jute mallow, African nightshade | African eggplant, Okra, *Nkea*, Jute mallow, African nightshade |
| Region II | Carrot, Fluted pumpkin, Okra, Huckleberry, Pepper, Tomatoes, Nightshade | Bitter leaf, Carrot, Cabbage, Fluted pumpkin, Okra, Huckleberry, Pepper, Water leaf, Water melon | Bitter leaf, Cabbage, Fluted pumpkin, Huckleberry, Water leaf, Nightshade | Bitter leaf, Carrot, Cassava leaf, Fluted pumpkin, Okra, Pepper, Tomatoes, Water leaf |
| Region III | Carrot, Celery, Cabbage, Huckleberry, Leeks, Nightshade, Okongobong, Tomatoes | Bitter leaf, Carrot, Celery, Cabbage, Cucumber, Green Bean, Leeks, Huckleberry, Lettuce, Nightshade, Okra, Onion, Parsley, Hot pepper, Pepper, Tomatoes, Water leaf | Anchia, Bitter leaf, Cabbage, Carrot, Celery, Nightshade, Okongobong, Onion, Parsley, Hot pepper, Leeks, Pepper, Tomatoes | Bitter leaf, Carrot, Celery, Cabbage, Green bean, Huckleberry, Lettuce, Leeks, Okongobong, Okra, Hot pepper, Pepper, Tomatoes |

Tomato is the vegetable in highest demand in all three regions, closely followed by African nightshade (Table 5). Traditional vegetables such as bitter leaf and African nightshade are categorized as vegetables that are 'easy to cultivate' in the three regions. Region III has largest concentration and diversity of vegetables in the four classes of importance for growing vegetables in the study area.

*Contribution of vegetables to producers' income*

The contribution of vegetable production irrespective of region varies between 49 % and 52 %. Other food crops contribute between 20 and 23 %. Vegetables as a source of household income have taken over the position traditionally held by export tree crops such as cocoa and coffee (Fig. 1).

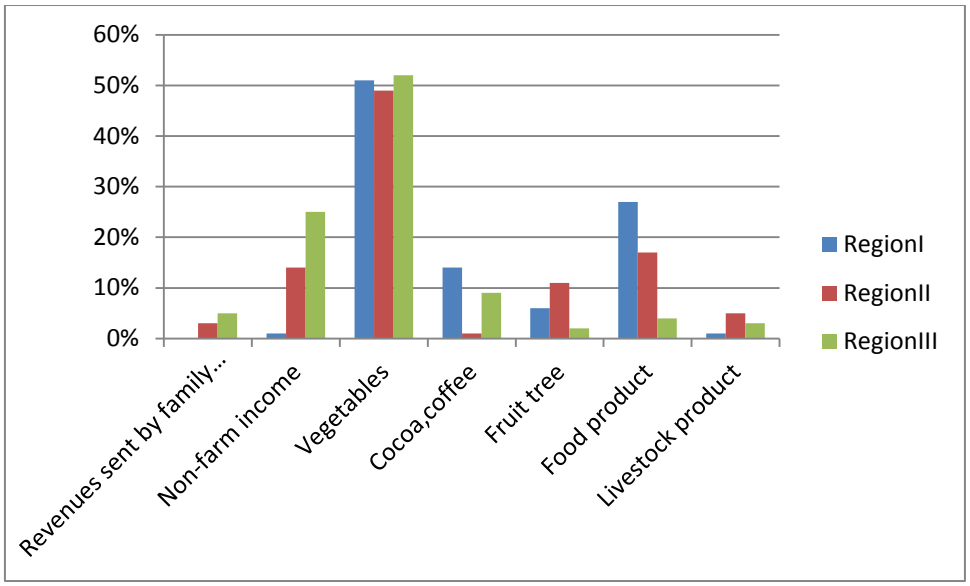


**Figure 1. Main sources of income to vegetable producers in the three study sites**

*Contribution of vegetable income to the livelihoods of producers*

Income from vegetable sales contributes directly toward improvement of livelihoods. Figure 2 ranks the uses that absorb income from vegetables in humid tropics zone of Cameroon. Percentages are based on the average from the three regions.

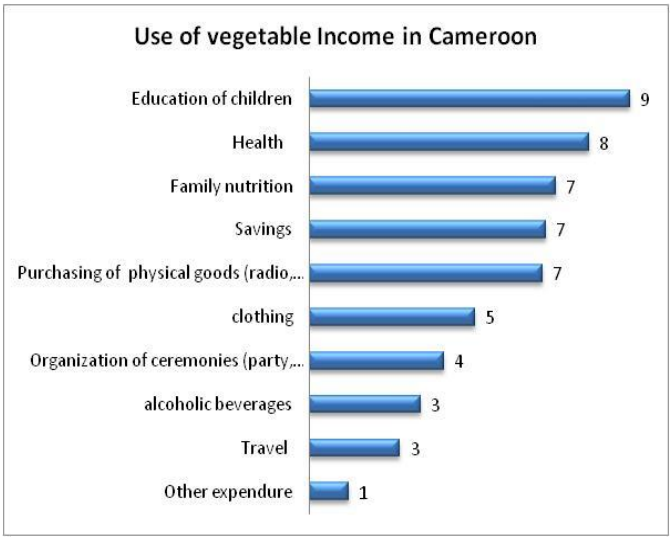


**Figure 2 Usage of income obtained from the sale of vegetables**

With income from obtained from selling vegetables, producers give priority to covering education and health expenses for their children. Food for family, savings and physical goods (i.e., radio, bicycle) are other categories of expenditures for which income from vegetable sales is spent.

## 3.2 Value chain mapping

The five main stakeholder groups who are engaged mainly in vegetable production, transportation, trading, processing and export in the study area and their respective roles are presented in Figure 3. A sixth stakeholder group—input suppliers for standard vegetables—is conspicuous at the upstream end of the value chain. Figure 3 shows the close relationships between the different actors. Producers are at the center of the distribution chain. Transporters facilitate the flow of vegetables in local markets and major urban centers.

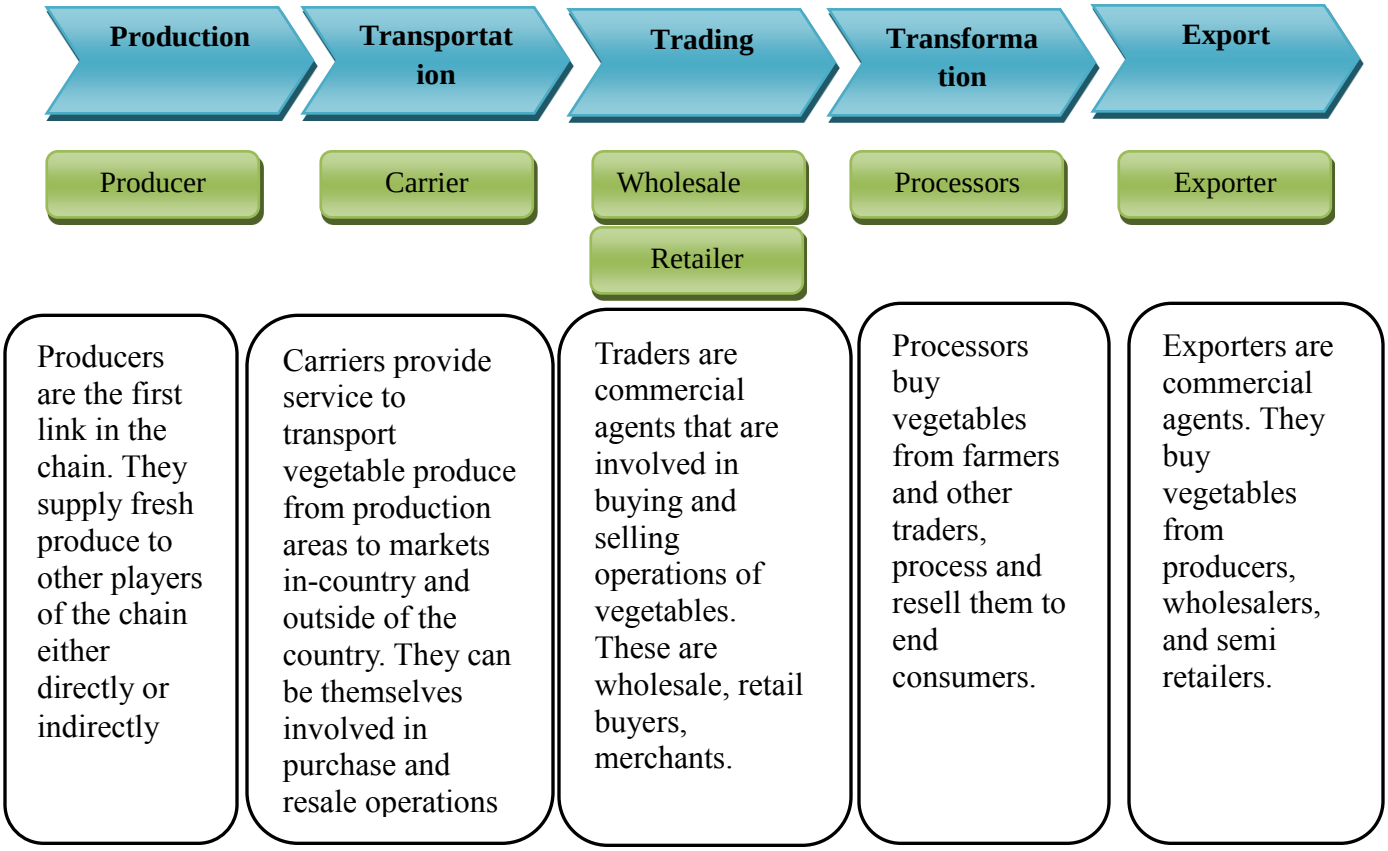


**Figure 3: Mapping of key actors and chain links of traditional vegetable in Cameroon**

## 3.3 Detailed description of horticultural crop value chains

*Socioeconomic characteristics of the vegetable producers*

Vegetable farming and cropping systems are highly diversified in the study regions. Vegetables are cultivated in combination with other food and cash crops, including cassava, peanuts, plantain, cocoyam, sweet potato, yam, maize, avocado, coffee, and oil palm.

Table 6 provides data that shows rural cooperatives are well established in Region III, where vegetable producers have more members than similar groups in Regions I and II. Vegetable producers in Region III have more access to rural credit from either formal or informal sources,

use more inputs on a regular basis, and have closer proximity to inputs sale outlets than those in Regions I & II. Generally, vegetable farmers have poor access to rural financial services such as credit as reported by some authors (e.g., El-Sayed *et al.*, 2015). More than two-thirds of farmers have no access to agricultural credit in Region I; half lack access in Region II; and a third in Region III. Those who have access to formal and non-formal credit are mostly in Region III, followed by Region II. In Region I, only 5 % of men were able to access loans, and no women had access (0 %). In Region II, 7 % of women have access to formal and non-formal credit while in Region III, this increases to 15% for women, compared to 19% for men.

**Table 6: Characteristics of vegetable production systems in the study regions**

| Parameters | Region I | Region II | Region III |
|---|---|---|---|
| **Source of livelihoods to your household in past 12 months (in % of HH)** | | | |
| Vegetables | 100% | 100% | 96% |
| Cocoa/coffee | 44% | 14% | 4% |
| Other cash crops (*e.g. oil palm*, *fruit*) | 49% | 14% | 12% |
| Other food crops (*e.g. plantain*, *cassava*) | 100% | 84% | 70% |
| Livestock products | 10% | 30% | 39% |
| Income received from family members | 5% | 11% | 4% |
| Other sources of income | 0% | 11% | 16% |
| **Use of fertilizer and pesticides** | | | |
| Regularly use a fertilizer (chemical and/or organic) in one of your vegetable fields | 90% | 70% | 92% |
| Regularly use pesticides in one of your vegetable fields | 93% | 59% | 86% |
| **Socio-demographic** | | | |
| Total # of persons in the household | 7 | 7 | 6 |
| Years in education, household head | 7 | 8 | 8 |
| Average age, household head | 43 | 44 | 44 |
| **Proximity to inputs retail outlets** | | | |
| Distance to purchase inputs (km) | 25.6 | 9.5 | 3.9 |
| Transportation cost of the fertilizer (CFA) | 8202.6 | 2846.7 | 3524.2 |
| **Rural Credit** | | | |
| Formal credit/loan (bank, cooperative, etc.) | 0% | 2% | 16% |
| Tontine, Ndjangi | 7% | 30% | 45% |
| Usurers of the village | 2% | 2% | 3% |
| Vegetable buyers | 5% | 5% | 1% |
| Loan from friends or family members | 12% | 16% | 25% |
| Nothing | 83% | 51% | 32% |

| | | | |
|---|---|---|---|
| **Rural Organization** | | | |
| Member of rural organization | 8% | 30% | 58% |
| Common Initiative Group (CIG) | 33% | 15% | 45% |
| Informal group | 33% | 33% | 52% |
| Nageria union | 0% | 4% | 4% |
| Member of a vegetable GIC | 0% | 14% | 12% |
| Member of a cooperative receiving input subsidies for the production of cocoa | 10% | 2% | 0% |

*Market costs*

Every stage of the value chain involves costs that may correspond to the value added. Figure 4 gives the details of the descriptions of these costs at each stage of the value chain. Costs are lower for transportation and export compared to other stages, such as production, trading and transformation. The latter seems to have a much higher cost expenditure. Costs include transportation; cleaning, grading, sorting, and packing; loading; storage; marketplace maintenance; payment of guards; withholding tax; counter rental; mooring; and other market taxes. The various costs supported by vegetable value chain actors are summarized in Figure 4.

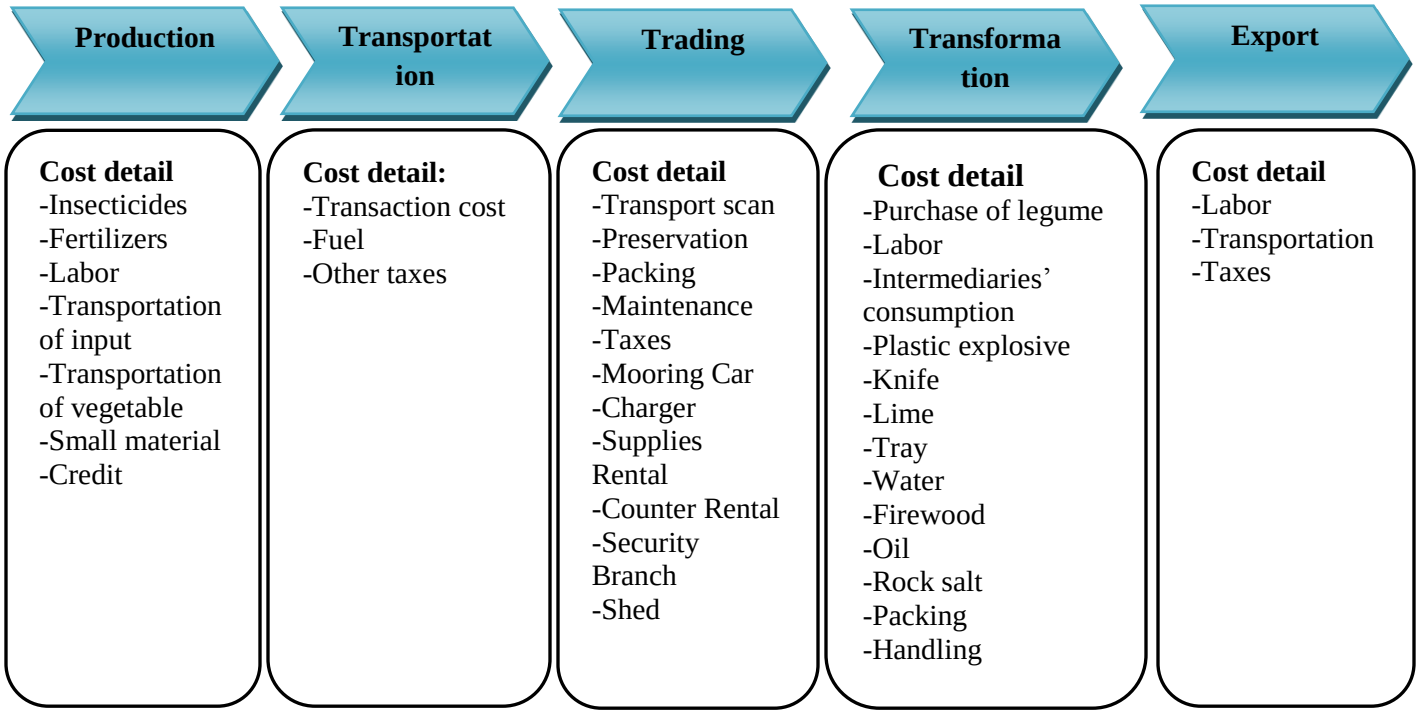


**Figure 4. Costs supported by actors in the vegetable value chain in Cameroon**

*Support services received*

The services provided to local organizations are many, from facilitating access to credit and bringing on board new knowledge through training, to having access to good quality seeds, chemical inputs (fertilizers and pesticides), and vegetable market information. It is important to note that producers of the Region I receive few services compared to producers in Region II and III. This may due to the limited number of farmer associations/cooperatives working in the vegetable sector in Region I.

*Information flow*

The information flow between the different actors in the vegetable value chain is presented in Figure 5. Information flow occurs between vegetable producers, traders, and transporters, especially on types and quantities of vegetables available in the villages. Also, information flows from traders, who relay prices of vegetables in the markets, to transporters and producers. Market relationships exist between actors who pay cash to acquire produce between producers - traders, producers - exporters, traders and carriers; carriers - exporters and transporters - transformers.

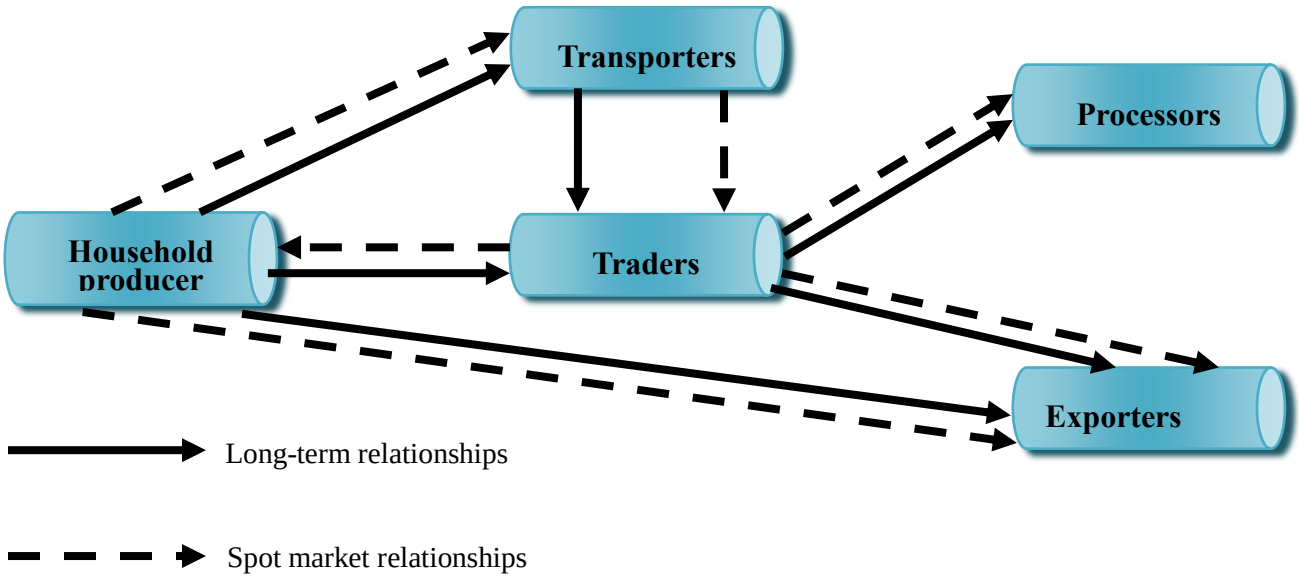


**Figure 5. Knowledge and flows of information between actors in horticultural crop value chains**

*Economic analysis of value chains*

*i. Value addition along the stages of horticultural crop value chains*

The economic analysis of the value chain is the assessment of the chain's economic efficiency. This includes determining what value is added along the stages of the value chain, the cost of production, and the income of operators. Transaction costs, which are the costs of doing business such as collecting information and enforcing contracts, are also considered in the analysis. The costs, gross income, net income and cost/benefit ratio of different stakeholders in the value chain are summarized in Figure 6. In Region I, the benefit/cost (B/C) ratio is greater than 1 for all stakeholders with the exception of traders (0.6). Generally, for B/C greater than 1, the business is profitable (Kahraman et al., 2000). A B/C for traders less than 1 does not necessarily mean the activity is not profitable, but is due to fiscal constraints (taxes of about CFA 51,938 on average). In addition, traders' income is less (CFA 70,818) compared to income of other actors in the value chain.

In Region II, the B/C ratio is greater than 1 for all actors. The activity is more profitable for exporters than for producers. Moreover, transformers earn half as much as producers, and carriers and retailers earn less than transformers. The analysis of value addition shows that all actors have a significant added value. The difference in standard value addition is fairly very large between traders and other stakeholders in the value chain. Therefore, traders create less wealth in the chain than other actors. In Region III, the B/C ratio exceeds 1 for almost all the actors except for carriers (0.4). Value addition is larger among exporters in the region. The relative difference between exporters and other transporters and processors actors is 61 % and 64 %, respectively. In all three study sites, the B/C ratio is greater than 1 for all actors in the chain, which implies that the activity is profitable for all stakeholders. However, throughout the value chain, the analysis shows that the producers are the most numerous, and most vulnerable, beneficiaries. These differences (based on the current ratio) among actors in the chain can be explained by the opportunities and constraints that arise at each level of the chain. The overall analysis of the value addition shows that all actors have a significant added value. However, we cannot make conclusions by proclaiming similarities between the actors on the basis of value added for the

simple reason that actors are not subject to the same market situations and conditions across the three study regions.

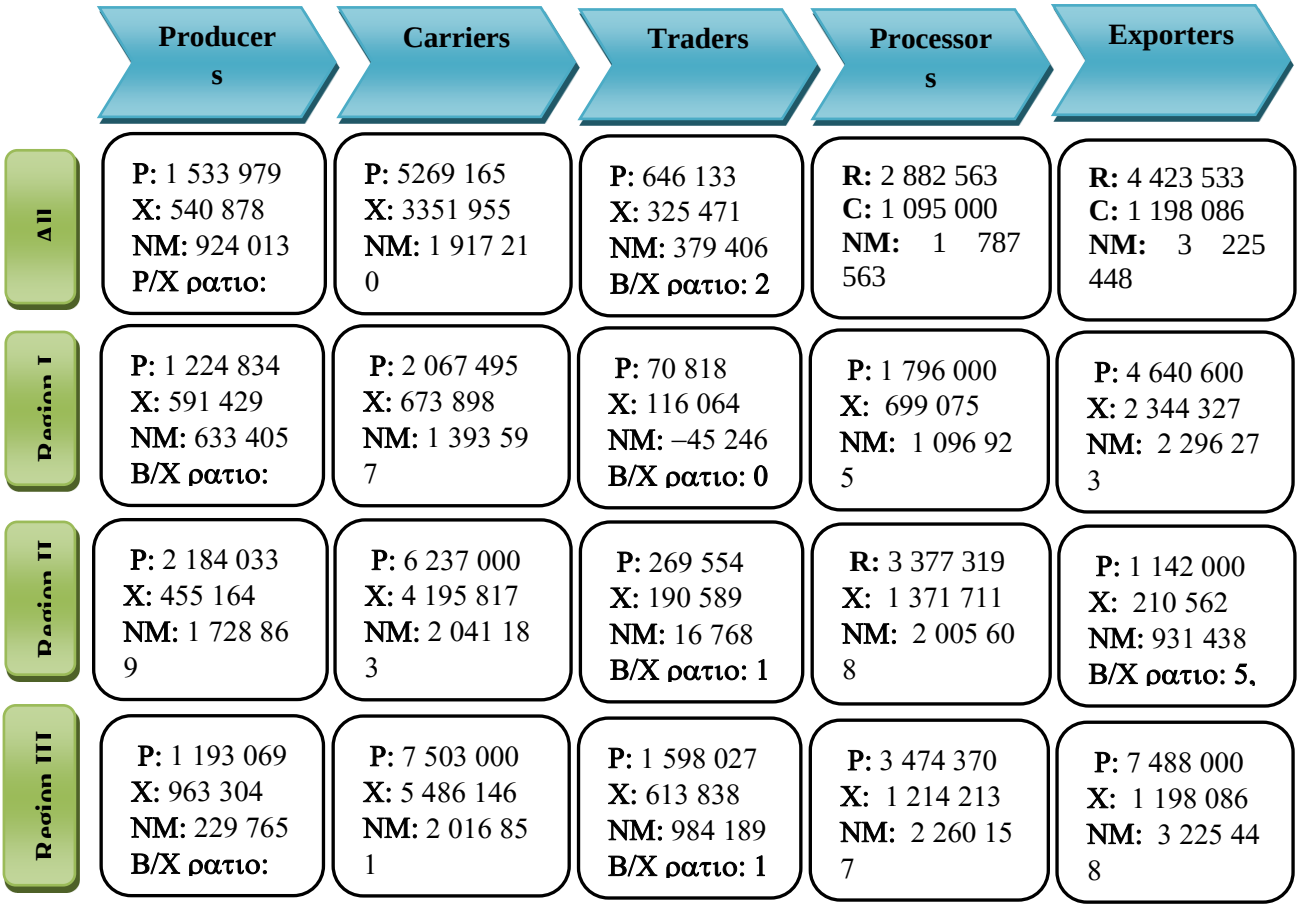


**Figure 6. Distribution of revenue (R), cost (C), net margin (NM), and benefit/Cost (B/C) ratio in the vegetable value chain in Cameroon.**

## 4. Conclusion

This study analyzed horticultural crop value chains in three regions of Cameroon representing parts of the country's humid tropics. Overall, vegetable value chains in these regions are relatively simple, including only five main stakeholder groups: producers, transporters, traders, processors and exporters. Vegetables are produced under different production systems, as

agroecological and climatic conditions vary from one region to another. The analysis of value addition in vegetable production systems indicates that value-added activities are profitable for all actors in the value chain. However, many existing technical and socioeconomic constraints hinder the production, marketing and promotion of vegetables to optimize net benefits for all actors. The vegetable sector is generally profitable for all actors along the chain, although there are wide disparities in earnings as different actors are subject to site-specific market conditions, constraints, and circumstances.

**Acknowledgements**

Financial support of the Integrated Agricultural Systems of the Humid tropics (Humidtropics), a CGIAR Research Program, is gratefully acknowledged.

**References**

Achancho, V. (2013). Revue et analyse des stratégies nationales d'investissements et des politiques agricoles en Afrique du Centre: Cas du Cameroun. In A. Elbehri (Ed.), *Reconstruire le potentiel alimentaire de l'Afrique de l'Ouest*: FAO/FIDA.

BIT. (2011). Les chaînes de valeur pour le développement rural. *http://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/---ifp_seed/documents/publication/wcms_166017.pdf (accessed on 28-10-2014).*

El-Sayed, A. F. M., Dickson, M. W., & El-Naggar, G. O. (2015). "Value chain analysis of the aquaculture feed sector in Egypt". *Aquaculture, 437*, 92–101.

Fongang, G. (2012). Les organisations de producteurs en Afrique de l'Ouest et du Centre : attentes fortes, dures réalités. Le cas du Cameroun. *Country Report*. FARM.

Gómez, M. I., & Ricketts, K. D. (2013). "Food value chain transformations in developing countries: selected hypotheses on nutritional implications". *Food Policy, 42*, 139–150.

GTZ. (2007). ValueLinks Manual – The methodology of value chain promotion.

IMF. (2010). Cameroon: Poverty Reduction Strategy Paper. *Country Report No. 10/257*. IMF.

INS. (2010). Annuaire statistique du Cameroun. Republic of Cameroon.

Kaplinsky, R., & Morris, M. (2001). A handbook for value chain research. Canada: IDRC.

Lundy, M., Verónica Gottret, M., Ostertag, C., Best, R., & Ferris, S. (2007). Participatory market chain analysis for smallholder producers. Centro Internacional de Agricultura Tropical.

M4P. (2008). Making value chain for the poor: a toolbook for practitioner of value chain analysis. *Version 3. Making Market Work Better for the Poor (M4P) project*. Phnom Pend, Cambodia: UK Department for International Development (DFID). Agricultural Development International.

MINEPAT. (2008). Autosuffisance et sécurité alimentaire au Cameroun : une analyse basée sur la flambée des prix des Produits alimentaires de première nécessité. Republic of Cameroon.

Nambangia, O. J., Tata Ijiang, P., & Ngome, F. A. (2014). Evaluation of farmer's knowledge on pests and diseases of vegetables and their management practices in three different Agroecological zones in Cameroon. AVRDC.

Taylor, D. H. (2005). "Supply chain analysis: an approach to value chain improvement in agri-food chains". *International Journal of Physical Distribution & Logistics, 35*, 744–761.