VCA4D
VALUE CHAIN ANALYSIS FOR DEVELOPMENT

agrinatura for European Commission

Cashew value chain analysis in Sierra Leone

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LA RECHERCHE AGRONOMIQUE POUR LE DÉVELOPPEMENT

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The information and knowledge produced through the value chain studies are intended to support the Delegations of the European Union and their partners in improving policy dialogue, investing in value chains and better understanding the changes linked to their actions

VCA4D uses a systematic methodological framework for analysing value chains in agriculture, livestock, fishery, aquaculture and agroforestry. More information including reports and communication material can be found at: https://europa.eu/capacity4dev/value-chain-analysis-for-development-vca4d-

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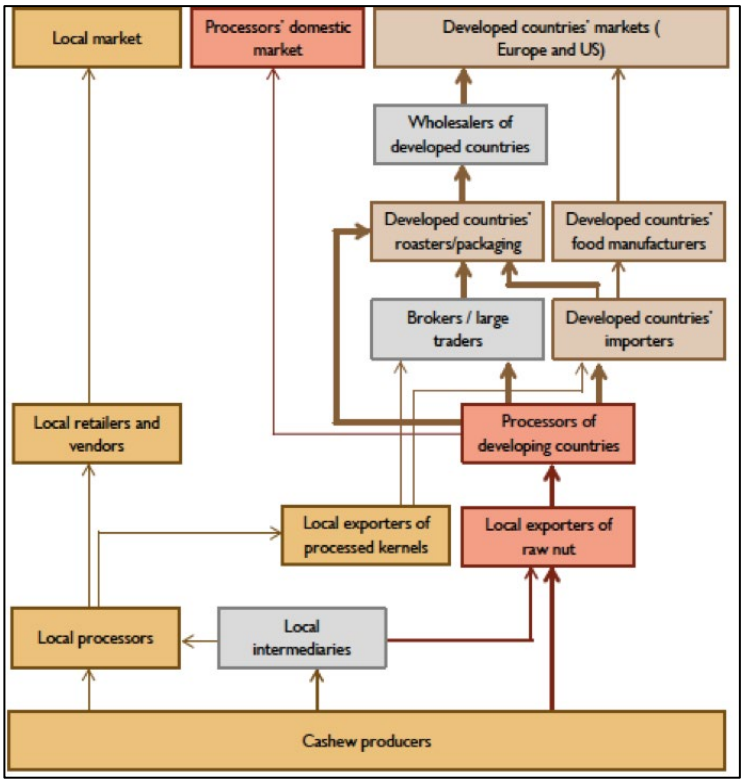
Executive summary

The benefit of focusing on value chain analysis is that it can make information and knowledge available to support policy dialogue, decision-making, the role of the private sector, interventions' scale up and accountability, etc. Value Chains Analysis for Development (VCA4D) is a powerful tool for assessing a value chain potential in terms of growth, inclusiveness and sustainability. As requested, the analysis is guided by four questions: (1) what is the contribution of the VC to economic growth? (2) Is this economic growth inclusive? (3) Is the VC socially sustainable? (4) Is the VC environmentally sustainable? To answer these four questions, the analysis of the value chain is structured and subdivided into four sub-analyses: a functional analysis, an economic analysis, a social analysis and an environmental analysis.

Cashew is one of the most emerging cash crops in the West African region. It is a concrete opportunity for smallholders and farmers to increase their family income. The Sierra Leone government has been encouraging this crop for several years. Currently cashew yields in Sierra Leone are low compared to the world and regional average. The national production volume of raw cashew nuts (RCN) in Sierra Leone was estimated 4300 metric tons in 2017 (Comcashew baseline survey, 2017). There are three different RCN production actors in the country: the most significant are 'smallholders' who cover between 90% and 95% of the RCN production, the Block farms and private plantations of various sizes. Harvesting, collection and storage processes of the cashew VC are locally managed at the family level. Generally, collection and transports processes are performed by local intermediaries collecting from village to village and from production areas to larger storage centres.



AFRICAN CASHEW DISTRIBUTION FLOWS (SOURCE: CORSI, 2017)

Two markets are available for cashew producers in Sierra Leone: the domestic / regional market in West Africa, and the international market (mainly to Asia for processing). It is in relation to these

markets, opportunities for development and growth and the creation of more added value exist for cashew in Sierra Leone.

The main findings of the sustainability and inclusiveness of this VC show that conditions of the cashew market in West Africa and Sierra Leone provide a relatively good environment for its development. Some governance and political adjustments would be useful for improvements but there is no major barrier and the main obstacles are not cashew sector specific. It depends on the structural context and business environment of the country. Investments in processing would be positive for the VC in Sierra Leone, but large investors are shy because of the inherent risks in the country and the technical challenge of developing this segment of the VC.

Framing Question 1: What is the contribution of the VC to economic growth?

The financial and economic analyses conducted on the VC lead to the following results.

- Main actors involved in the VC, producers, processors and traders earn profits through their activities in the VC. Producers profits are not easy to measure because smallholders are the main producers, but they are in a self-consumption system and they are mainly self-employed in agricultural activities. Traders generate the highest profits. But informal trade is very common. And processors don't get significant profits because this activity is integrated in farms or villages and mainly artisanal.
- The contribution of the VC to the overall GDP is not significant but in Sierra Leone, the Agricultural sector contributes around 60% to the GDP and food crops are increasing. Indeed, climate and topographic conditions are very good in Sierra Leone, as well as in West Africa, for tree crop cultivation such as cashew.
- The rate of integration of the VC in the economy is high and equals 85.46 %.
- The VC does not contribute concretely to the public finance because many agricultural products and incomes are not levied because the government has adopted a policy of encouraging agricultural production to fight against poverty and to guarantee a better food security. Taxes collected through the VC are at the level of traders and retailer (and official exporters).
- The cashew VC does not have a significant impact on the national balance of trade. Indeed, this VC involves few imported goods and services, around 14 % of the value of total production of the VC. Moreover, cashew products official exports are 63 MT for 2017. The goal is to increase this level, but the quality and the yields must follow.
- The DRC measured is 0.19. In terms of international economy, the cashew VC in Sierra Leone has a comparative advantage.
- The NPC measured is 0.87. Domestic prices are lower than the international prices (nearly neutral). It means that producers are not well protected. Producers income could be higher with farm gate prices closer to the international market prices.

The agricultural sector is very significant in Sierra Leone. The development of food and tree crops is encouraged and arable land is available. The cashew VC in Sierra Leone is embryonic, but development and growth potentials are there. With better transparency between actors in the VC and yields improvement, economic growth could become more sustainable.

Framing Question 2: Is this economic growth inclusive?

The study analysed the potential of cashew value chain development in Sierra Leone in addressing the dire situation of food and nutrition insecurity. The study results show that with a 2.5 ha cashew farm (median cashew holding of a cashew farmer as per Comcashew baseline survey, 2017), a

farmer in Sierra Leone can, in many likelihoods, earn annual profits (after deducting the cost of production) almost equivalent to the living wage (USD 800). Cashew can, therefore, be a poverty alleviation tool. This is achievable if high quality planting material is provided to the farmers along with the needed management inputs and easy finance. Comcashew survey (2018) stated access to finance as 'almost a precondition' to achieve the overall objective.

Further economic growth induced by the development of the cashew value chain is expected to be economically inclusive. Most cashew processing enterprises are run single-handedly by women and contribute on average 30% to the total family income in processing families. The cashew value chain offers many other economic opportunities (such as cashew apple processing, bee keeping, and nursery management) for women.

- % final price at farm gate is estimated at 30% with the farm gate price for RCN 3,500 – 5,500 SLL / kg according to the quality.
- Smallholders and farm/village gate traders obtain 57 % and 37 % of the income generated within the VC.
- The cashew VC is estimated to create 10,000 jobs (self-employed and seasonal) at smallholder level. Similarly, it is estimated that there are 500-750 workers (fixed and seasonal) at private plantations and 500 (fixed and seasonal) at Blockfarmings.

The study also uncovered areas where 'inclusivity' of the value chain can be improved:

- Majority of workers across different parts of the value chain are probably earning much less than the minimum wages (~800 USD per annum), as data from sample investigations in the four districts shows. The worse-off are farm workers involved in cashew production.
- The prevailing rate of annual compensation from land-lease is $12.5 /hectares. If large-scale land investments in the cashew sector become a reality (which it may), then there is a need to rethink and revise the compensation for the land owners. More so, as the alternative business model of block farming can provide much better returns (~100 to 240 USD per ha.[1]) to land owners.
- Lower technical capacities (at MAFFS, SLARI etc.) in cashew, low access to finance and labour could constrain efforts to increase cashew yields in the country. Agriculture productivity can remain low in the absence of strong information and extension services to the farmers. Also, improper /unregulated marketing structures may continue to bring the sector down, in terms of its contribution to farmers' incomes and economic growth of the country. The marketing structure in the sector is evolving. A need has emerged for streamlining marketing structures.

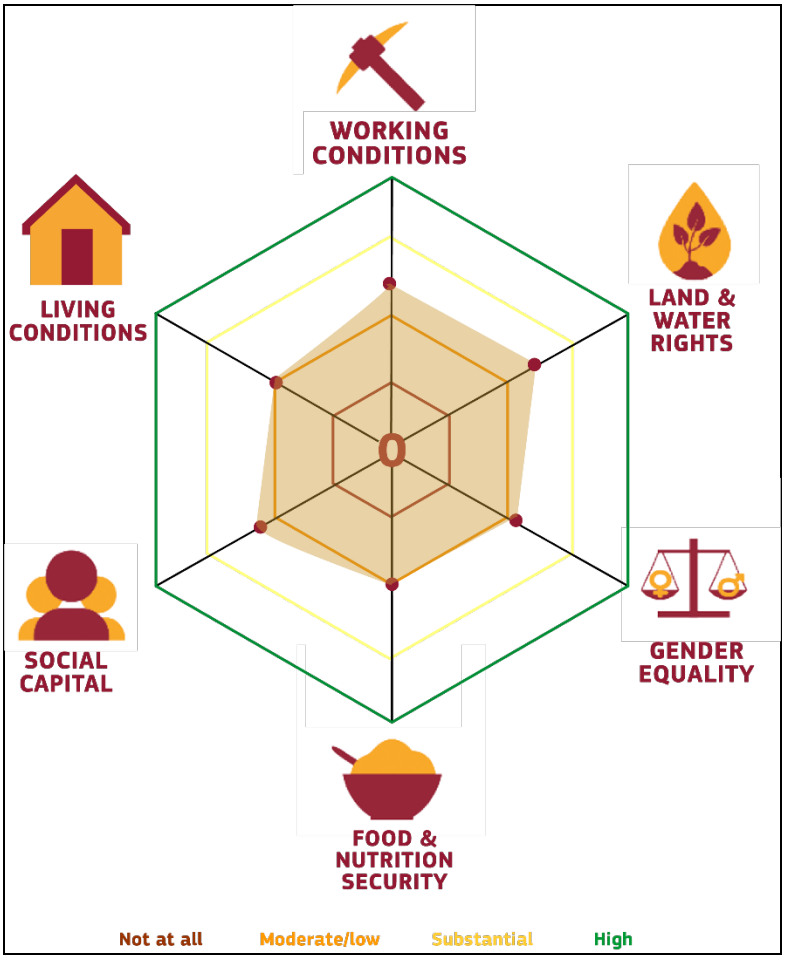
Overall, the Cashew value chain is showing signs of exemplary pro-poor and inclusive value chain development. However, this is at present small scale and needs improvement in order to lead to inclusive and sustainable expansion of the sector, for which there is a large potential[2] .

Framing Question 3: Is the VC socially sustainable?

The social analysis conducted in 2018 shows that the cashew value chain, at the present juncture, carries low social risks and offers vast opportunities for pro-poor and inclusive economic development in the country. The main findings from the social analysis of the cashew value chain are presented below.

[1] Computed by the study, based on assumptions and basic data collected on block farm model from Balmed

[2] A World Bank study analysed cashew sector export potential in Sierra Leone to be about 10000 t per annum



- ***Working conditions:*** The workers in the cashew VC are found at production, processing and trading levels, the majority being at the 'production' level. The processing of raw cashew nuts (RCN) is currently very limited in the country. Among the three cashew production systems (small holder, private plantations of different sizes - mid-size /large size, block farm), respect of labour rights is observably better in the block farming model initiated in cashew by the Balmed company[3]. Two clear risks are present in the value chain: a) The wages of farm level workers, working on farms and mid-size /large size cashew plantations are very low - much less than minimum wages (~800 USD per annum), b) Overall, the 'informal' nature of wage employment in the cashew value chain makes it difficult to implement or monitor compliances to labour standards. Workers' associations or collective bargaining possibilities cannot be expected to exist in this set up.
- ***Land and Water Rights***: it seems that there is a clean slate to begin cashew VC development – learning from experiences in other crops (e.g. oil palm, sugarcane in Sierra Leone) and from other countries (in cashew). Large-scale land investments in cashew are a distinct possibility in next few years. Conditions are favourable for investments. However, it is to be seen, whether past mistakes would not be repeated. Promising business models are being developed by Balmed and COOPI, which could provide an alternative to large-scale land acquisition by 'non-natives'. Balmed's model is demonstrating a transparent approach. If compromises on transparency, participation and consultation during large-scale land acquisition happen in the cashew sector as well, then the socio-economic benefits realised by communities would be low, leading to dissatisfaction. In this context, the new land policy (NLP)

[3] Balmed first introduced block farming model in Cocoa and coffee in the eastern province. Learning from experience, Balmed have now adapted and replicated the model in cashew in the northern province of Sierra Leone

will have high relevance for the cashew value chain as it can help the cashew sector to avoid the pitfalls already experienced by other commodity sectors.

- ***Gender equality:*** The women are economically very active in the cashew value chain and play significant roles throughout the VC. Men mostly control incomes from cashew farming. Women have direct control of incomes earned from processing and trading engagements. Barriers to greater decision-making role of women in the VC are related to prevailing economic, social and policy constructs. Female ownership of assets (such as housing) are very low. The new National Land Policy provide specific provisions for "joint spousal consent to land disposals". The implementation of the policy is yet to be promulgated. Women's participation and leadership roles in groups as currently it is very limited. Cashew value chain development can improve women's income, leadership and empowerment, while at the same time, it can increase women's work load, as it will seek to increase participation and engagement of women in various training, enterprises (CPUs, income generating activities - cashew apple processing, bee keeping, nursery etc.). This clearly demands a nuanced approach to women's empowerment, while adding more activities to their task list. Labour savings technologies in cashew production (e.g. for cashew harvesting) and processing (e.g. mechanical processing tools) and in other spheres of women's activities could be developed and implemented.
- ***Food and Nutrition Security:*** Cashew communities have experienced hungry season and have adopted various coping strategies. The diet of cashew producers and processors generally lack proteins and vitamins. About 60 to 70 % of cashew farmers are suffering from dietary deficiency, which have deteriorated over last five years. Cashew and its products have potential to address some of these nutritional deficiencies as cashew kernel is very rich in fat (46 %) and protein (18 %) and a good source of calcium, phosphorus, and iron. Food price variations are increasing over last 5 years, putting additional pressures on household economy. Cashew value chain development, in this context, have potential to increase stability of incomes and food security for cashew producers and processors.
- ***Social capital:*** More participation for cashew producers and processors in existing FBOs /ABCs can be encouraged as these organisations can provide various services to their members. CPUs are starting to play a role in input and output markets. However, this requires strengthening their capacities. The study found out that there is no defined place on the market for cashew in the district, no organisation to ensure the farmers get a fair price. So, farmers get discouraged and this could be one of the factors why farmers generally do not take care of their farm. The value chain may need some institutional interventions such as cashew commodity association at district level and cashew development board at national level to steer and coordinate all cashew value chain upgradation activities at respective levels. At the same time, PMB could play a hugely important role in organising and governing the value chain (in areas such as transparent price discovery, cashew quality standards setting and regulation, regional trade regulation, producer support programme etc.). Realisation of cashew's full potential demand such structural improvement actions. The farmers in the value chain have very low access to information and agriculture extension services. Cashew farmers are facing constraints related to capital and labour availability. Technical support capacity at MAFFS and SLARI needs to be upgraded as well. Cashew value chain have seen many novel experiments such as Balmed's block farm model, COOPI's semi block farming concept, COOPI's CPUs, COOPI's FBOs made by individual farmers, women-centric ABC working on cashew trading and processing (Ladeka ABC) are some examples of on-going value chain experiments of social involvement at small-scale. Further development and strengthening of these initiatives are important for achieving country's export potential of cashew (~10,000 t).
- ***Living conditions:*** Basic health infrastructure in rural areas in Sierra Leone is very limited. Primary health centres are available approximately 2-3 miles from a village. The secondary hospitals are further away from villages. Unsafe drinking water and unhygienic sanitation practices could pose considerable strain on achieving health outcomes, while high cost of

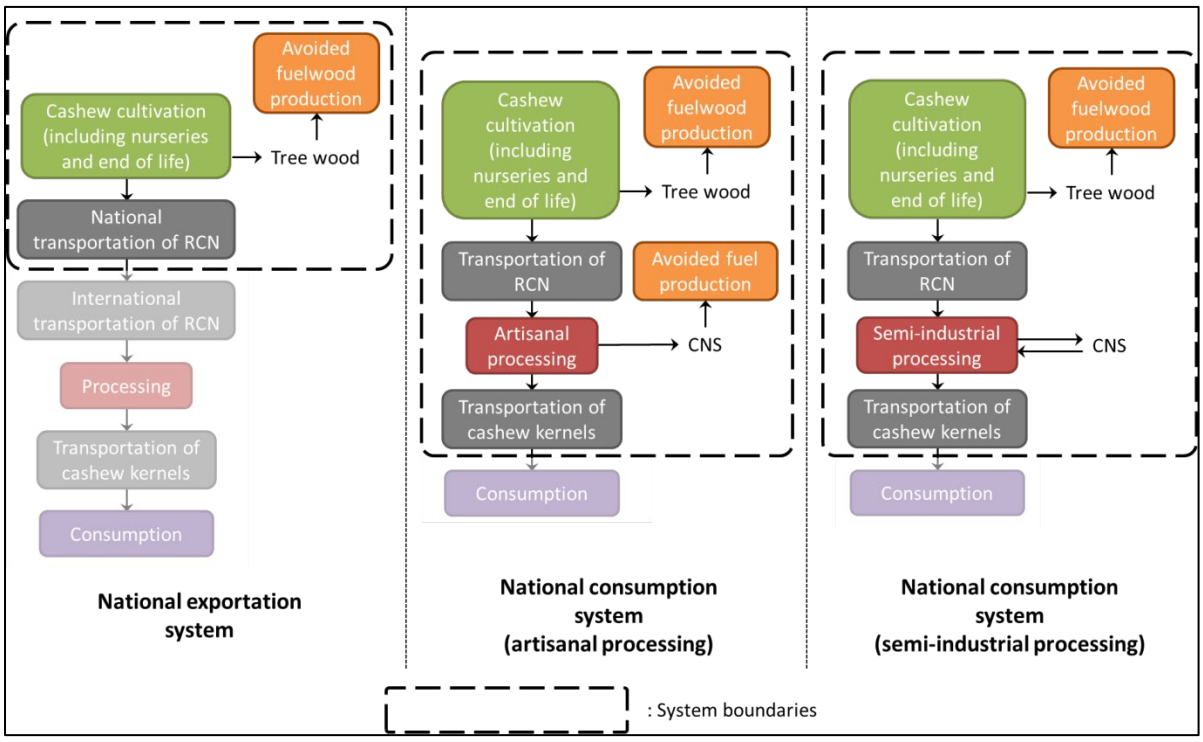
seeking treatment from primary or secondary health centres can continue to pose barriers for poor people in terms of health seeking behaviour. Cashew production by smallholders is hampered, in terms of both quantity and quality, by limited education and training, as highlighted in earlier sections. The farmers need to improve their knowledge and skills related to cashew production and processing.

Framing Question 4: Is the VC environmentally sustainable?

For the environmental analysis of this VCA4D study, an attributional LCA for micro-level decision support was undertaken, with the following specific objectives:

- To quantify the potential environmental impacts of the current cashew value chains in Sierra Leone, based on available knowledge, and to highlight the environmental hotspots;
- To determine, through sensitivity and uncertainty analyses, the main gaps in knowledge that can introduce biases in findings and comparisons and that would need to be filled by specific studies;
- To explore, through sensitivity analyses, key opportunities and risks for the development of the cashew value chains from an environmental perspective; and
- To provide elements for discussion on the sustainability of current cashew value chains in Sierra Leone.

Three systems related to different purposes for cashew production were considered in this analysis: national exportation, and national consumption based on artisanal processing for Sierra Leonean markets, or based on semi-industrial processing for Freetown mini-markets. The description of these systems was built on primary data collected during this VCA4D study from a field mission and a field survey, secondary data from recent surveys and studies by the European Commission (A4D project, ProAct action), ComCashew and the GIZ, and background data from literature and available databases.



The main conclusions of the environmental analysis can be summarised as follows:

- Regarding the potential environmental impacts of current cashew value chains in Sierra Leone:
  - All systems considered show a benefit for human health, due to the carbon storage potential related to the establishment of cashew plantations on bushlands, in the Northern Province of Sierra Leone. Even if this benefit is subject to high uncertainties, it prevails on other potential impacts on human health, and the uncertainty analysis determined that the probability for this overall benefit to be confirmed varies between 76% for the national consumption system based on semi-industrial processing, and 83% for the national exportation system.
  - For national consumption systems, this benefit on human health from carbon storage is reduced by 6% for artisanal processing and 25% for semi-industrial processing. This reduction is explained by the fine particulate matter formation from the production and combustion of fuels, either fuelwood, charcoal, or CNS.
  - Cashew cultivation is also the main contributor to the potential damages on ecosystems and biodiversity, due mostly to land occupation for cashew plantations and to habitat losses from bushland conversion. In the case of the national consumption system based on artisanal processing, the land occupation impact is higher than for other systems due to palm oil and charcoal consumptions during RCN processing.
    - Finally, the potential impacts on resource scarcity from the three systems considered come from fossil fuel consumption. However, consumption sources differ slightly depending on the system: RCN transportation for the national exportation system, RCN processing due to palm oil consumption for the national consumption system based on artisanal processing, and RCN transportation and cashew kernel distribution for the national consumption system based on semi-industrial processing.

- Three main gaps in current knowledge were identified during the study, and should be filled by specific studies for a more accurate environmental assessment:
  - Even if the uncertainty analysis helped to manage the high uncertainties associated to the potential carbon storage under cashew plantations, specific studies on this issue should be carried out in order to validate this potential and to enable a better discrimination between agricultural practices.
  - Since recent studies mainly focused on cashew cultivation, little information and data was available on artisanal production of cashew kernels for local consumption, whereas this type of processing can be a non-negligible source of environmental damages. Specific studies should then be carried out in order to have a better understanding of current processing practices and to be able to propose improvements.
  - Most of the current Sierra Leonean cashew production is located in the Northern Province, especially Kambia, Bombali, and Port Loko districts. Most of the recent available data then refers to these three districts. However, the recent survey by ComCashew and the GIZ suggests that agricultural practices in cashew plantations might be different in other parts of the country, which might be due to a higher access to pest controls and chemical inputs. A survey should then be carried out to have a better picture of agriculture practices in cashew plantations in the whole country.

- Along with these gaps in knowledge, one major threat and one opportunity were identified for a sound development of cashew value chains in Sierra Leone:
  - Bushfires are both an important environmental issue in the Northern Province of Sierra Leone and a key threat for cashew plantations, which can dramatically increase the potential environmental damages of cashew value chains. Actions to reduce the number of bushfires should then be taken. Potential positive or negative effects on bushfires of cashew development in the Northern Province of Sierra Leone may also be investigated.

- A specific sensitivity analysis on semi-extensive plantations has shown that there is room and opportunities to reduce impacts and to increase environmental benefits from cashew cultivation. In this regard, the use of organic fertilizers should be promoted to favour the establishment of young cashew trees, to increase yields and to avoid losses in soil fertility.

Finally, comparisons with benchmark systems were performed to discuss the sustainability of cashew value chains in Sierra Leone. These comparisons have shown that the current potential impacts of cashew value chains are marginal compared to other environmental issues relevant in the context of this study: impacts of bushfires on human health and ecosystems, and resource consumption of air flights between Brussels and Freetown. From this perspective, current cashew value chains can be considered as environmentally sustainable.

However, in the case of the national exportation system, it is important to keep in mind that steps taking place outside of Sierra Leone were out of the scope of this study. This conclusion cannot then be generalized to the international cashew market.

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A4D	Agriculture for Development
ABC	Agriculture Business Centres
ACA	African Cashew Alliance
AFA	Analyse des filières agro-alimentaires (CIRAD)
AoP	Area of Protection
CNS	Cashew Nut Shells
CNSL	Cashew Nut Shell Liquid
ComCashew	Competitive Cashew initiative
COOPI	International Cooperation (Italian NGO)
CPU	Community Processing Units
DEVCO	Commission's Directorate-General for International Cooperation and Development
DRC	Domestic Resource Cost Ratio
EC	European Commission
EDF	European Development Fund
EU	European Union
FBO	Agriculture Business Centres
FFS	Farmer Field School
FU	Functional Unit
GIS	Geographic Information System
GIZ	German Society for International Cooperation
HH	Households
HWSD	Harmonized World Soil Database
iCA	African Cashew Initiative
ILCD	International reference Life Cycle Data system

ILO	International Labour Organization
INC	International Nut&Dried Fruit
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
LUC	Land Use Change
MAFF	Ministry of Agriculture, Forestry and Food Security
NCP	New Land Policy
NGO	Non-Governmental Organization
NPC	Nominal Protection Coefficient
NSADP	National Sustainable Agriculture Development Plan
PHC	Population and Housing Census
RCN	Raw Cashew Nuts
SCP	Smallholders' Commercialisation Programme
SLARI	Sierra Leone Agricultural Research Institute
SLIEPA	*Sierra Leone Investment & Export Promotion Agency*
SLL	Sierra Leone Leones
SOC	Soil Organic Carbon
ToR	Terms of Reference
VA	Value Added
VC	Value Chain
VCA	Value Chain Analysis
VCA*4D*	Value Chain Analysis for Development

1. Introduction and context

This report on the Cashew Value Chain Analysis in Sierra Leone has been conducted under the VCA4D project which is part of the European Union 'Inclusive and Sustainable Value Chains and Food Fortification Programme'. The study was achieved by using the tools and methods presented in the DEVCO1/C1 "Methodological Brief – Frame and Tools. Key features of the experts' work (20p)".

The cashew value chain in Sierra Leone represents a good opportunity for applying a value chain analysis from the EU point of view. Indeed, the EC is involved in the highly vulnerable agricultural sector in Sierra Leone. The EU support in this sector is mainly to improve food security, productivity and value addition in cash crop production. The overall objective behind it consists in addressing food security and agricultural development in a sustainable and inclusive way. In Sierra Leone, through the 11th EDF and in line with the National Sustainable Agriculture Development Plan (NSADP), the EU is sustaining cash crops: cocoa, coffee and cashew. Among these crops, cashew was selected to assess inclusion and sustainability and to target appropriate and relevant interventions to meet sustainable development.

As most West African countries that practice this crop, cashew cultivation in Sierra Leone started at the end of the 1980s. In January 2005, it was estimated that 3,600 ha of cashew trees existed in the country and around 1,200 ha of them were bearing fruits. In 2010, the national government launched an initiative promoting cashew crops in the different regions of the country offering planting and cultivation material to farmers and smallholders (mainly in Kambia district due to the small spontaneous cashew cultivation which exist there because the proximity to the Guinea border to which the produce was purchased). At that time, production volumes did not yet allow exports. In 2011, the Sierra Leone Agricultural Research Institute (SLARI) pointed out that the cashew culture, which is mainly manual, offered a significant potential for exports.

Another remarkable step along the historic cashew cultivation in SL is the EU funded COOPI implemented A4D project from 2012 until 2016 which expanded cashew cultivation to Bombali and Port-Loko and the extension ProAct project from 2016 - 2020 which brought the nowadays actual cashew area to around 7,000 ha in the three districts.

It deserves to be mentioned that 2017 first official export of RCN carried out by BALMED was basically the first relevant harvest from the first seedlings planted during 2012.

To achieve this, the current challenge, is to make this industry competitive so that it becomes sustainable. It involves attracting international buyers and producing large and good quality nuts. It has been observed on the field that farmers and smallholders are ready to embark on the expansion of cashew crops (Costa and Bocchi (2017)).

To support the cashew value chain in Sierra Leone, it is necessary to understand it and to target where the leverage effects lie in the chain to intervene and make it inclusive and sustainable. It is the objective of the VCA final report.

2. Functional analysis

The functional analysis of the cashew crop in Sierra Leone was conducted to obtain a detailed 'big picture' of the value chain (internationally, regionally, nationally and locally). It is the first stage for understanding the functioning of a value chain from the production level to final consumption and to gather factual descriptive elements of technical processes and channels. It is also a way of identifying actors and stakeholders, as well as their power and role, in the value chain process.

2.1 West Africa and Sierra Leone

In an overall context, it is commonly known that Sub-Saharan African countries are facing deep poverty and food security problems. It explains why the agri-food sectors are a priority for interventions in these countries. The objective of such interventions consists in fostering productivity and efficiency in the related agricultural sector to contribute to rural development and growth.

As shown in Figure 1, in 2016, the world cashew production was strongly dominated by African countries (61% of the world production), followed by Asian countries (31% of the world production). Indeed, African countries and notably West Africa countries have a particularly favourable climate for cashew production. Unfortunately, African agricultural sector is largely exploited. Agri-food value chains are unproductive and uncompetitive. It can also be observed on the map that processing mainly takes place in Asia (more than 90%). Processing in Africa is estimated at 5% at the world level. In Africa, there is no final product consumption. End consumers are in industrialised countries such as USA, EU, Middle East countries, Russia and Australia.

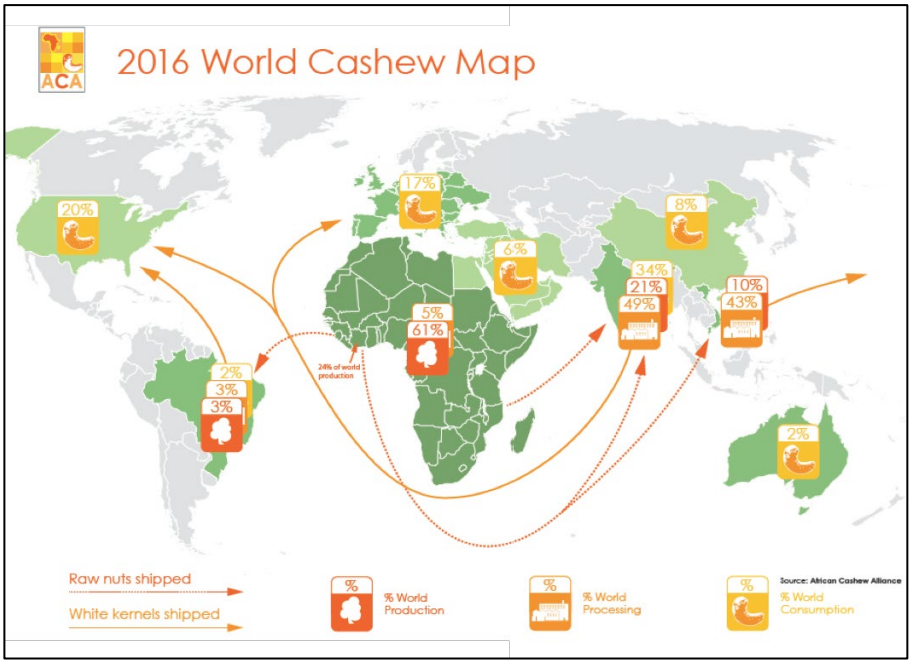


FIGURE 1: 2016 WORLD CASHEW MAP (SOURCE: ACA ANNUAL REPORT 2016)

Sierra Leone is in West Africa (Figure 2). This country is among the poorest in the world with a Human Development Index of 0.42 in 2016 (rank 172). 39.9% of its 6.5 million population live in urban areas and 60.1% in rural areas. 52.3% of this population lives below the income poverty line (PPP USD 1.9 / day). Moreover, historically, Sierra Leone has experienced a heavy and long colonial history, a civil war in the nineties, and more recently, in 2014, the Ebola outbreak.

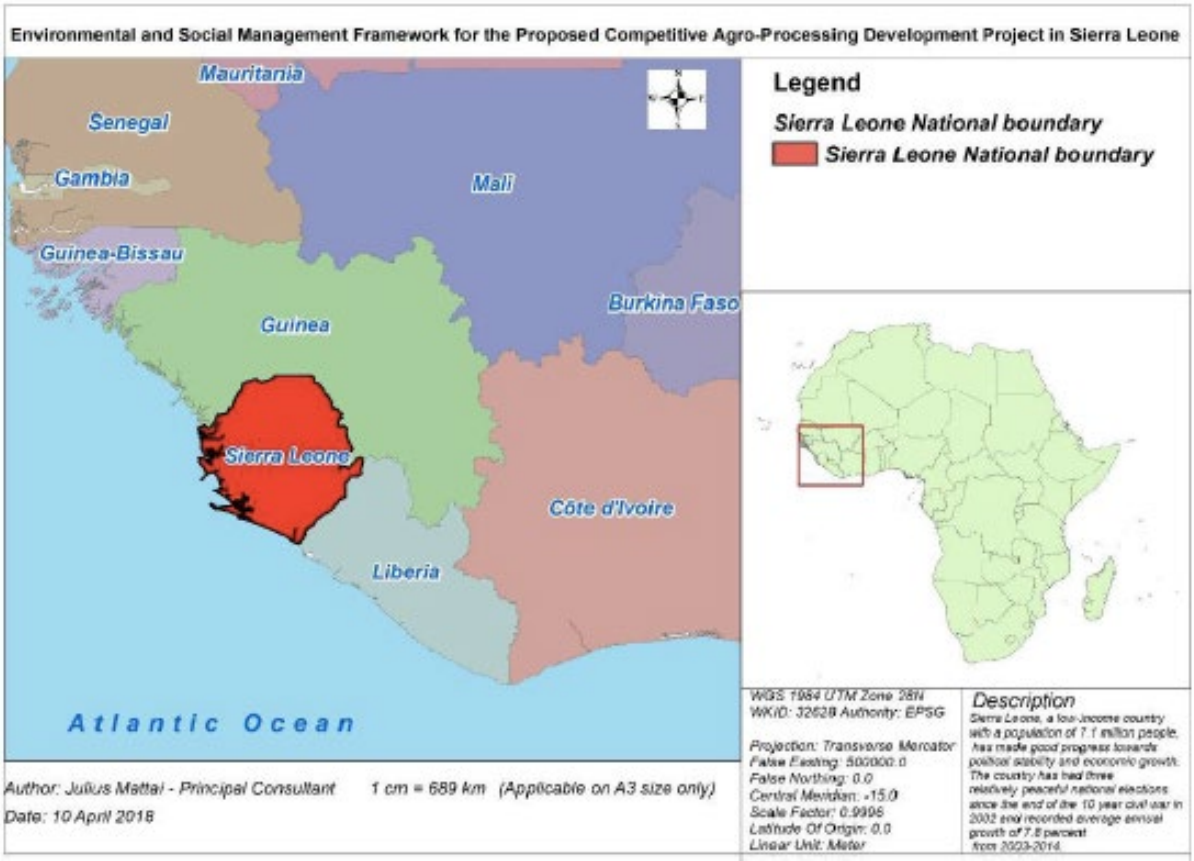


FIGURE 2: MAP OF SIERRA LEONE IN WEST AFRICA

Sierra Leone needs a new momentum and the cashew crop is a great opportunity to grow the agricultural sector whilst gaining access to the international market as a producer like its neighbours, Data collected for the Population and Housing Census (PHC) of 2015 reveals that there are 732,461 agricultural households in Sierra Leone. 625,679 (85.4%) of these households are engaged in crop farming activities, 539,304 (73.6%) are engaged in animal husbandry and 245,957 (33.6%) in Fishery (2015 PHC, Summary of Final Results).

2.2 The overall cashew value chain from the African point of view

The cashew value chain is divided into three main sections: production, processing and consumption Figure 3 and Figure 4. African countries act as raw cashew nut producers. Cashew production provides four main products (by order of consumption value): cashew nut, cashew apple, cashew nut shell liquid and cashew shell. If raw cashew nuts production is most frequently mentioned, it is simply because it is the most valuable product from cashew crops.

Most of the cashew producers' countries are in the north of the equator. Usually, harvests are made from February to May. For countries located in the Southern Hemisphere, harvests are rather from September to December. It means that most of cashew products on offer takes place at the beginning of the year. Plantation yields strongly depend on plantation age, species and maintenance. West African conditions are the most suitable and yields should reach 1 MT per hectare. Unfortunately, production conditions are not optimal and this profitability is not achieved. The most influencing factor is climate conditions because it impacts on flowering and fructification

periods and quality. Raw cashew nut quality is defined according to size and colour standards (Ricau, 2013).

Demand for cashew nuts and derived products varies also during the year. The main consumer peaks are Diwali / Navratri celebrations in India, Christmas and New Year holidays (Thanksgiving, Christmas and New Year) in the USA and Europe, Ramadan in all Muslim countries and Lunar New Year in China and in Southeast Asia. This nut unfortunately undergoes competition from other similar tree nuts that are cheaper. For example, in 2010 – 2012, the price of almonds became lower than the cashew nut because the world production of almond increased faster than cashew. Consequently, many consumers and transformers changed their habits in favour of the cheaper product (Ricau, 2013).

Cashew trade also depends heavily on the exchange rates of the concerned currencies. Currency fluctuations between USD and rupees, and USD and CFA francs. Indeed, the decisive factor for the price of cashew nuts in West Africa is the difference between the variations of the Rupee and the CFA Franc against the USD. After 2002, the value of the CFA Franc (which is fixed to the Euro) has increased sharply while at the same time the Rupee has remained much more stable compared to the Dollar. Under these conditions, Indian processors have lost much of their purchasing power in Africa and even if the prices on the international market were higher in 2012 than in 2002, the prices in the Economic and Monetary Union West African states (UEMOA) were lower (Ricau, 2013). Raw cashew nuts international market is strongly linked to the prices volatility.

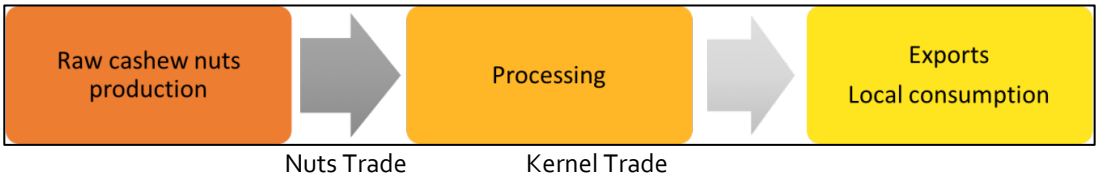


FIGURE 3: CASHEW OVERALL VALUE CHAIN (SOURCE: OWN)

This overview leads us to propose a more detailed visualization and description of the standard West African raw cashew nuts value chain. The main functions and operations that are found there are presented, as well as key activities and actors.

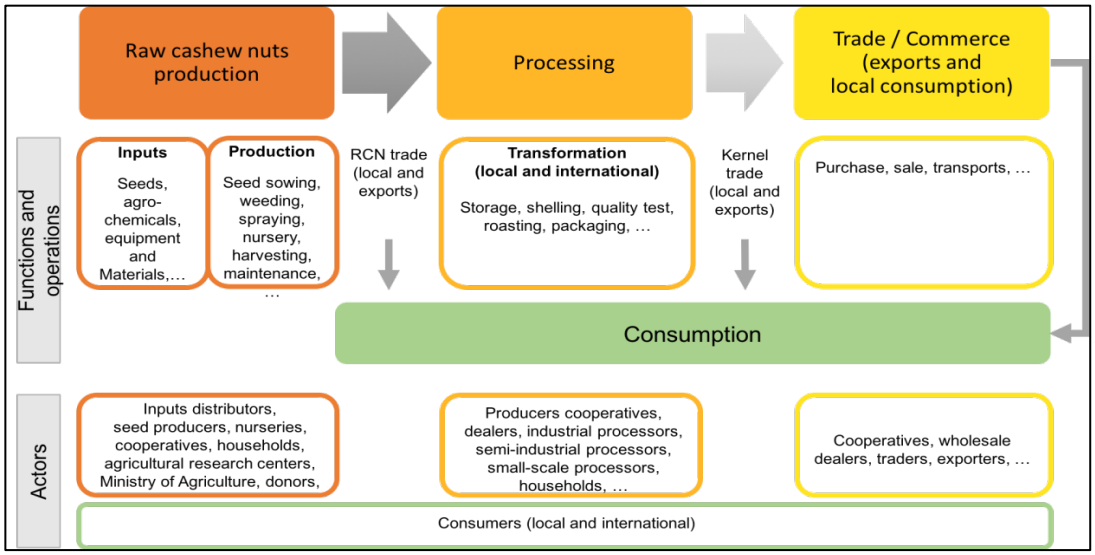


FIGURE 4: FUNCTIONS AND ACTORS IN CASHEW VALUE CHAIN (SOURCE: OWN)

It is sometimes considered that the African cashew VC is divided into two sub-chains: in-shell cashew chain and cashew kernels chain. The first one is the most developed and it is a "trader-driven" chain, while the other one is a young "buyer-driven" chain.

The African in-shell cashew chain or RCN chain is confronted with poor infrastructure, lack of financial services and entrepreneurial culture for producers, transports and energy costs, weak information and limited access to finance and insecurity. This impacts on the VC quality and competitiveness.

2.2.1 The production stage in the cashew VC

According to the African Cashew Alliance, over the last ten years African smallholders have doubled cashew production. In 2015, the yield has reached more than 1.6 million tons of raw cashew nut. Originally hailing from the northern region of South America, cashew trees are now abundant in tropical regions throughout the world, with the largest concentrations found in Brazil, India, Vietnam, Indonesia, and several countries in West and East Africa. In fact, as stated above, Africa has now taken over as the world's greatest producer of RCN. Between 2000 and 2016, production of cashews in Africa has grown by a factor of 4.5, from around 400,000 MT to an estimated 1,800,000 MT in 2016 (Figure 5). Cote d'Ivoire and Tanzania are currently the continent's top producers. While Cote d'Ivoire seems to have cemented the top production position in Africa over the past few years, Tanzania has replaced Guinea Bissau as the second biggest producer who now holds the third position. Production during the 2015-2016 season in West Africa was generally below expectations[4].

Figures confirm that recently, Africa is now the world leader in the production of raw cashew nuts.

The prospect for a country like Sierra Leone are therefore very optimistic. Indeed, both its location and potential in the development of the cashew value chain demonstrate the value of promoting it to contribute to economic growth and development of smallholders in the country.

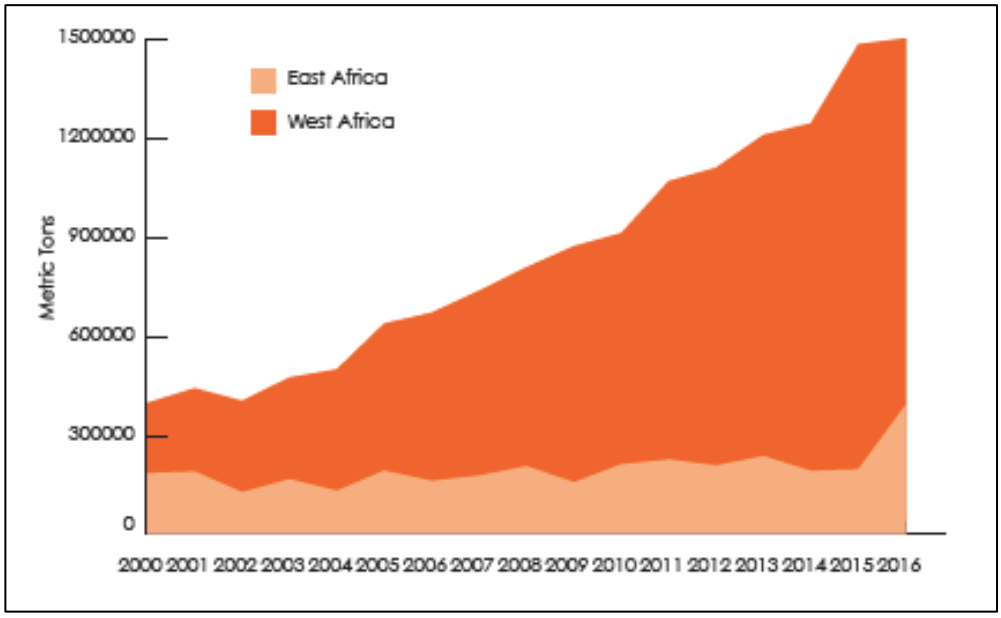


FIGURE 5: CASHEW PRODUCTION EVOLUTION IN EAST AND WEST AFRICA FROM 2000 TO 2016 (SOURCE: AFRICAN CASHEW ALLIANCE, REPORT 2016)

[4] https://www.africancashewalliance.com/sites/default/files/documents/aca-annual-report-2016-en-web.pdf

In Africa, there is an issue concerning yield quality because of a lack of training and equipment. But there is also a well-known lack of storage facilities that impact on in-shell cashew quality.

2.2.2 The processing stage in the cashew VC

While establishing itself as a world leader in production, West Africa has also gained more prominence in the cashew value chain processing stage.

Nevertheless, Figure 6 shows that in Africa, the share of processing compared to crops is minimal.

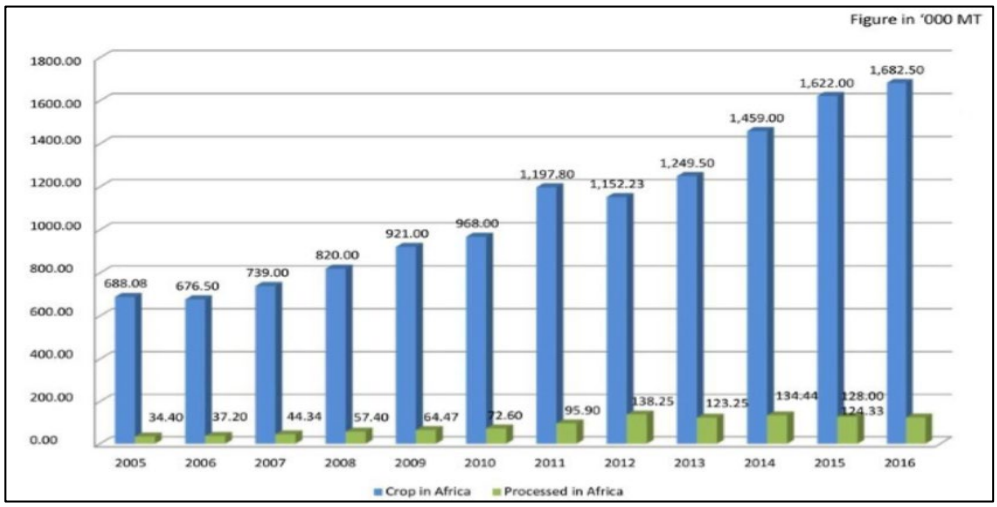


FIGURE 6: CASHEW PRODUCED AND PROCESSED IN AFRICA (2005 – 2016)
(source: Barkur Vasudev, World Cashew Convention, February 2017))

However, processing cashew is labor-intensive, so it has the capacity to generate employment for large numbers of people for shelling, peeling, and grading the nuts. The process of transforming the raw cashew nut into a consumable commodity entails a myriad of steps. Access to finance is a major constraint to the growth of the processing industry in Africa and this trend has continued through 2016. Another constraint this year was the quality of RCN especially due to poor drying and post-harvest handling.

RCN processing was increasing in East and West Africa until 2013 when it started to decrease in East Africa while it remained more stable in West Africa with a slight increase over these last few years (Figure 7).

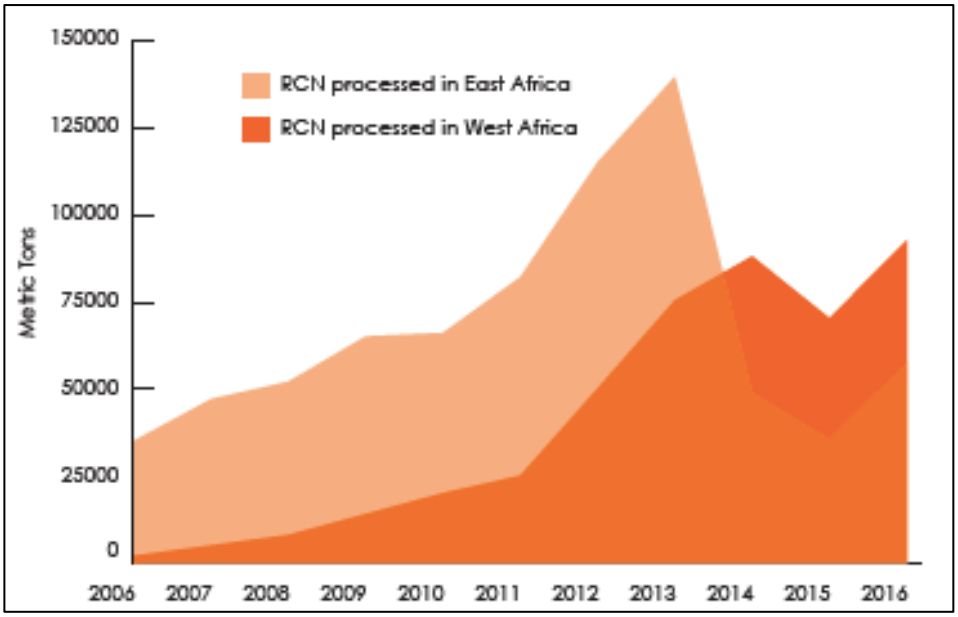


FIGURE 7: RCN QUANTITIES PROCESSED IN EAST AND WEST AFRICA BETWEEN 2006 AND 2016
(Source: African Cashew Alliance, Report 2016)

The processing section of the VC is driven by costs of production factors. Customers are also influencing it. New demands for traceability or labeling are very constraining for processors.

2.2.3 The trading stage in the cashew VC

Traders have the highest margins in the VC, but they are the main risk takers. Indeed, prices are set from outside the VC. Prices set by traders should cover risks, eventualities and failures in the VC. Trading is mainly unformal and locally managed by many small-scale traders. International retailers ie exporters are occupying more of the market because of their experience, their access and their ability to raise short term finance. Nevertheless, field contexts imply that they have to deal with many difficulties (ACi, 2011).

2.2.4 The consumption stage in the cashew VC

Except for India, the main consumers are not in cashew producing or transforming countries. The USA and Europe are significant final consumers of cashew products. In terms of location, West African countries could access those consumers for exporting processed cashew products.

2.3 Specificities of the cashew VC in Sierra Leone

In Sierra Leone, the cashew value chain is not well-developed. In fact, compared to neighbouring countries in West Africa, such as Guinea or Ivory Coast this cash crop is not advocated by Sierra Leone smallholders despite the opportunities it presents.

It is relevant to analyse the cashew value chain in Sierra Leone because cashew is one of the most emerging cash crops in the West African region. It is a concrete opportunity for smallholders and farmers to increase their family income with this activity. The government of Sierra Leone has been encouraging this crop for many years. Currently Sierra Leone cashew yields production is low compared to the world and regional average (Table 2). Few RCN are transformed and consumed locally and/or informally traded in the region. Exports are low but this channel is

increasing. There is a clear distinction made between RCN traded in the country and region and RCN exports for processing abroad. In fact, nearly all RCN produced by farmers (the main producers group) are traded informally in neighbouring countries. Production therefore leaves the country, and the national economy, but not in the form of exports.

ComCashew made extrapolations based on data they collected and here are some interesting facts and figures on the Sierra Leone Cashew VC.

	2015	2016	2017
National production volume of RCN – estimate (metric tons)	1 800[1]	2 200[2]	4 300[2]
National processing capacity – installed (metric tons)	None	None	None
National processing capacity – utilized (metric tons)	None	None	None
Productivity (kg/ha)		120[2]	150[2]
Number of Master Trainers trained (cumulative)	4	8	14

[1] MAFFS A4D Project, 2015
2 Extrapolation from ComCashew 2017 baseline study

TABLE 1: FACTS AND FIGURES ON SIERRA LEONE CASHEW VC (ESTIMATES FROM COMCASHEW[5]

As mentioned in Table 1, cashew production is increasing in Sierra Leone. Indeed, the country offers extensive arable land, the greater proportion of which is either underutilized or not utilized at all. Given this fact, the government has recognized cashew as an alternative cash crop to diversify agriculture.

	Growers	Yield kg/ha	Crop tonnes	Supply chain
India	Smallholders, plantations in new areas	815 national average	465,000	Multi collector, trader, import
Viet Nam	Smallholders	600–1,200	400,000	Multi collector, trader, import
West Africa	Smallholders	350–600	680,000	Multi collector, trader, export
East Africa	Smallholders	250–450	155,000	Multi collector, trader, export
Brazil	65% Smallholders	150–350, 1,000 new variety	300,000	Multi collector, larger traders

TABLE 2: CHARACTERISTICS OF THE CASHEW SECTOR IN MAJOR CASHEW-PRODUCING COUNTRIES AND REGION[6]

2.3.1 Main actors

In Sierra Leone, harvesting, collection and storage in the cashew VC are locally managed at the family level. Generally, collection and transport processes are performed by local intermediaries collecting from village to village and from production areas to larger storage centres.

[5] Sierra Leone – Country Report, February 2018, Promoting Competitiveness of the African Cashew Value Chain: The Competitive Cashew initiative (ComCashew)
[6] Competitiveness of the African Cashew Sector, ACi, 2011.

The main actors involved in the cashew value chain in Sierra Leone are the following:

- Inputs suppliers (NGOs such as COOPI): agrochemicals dealers, seed dealers, nurseries dealers, equipment dealers;
- Cashew producers: smallholder farmers (family labourers and seasonal labourers), associations / FBOs and CBOs (in Sierra Leone), private plantations;

RCN Local Collectors / Dealers;

- RCN Local Transformers / Processors;
- Regional Traders / Retailers,
- Exporters,
- Final National Consumers.

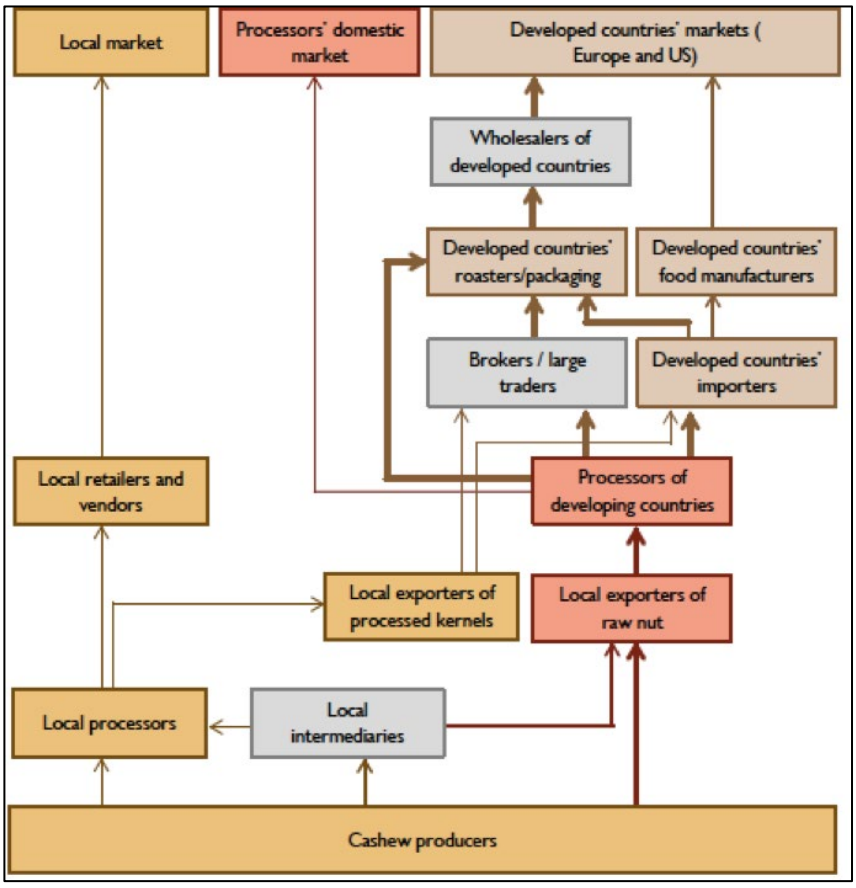


FIGURE 8: AFRICAN CASHEW DISTRIBUTION FLOWS (SOURCE: CORSI, 2017)

As shown in Figure 8, two markets are available for cashew producers in Sierra Leone: the domestic / regional market in West Africa, and the international market (mainly to Asia for processing). As mentioned above, it is in relation to this characteristic that opportunities for development and growth, attracting more added value, exist for cashew in Sierra Leone.

To optimize data quality on the most important actors of the Sierra Leone cashew value chain, three different surveys have been conducted in April – May 2018: a smallholders' / households' survey, a processors' survey and a traders' survey. In terms of representativeness, the regions where the survey focused are quite important for the European Union and with an outstanding potential of development.

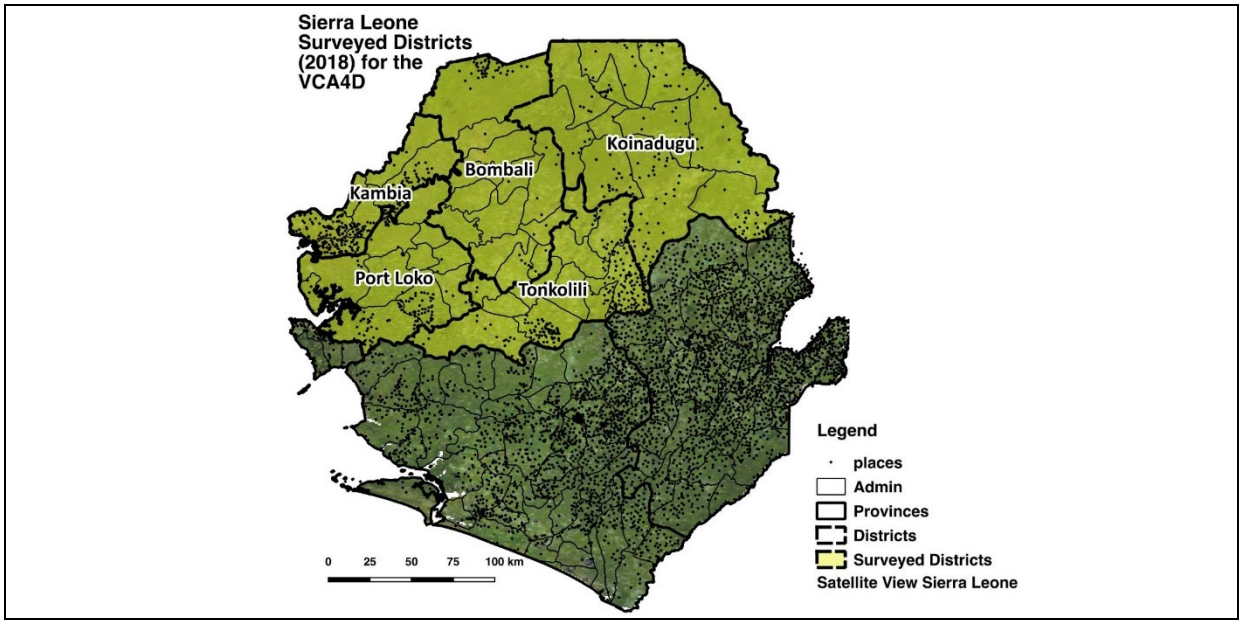


FIGURE 9: SIERRA LEONE MAP WITH SURVEYED DISTRICTS[7]

Data collected is integrated in a database and data is used according to requirements for the four sustainability and inclusiveness analyses (functional, economic, social and environmental). Based on the field work and the survey results, a representation of the cashew value chain in Sierra Leone has been drawn in AFA (Figure 10). This VC is represented as it currently exists. Clearly, according to sustainable development of this VC in Sierra Leone, the objective is to achieve another VC integrating more significant production level and processing capacities.

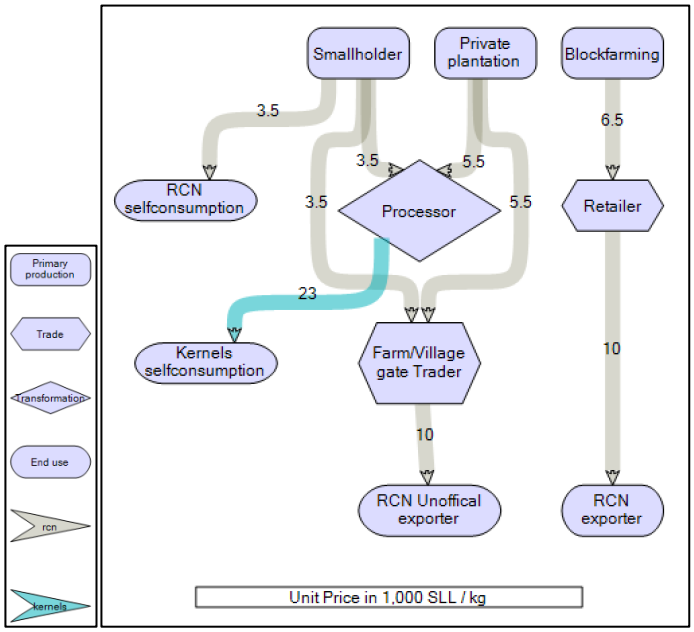


FIGURE 10: THE CASHEW VALUE CHAIN MAIN ACTORS, OPERATIONS, FLOWS AND PRICES IN SIERRA LEONE (IN AFA)

[7] The surveys were conducted in the northern districts of the country because it is in this region that agriculture (cash crops) is mainly practiced (because of land use).

There are three different RCN production actors in Sierra Leone: the most significant is 'smallholders' who cover between 90% and 95% of the RCN production, the Block farms and private plantations of various sizes.

Only a share of RCN production from the smallholders' crops is locally processed (artisanal or industrial). A small share of this production is self-consumed by households and the rest is collected by traders / dealers or private buyers. Traders sell RCN to regional traders. Private buyers sell RCN to exporters. None of the nationally processed RCN or kernels is exported. It is consumed in the country.

Because of those field observations, the following actors have been identified for the following financial and economic analyses of the Sierra Leone Cashew VC:
For the RCN Production:

- Smallholders,
- BlockFarming (Balmed),
- Private Plantations.

For RCN Processing to kernels:

- Local / Village processors (artisanal and industrial processing are considered as being similar at this level and scale of transformation)

For RCN trade:

- Farm / village gate traders (local ones mainly involved in informal trading in the region or unofficial exports in neighbour countries (RCN are leaving the VC)
- Private retailer such as Balmed also managing the official exports of RCN (it has been considered that Balmed BlockFarming produce what the company is trading and officially exporting.

Concerning consumption, only 10% of RCN are self-consumed by smallholders. Kernels processed locally are also self-consumed and a few are sold in local markets. The vast majority of RCN production leaves the country through trade and in the form of unofficial or official exports.

2.3.2 Main flows

In Sierra Leone, cashew nuts are marketed under a multi-channel system depending on the number of intermediaries between the producers and the final consumers. Two channels are mainly observable in Sierra Leone: the small-integrated farmer channel and the local small processing or retailing channel. Generally, two additional channels can exist: the medium-large processing channel and the RCN export trader channel. But in the case of Sierra Leone, those two last channels are not really developed. While the objective would be to improve those channels locally. Indeed, the processing can take different forms in Sierra Leone: households' processing for self-consumption and a few quantities sold at the community market, small and medium scale processors with cashew nuts sold to markets, and finally, large-scale industrialized processors. But processing in Sierra Leone (as well as in Africa), both artisanal and industrial, is very limited because of a lack of processing facilities and markets accesses (De Noni, 2017).

In terms of consumption, because production is still low, domestic demand and self-consumption cover almost all production. According to SLIEPA[8], *'the first official export of 75 metric tons of raw cashew nuts from Sierra Leone to Vietnam'* was made in summer 2017.

[8] http://sliepa.org/first-official-export-of-cashew-from-sierra-leone-commences/, consulted on June 8th, 2018.

Transports constraints affecting commodities flows in Sierra Leone

In general Sierra Leone has a limited commercial transport capacity and most of the transporters own a limited number of trucks. The transporters accept to deliver goods from Freetown to major towns in the country (Figure 11).

Transport services are mainly performed on a one-off contractual basis. Agricultural commodities such as palm oil, cocoa, rice and coffee are the main transport products, as well as livestock.

According to a World Bank study in 2011, the road freight costs in Sierra Leone are much higher than some major routes in sub-Saharan Africa both within the country and across borders. For example, it can vary from 0.09 USD per km up to 0.16 USD per km within the country to reach 0.21 USD per km across border.

FIGURE 11: SIERRA LEONE ROADS MAP[9]

As mentioned in the Sierra Leone Diagnosis Trade Integration Study of 2013, the cost of moving freight along the two major international routes, Freetown to Conakry and Freetown to Monrovia, is 21 and 17 cents per kilometer ton (kmt), respectively, whereas the cost along the Lome-Ouagadougou route is just 7 cents per kmt (Figure 12). Even when there are no border crossings involved, the cost of moving freight in Sierra Leone is very high.

[9] http://www.geoatlas.com/medias/maps/countries/sierra%20leone/co431s11/sierraleone_road.pdf, consulted on June 21st, 2018.

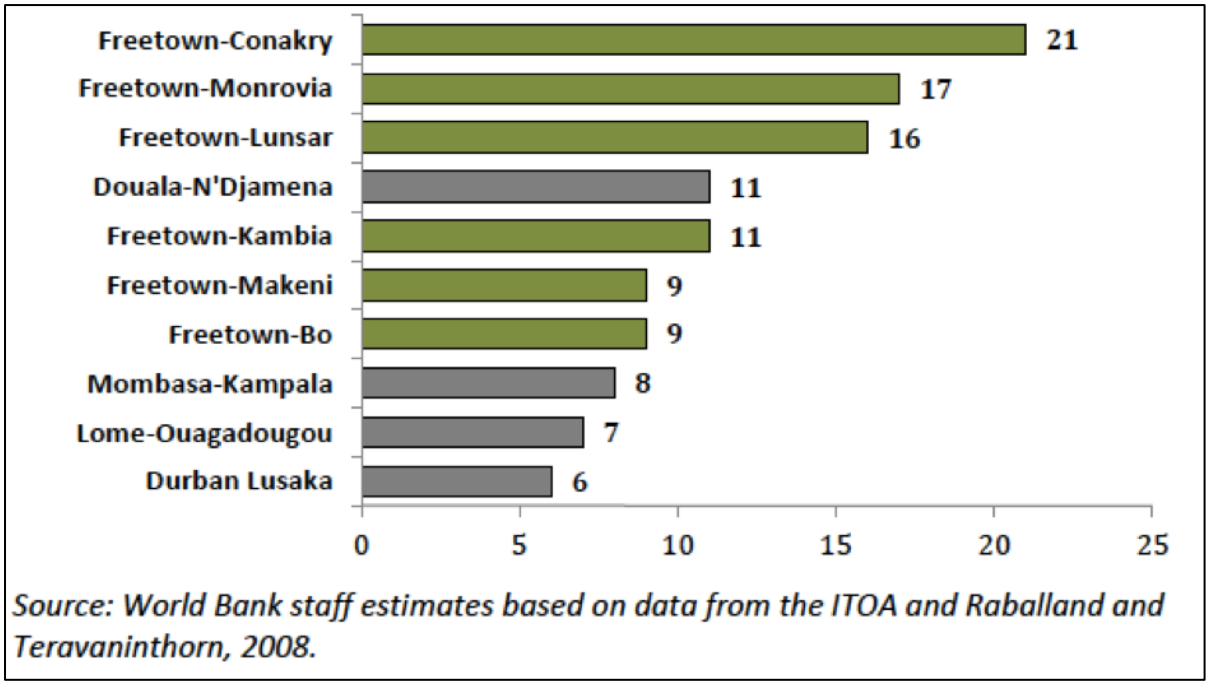


FIGURE 12: ROADS FREIGHT RATES IN SIERRA LEONE (CTS/KG)[10]

A significant amount of cross-border trade takes place on an informal basis between Sierra Leone and neighboring countries, carried out mainly by individuals or micro and small firms. This form of trade is conducted mostly by middlemen/traders who buy products from farmers, processors and agents either from distant production areas and/or periodic markets close to the border crossing points. Those products or commodities are transported by road on commercial vehicles.

In Sierra Leone, intra-regional road and air links remain weak, sea transport is primordial to allow imports and exports. Efficient sea transport and port activities are critical to Sierra Leone's trade and economic growth. In this context, the Port of Freetown is not very developed. It is served by coastal traffic linking into large transshipment ports like Dakar, Abidjan, Port Tangier, and Lomé. But the national port serves as the major logistics hub for national imports and exports.

It is why, to optimize intra-country transport efficiencies, it is necessary to provide adequate and functional intermodal linkages from the port to sub-centers. Due to the lack of railway infrastructure, all goods delivered to Freetown are transported by road, which necessitates seamless intermodal connectivity with the national road network. Unfortunately, as shown in Figure 13, Sierra Leone logistics performance indicator level was bad and lower than its neighbours', in 2012. Improvements have been implemented but concrete effects are still not observable.

[10] Sierra Leone Diagnostic Trade Integration Study Update 2013

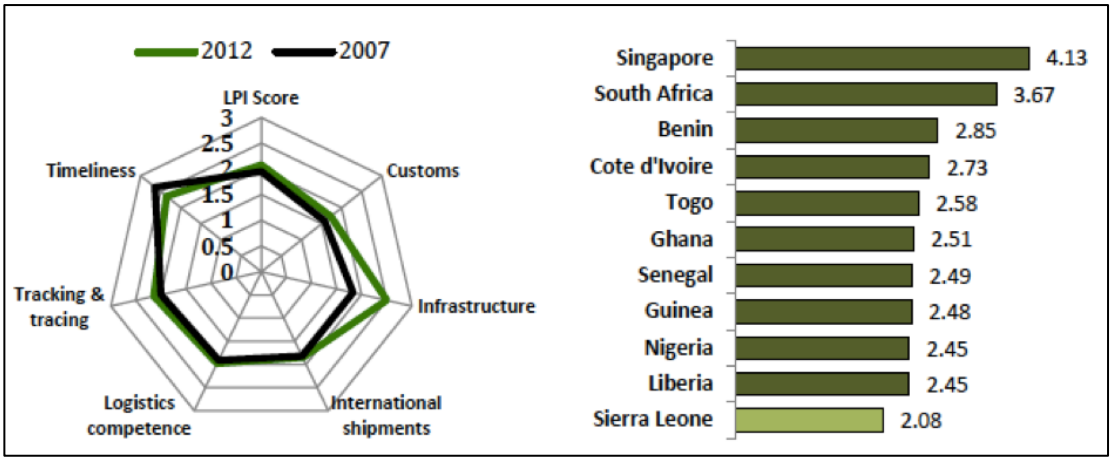


FIGURE 13: SIERRA LEONE LOGISTICS PERFORMANCE INDICATORS (2007 – 2012)[11]

Customs constrains were one of the weakest point in logistics performance for Sierra Leone. It is confirmed by Figure 32 but as explained the financial act of Sierra Leone is regularly reviewed to improve country products and trade attractiveness at the international level.

2.4 Competitiveness and main constraints of the Cashew VC

The various elements presented below for the functional analysis of the cashew VC in Sierra Leone helps identifying relevant strengths and weaknesses to consider for the different stage of the VC and competitiveness improvements.

Strengths	Weaknesses
► Scale of production ► Quality ► Competition btw India and Viet Nam ► Cluster of cashew countries	► Low yields ► Poor post harvest handling ► Timing of harvest ► Cost of transport ► Narrow market linkage ► Low processing volumes ► Country risk ► Business and work culture
Opportunities	**Threats**
► Improving post harvest handling ► Rewarding quality ► Improving yields ► Reducing costs	► Low yields ► Tree diseases and pests ► Fire ► Indian self-sufficiency ► Political instability

TABLE 3: SWOT ANALYSIS OF RCN WEST AFRICAN COUNTRIES COMPETITIVENESS[12]

2.4.1 Main constraints identified in Sierra Leone

Main constraints and problems impacting on the Sierra Leone cashew value chain identified by the government (Government of Sierra Leone, 2010):

- Insufficient quantity,
- Insufficient quality,
- No warehouses,
- No proper Outgrowing scheme,
- Due to the difficult road-situation the collection of RCN is sometimes complicated,

[11] Sierra Leone Diagnostic Trade Integration Study Update 2013, World Bank
[12] Competitiveness of the African Cashew Sector, ACi, 2011.

- Lack of technical expertise (machinery),
- Lack of capacity building.

In this context, it is evidently a real opportunity for Sierra Leone to contribute to the development and improvement of its cashew value chain. Because of the regional dominant position to cultivate cashew and potential for processing, Sierra Leone could benefit from the African Cashew Initiative, recently named the Competitive Cashew Initiative (ComCashew)[13]. Nationally, the objectives are: improving cashew crop production in terms of quality and quantity, improving involvement and management of cashew processing, and improving logistics and transports throughout the value chain links and levels. It would allow for promotion of Sierra Leone Cashew value chain competitiveness (as well as the competitiveness of Western Africa area).

The overall objective of the ComCashew is presented in Figure 14.

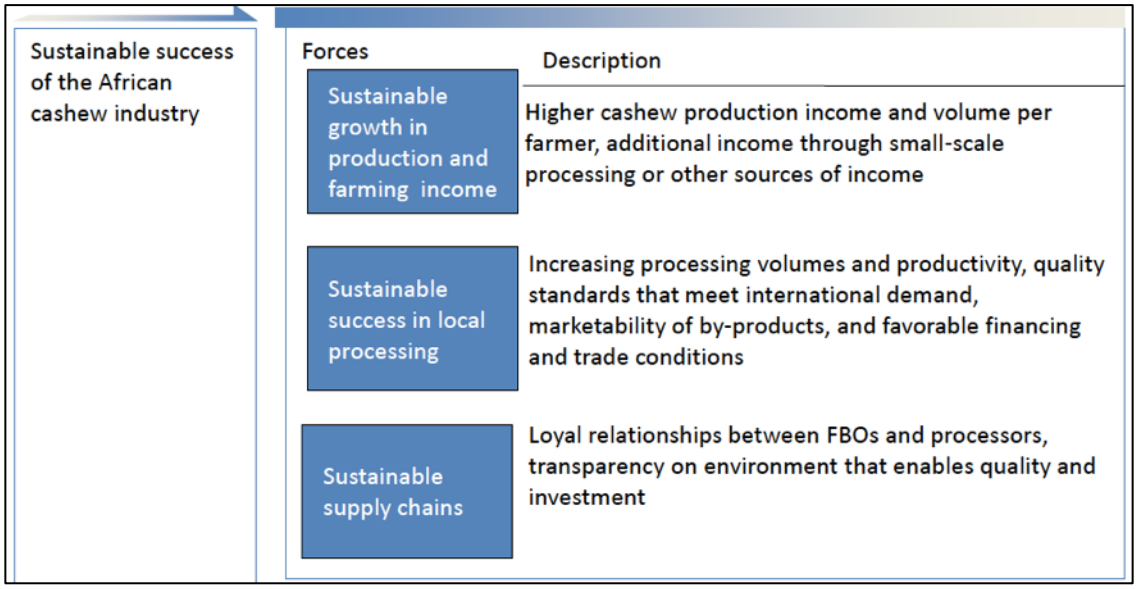


FIGURE 14: MAIN FORCES FOR CHANGES IN THE CASHEW AFRICAN VALUE CHAIN (SOURCE: GOVERNMENT OF SIERRA LEONE, 2010)

2.5 Governance in the cashew VC in Sierra Leone

As for most agri-food value chains in Africa, the cashew value chain in Sierra Leone is characterized by a large fragmentation of smallholders and a strong transactional dependence of small local suppliers and producers on large buyers. In this kind of context, the captivity of governance is correlated with a very low bargaining power and credibility of smallholders, as well as a low ability to codify knowledge and competencies in ensuring good productivity and quality of yields. Cashew producers are marginalized and cannot concretely benefit from the economic advantage of improving the cashew value chain in Sierra Leone (De Nori, 2017). It would require monitoring and control processes implementation at production and trading levels to ensure good quality and quantities. One way to counteract these disadvantages and support the socio-economic development of the cashew VC is to encourage collective actions and the creation of smallholders' associations.

Governance characteristics of the VC are dependent on the actors and market channels. Smallholders producers and processors are local and characterized by a local market governance

[13] http://www.africancashewinitiative.org, consulted on May 8th, 2018

structure. It implies codified and organized transactions between farmers, processors, local retailers, etc. It is the main governance type observed in Sierra Leone for the moment. But according to improvement objectives of the VC growth inclusiveness and sustainability, medium – large scales processing and RCN export channels could develop and bring about other forms of relational governance. The first one concerns power relationships between local exporters and international importers which is a subtle equilibrium between risks, diversity and bargaining power management. And the relationship with farmers demonstrates a clear captive or hierarchic governance structure (De Nori, 2017).

In Sierra Leone, the lack of large-farmers and the quasi monopoly of the Asian market for raw nuts explain the captive governance structure of the cashew VC.

In terms of market access and market linkage, in the RCN market, market access refers simply to the ability of growers, farmers' groups and cooperatives to assess which buyer to sell to, and whether or not the price and terms proposed represent the best available deal. The volatility of prices suggests that there is competition for product. According to many surveys conducted in African countries, many people believe that the traders keep information to themselves, deliberately putting their suppliers at a disadvantage. Moreover, in African cashew-producing countries such as Sierra Leone, market access is often limited from the outset, simply by the fact that most cashew nuts are exported in-shell for processing elsewhere. In addition, the quality of market information is very poor. Cashew processing is the key factor in developing market access, as either a localised or an international activity. Processing takes place throughout the year, and processors are always interested in the market and in developing sales and quality (ACi, 2011).

Moreover, to access the international market, the quality standards required from farmers are much higher than those of the domestic market. They therefore do not have the capacity to effectively and efficiently access the international market without the establishment of export control processes. These gaps make things far too complicated for large scale buyers who want quality and traceability.

And finally, the political context of countries like Sierra Leone is a great weakness to support opportunities for local socio-economic development and sustainable growth.

It is also interesting to have a look on the land use governance and not only on markets or exchanges between actors' governance.

Land use and land tenure in Sierra Leone

In the context of governance analysis of an agri-food value chain such as the cashew one in Sierra Leone, it is relevant to understand better the concrete situation of land use and governance. Indeed, it can have an impact on food security and yields growth opportunities.

In Sierra Leone, a high percentage of the population directly depends on land for food and livelihoods. Unfortunately, the land tenure system is not secure. The concern is, how to make the system more effective, transparent, and foremost just and fair towards all citizens.

According to the *'NATIONAL LAND POLICY OF SIERRA LEONE (2015)'* some of the main problems related to land tenure currently prevalent in Sierra Leone are:

a. Inequitable access to land;
b. Shortage of accessible land in the Western Area;
c. "Squatting" on State and private lands in the Western Area due to rapid urbanisation;

d. Insecure tenure forms and rights due to the absence of a system of registration of titles; lack of proper cadastral mapping and land information; unclear and diverging tenure forms under customary law; overlapping jurisdictions for statutory and customary law;
e. Weak land administration and management, i.e. inadequate capacity within the Ministry of Lands, Country Planning and the Environment to carry out its scope of responsibility and meet set objectives;
f. Lack of a proper cadastral and land use information database for State, private, and customary lands; and
g. Inadequate concession practices and protective mechanisms inserted to prevent "land-grabbing" in the commercial land use sector.
h. International boundary disputes, such as that of Yenga.

These issues must be considered in the functional analysis of the Cashew VC in Sierra Leone because it has an influence on opportunities for crops production national growth based on land availability, and on cash crops and especially cashew crops growth inclusiveness and sustainability at the level of smallholders. It is summarised in the following table.

Elements	Kind of information
Marketing networks	Formal and mainly informal Mainly short distribution channels Innovations (in processing and capacity building in production) Lack of training and information for yields improvement
Actors strategies (mainly at producers' level)	Smallholders do not have lots of power and opportunities for crop Cooperative and more coordinate actions planned Traders have power and bargaining power
Horizontal coordination between actors and in their relationships	Lack of confidence between the different levels of the VC. More and more coordination between smallholders through cooperatives and groups. Initiatives for integrating different stages of the VC take place.
Legal and political frameworks	Subsidies[14] and help in various forms for crop improvement (improved seeds, training, etc.) Taxes adjustments for agricultural products (for imports and exports too) Tax base is very few Policy willingness to take place on the international market
Governance	Many formal and informal rules Traders dominant position Insecure land tenure system for smallholders

2.6 Conclusion of the functional analysis

In the light of the evidence gathered in the foregoing functional analysis, it is evident that a thorough analysis of the sustainability and inclusiveness of the cashew value chain to assess the relevance of supporting its development and to target the leverage factors will be useful.

Data and information research conducted to understand better the cashew value chain in Sierra Leone allow better reflect the specificities of this value chain in Sierra Leone. Nevertheless, as the value chain is not very developed, it is not easy to find a lot of recent and reliable information about it.

[14] As the direct subventions are low, they will not be considered in the financial analysis. As the information of the global amount of subsidies was not available, it will not be considered in the assessment of the contribution of the value chain on the public finances.

West Africa is the main cashew producer in the world. Climate and topography of this region are giving opportunity for countries to enhance cashew production. Sierra Leone is in this region and is conscious of such opportunity.

Most cashew production in Sierra Leone is provided by poorly trained farmers with few means of production. This implies low crop yields (while since 2016 COOPI is collaborating with the Ministry of Agriculture of Ghana importing high yields varieties which means that youngest trees are good quality). Farmers work in self-sufficiency and combine crops. It is therefore quite difficult to estimate the costs in working time that cashew culture requires.
Some blockfarming and private planting systems are in place.

Most of the traders buy the products from the farm or village gates and resell them informally either locally or in neighbour countries. An important retailer on the market in Sierra Leone is Balmed. This private buyer attracts nearly half of the RCN production and manages the few tonnes exported from the country. There is a lack of transparency on the RCN market and this lack seem to be managed by traders. Producers are not well informed on prices and markets.

There is a real price volatility on the RCN market and traders are the actors taking most risks.

Sierra Leone is not focused on processing but on RCN trade (informal and exports to processing countries. The processing is usually done in a very traditional way in farms or villages. Processed kernels are consumed locally.

A field survey has been conducted to collect data on cashew producers, on processors and on traders.

Using the combination off various sets of data is necessary assessing the sustainability and inclusiveness of the cashew value chain in Sierra Leone as much as in financial and economic terms, as in environmental terms and in social.

The final objective consists in gathering the requested information for replying to the four assessing questions: (1) what is the contribution of the VC to economic growth? (2) Is this economic growth inclusive? (3) Is the VC socially sustainable? (4) Is the VC environmentally sustainable.

3. Economic analysis

The objective of the Economic analysis of the cashew value chain in Sierra Leone consists in collecting relevant information to answer the two following framing questions:

- What is the contribution of the value chain to economic growth?
- Is the economic growth inclusive?

The economic analysis follows the functional analysis of the value chain because much of the information and data collected can be used in both analyses. It is, for example, the case for the main actors of the VC identified, the main impacts of the VC on the global economy and on the overall economic growth of the country.

Results of the economic analysis of the VC should bring clear and detailed indications on its contribution to economic growth (including financial or actors individual impact) and on the inclusiveness of the growth and impacts.

The economic analysis of the Cashew VC in Sierra Leone begins with a financial analysis of the main VC actors (identified in the functional analysis). Then, the economic effects of the VC in the national economy is analysed and the sustainability and viability of these effects are assessed. And finally, the inclusiveness of growth generated by the VC is evaluated.

3.1 Financial analysis of the VC main actors

According to the Statistics Sierra Leone, 2015 - Population and Housing Census, a total of 203,589 households are involved in tree crops production for the agricultural sector. And it has been estimated that 0.4% of those households are producing cashew. The same census results mention that a total of 4,368 hectares in Sierra Leone are dedicated to cashew crops in 2015. It is not a high level of hectares but it is explained by the fact that cashew is a relatively recent crop in Sierra Leone and it is increasingly produced because it is a cash crop.

The financial analysis of the Sierra Leone cashew VC key actors is based on their identification and data collected from the field survey, but also on data collected and treated by De Noni in 2017. It gives indications on the size of monetary values of exchanged cashew products.

The price structure used in the AFA model and in the costs and profits analysis by main actors group is a combination of data collected through the field survey and secondary data found.

3.1.1 Cashew producers (smallholders, blockfarming, private plantations)

According to the ComCashew Baseline Survey[15], the cashew sale price by farming area varies with the seasons. The average price at which farmers sold their cashew yields in 2017 was 5,000 SLL/ kg. This figure is consistent with the data collected from the survey conducted in the context of this work. The RCN national production level used in the analysis is 4,300,000 kg (the ComCashew estimation for 2017 mentioned in Table 1.)

[15] Competitive Cashew Initiative, February 2018, Baseline Survey to Assess the Potential of Cashew Development in Sierra Leone.

In terms of production shares, on the basis of information and data collected in the field, it has been estimated that 92% of the RCN production is done by smallholders, 5% by private plantations and 3% in block farming organisations.

The quality of cashew nuts production is unfortunately very low in Sierra Leone. Yields' quality could be improved by giving more capacity to producers, such as better machines , knowledge and training, etc.

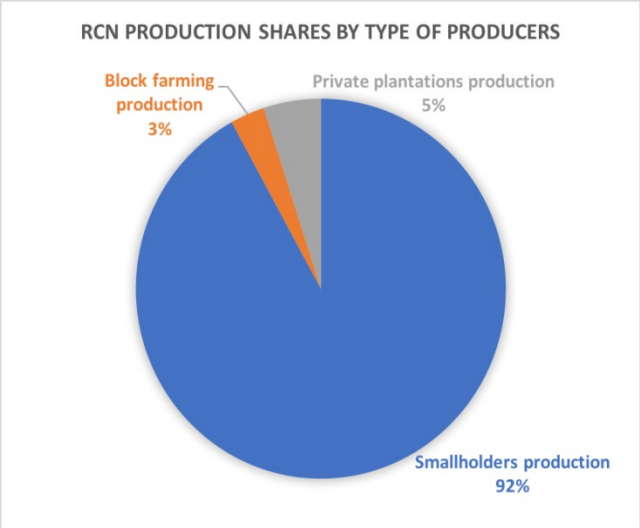


FIGURE 15: PRODUCTION OF RCN IN SIERRA LEONE[16]

ComCashew conducted a survey in 2017 to collect information and data on the potential for developing the Cashew VC in Sierra Leone. They computed an average price of 5,000 SLL per kg of RCN (Figure 16 and Figure 17).

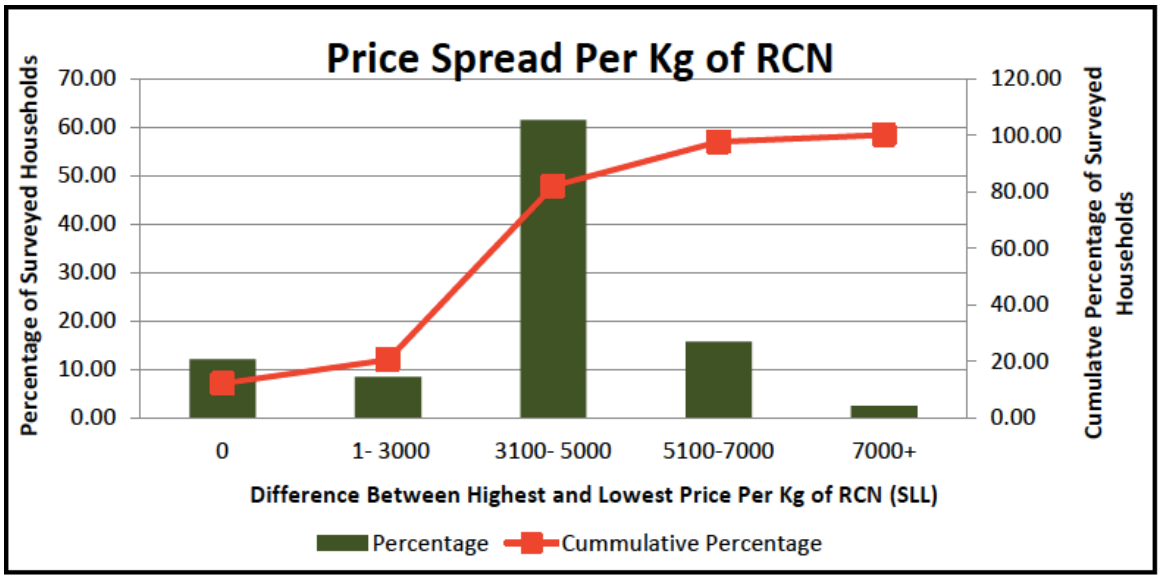


FIGURE 16: PRICE PER KG OF RCN IN SLL[17]

[16] http://cucsmilano2017.unimi.it/wp-content/uploads/2017/07/Sess3_Corsi_CUCS-15-9-17.pdf
[17] Baseline Survey to Assess the Potential of Cashew Development in Sierra Leone, Competitive Cashew initiative, February, 2018

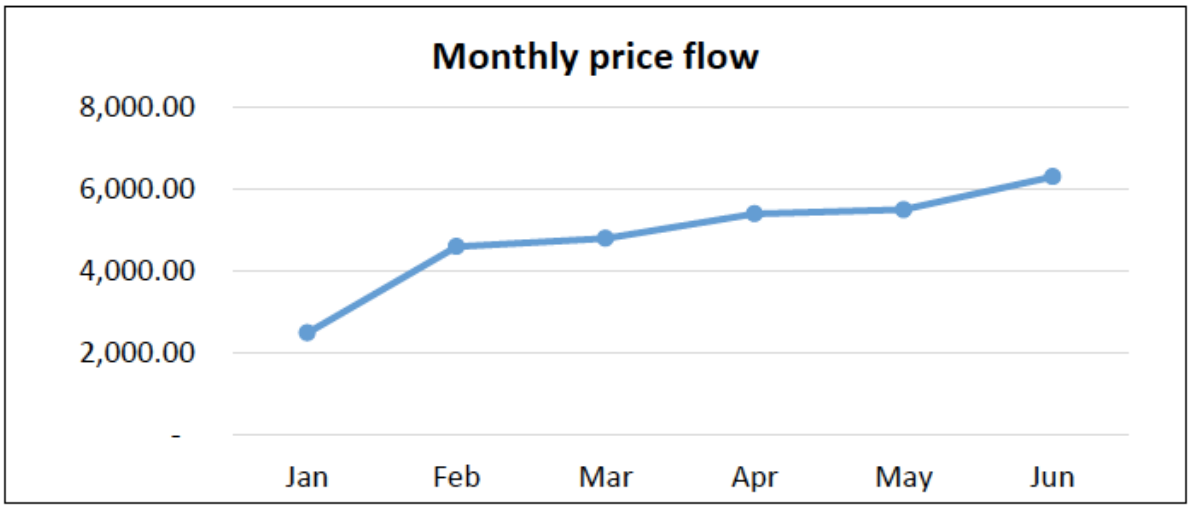


FIGURE 17: PRICE PER KG OF RCN IN SLL[18]

Comcashew estimates that 10% of the overall RCN produced by smallholders is processed locally and /or self-consumed. It means that 3,904,400 kg of RCN are traded at different levels.

In terms of consumption, cashew farmers do not purchase agricultural inputs or, if they do, only at very insignificant quantities. Yields are manual and generally, farmers hire labour for l field work, which implies some wage costs for cashew producers. An estimation of this cost per kg of RCN produced has been made based on data from the survey and secondary data found in relevant reports and documents.

Hypotheses on RCN producers in the financial analysis:

- According to field observations and the current situation of this embryonic value chain in Sierra Leone, we consider shares of the overall national production from smallholders/farmers at 92%, at 3% from blockfarming and at 2% from private plantations.
- The average cashew yield per year for smallholders is estimated at 300kg (150 kg per ha), yields for private plantations and block farming are better because of better input quality and it is estimated at 250 kg per ha. According to the field survey results, private plantations cultivate around 10 ha of cashew on average (mid- and large-size). We consider that BlockFarming is producing the 63 tons exported by Balmed.
- Labour costs / kg of RCN produced (off-farm and hired workers)[19]:
  - average labour cost of 746,361 SLL per hectare of cashew yield,
  - average cashew yields per ha = 150 in 2017, so we fixed an average of 300 kg per smallholder per year because smallholders have maximum 2 ha of cashew crops (based on Survey results),

It means that 1 kg of RNC produced costs 2,488 SLL of labour on average.

- Agricultural inputs for cashew production are not high because most of the time they are self-produced and the availability of agricultural equipment is low. Moreover, most cashew farmers received seedlings and hand tools from A4D and ProAct. For private plantations, some agricultural inputs are valued based on data gathered from Balmed and KamCashew Enterprise (both are beneficiaries of ProAct).

[18] Baseline Survey to Assess the Potential of Cashew Development in Sierra Leone, Competitive Cashew initiative, February, 2018

[19] Wonongnaa et al 2013 Profitability of cashew production in Ghana, Bots. J. Agric. Appl. Sci (2013)9 (Issue 1) 21-31

- Nevertheless, we applied an inputs' costs of 212 SLL per kg of RCN to all kind of producers because it includes seeds, seasonal work, etc.
- Seeds cost 30,000 SLL for 1 kg and 1 kg is needed for 1 ha of plantation (included in the inputs value estimate)
- Farm gate average price of 1kg of RCN: 3,500 – 5,000 SLL (we consider that nut quality is better from blockfarms and private plantations than from smallholders because of lack of training and equipment.
- Currently, no tax is considered because it is not applied on crop production and linked investments.
- Cashew trees are profitable from year 3 to 20. The most profitable age is around 10 years. We consider a live cycle of 20 years (COSTA S., BOCCHI S., (2017)).

Profits for smallholders are not high according to other types of producers. It is mainly explained by the fact that yields are bad because of a lack of material and training (about 3500 farmers received basic trainings). Private plantations are more profitable.

Field visits suggest that the blockfarming system will gain momentum once newly established plantations become profitable. Significant retailers like Balmed adopt more and more this type of structure.

It is considered that 10% of the overall RCN production is self-consumed.

3.1.2 Cashew traders (farm and village gates traders, private retailers (including exporters)

As it has been observed, local smallholders are the main RCN producers. Figure 18 shows that according to the ComCashew baseline survey of 2017, the main RCN buyers are "Farm gate buyers", "Village level buyers" and "Traders" for more than 90% of produced RCN by smallholders. A few RCN quantities is sold to processing units and "Farmer based organization (FBO)".

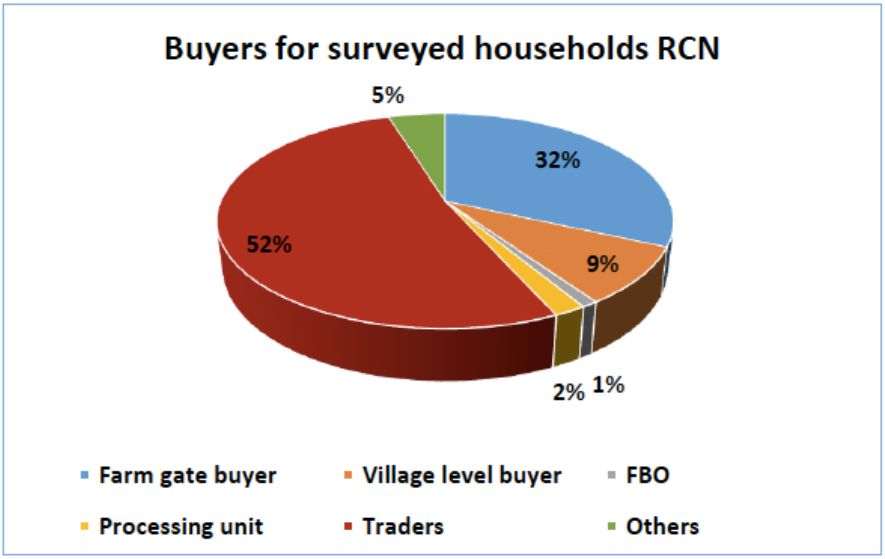


FIGURE 18: SMALLHOLDERS MAIN RCN BUYERS[20]

[20] Baseline Survey to Assess the Potential of Cashew Development in Sierra Leone, Competitive Cashew initiative, February 2018

It is more difficult to find relevant and qualitative data about trading activities. It is clearly mostly an informal section of the VC in Sierra Leone. A few figures have been collected and used in the below calculations.

Traders have great power, and strongly influence farm and village gates prices. According to results of the field survey, traders can reach profit margins of 30% to 50%. They attract a significant share of the VC value added in Sierra Leone. A significant portion of RCN traded goes unofficially to Guinea which is a hub to other countries of the region.

The range of small traders exists not because of the attractiveness of the margins that they make but because of the difficult infrastructure and the lack of local financial services (ACi, 2011). The main costs for traders are related to transports.

Hypotheses on RCN traders:

Based on a cost-benefit analysis conducted in January 2018 by Balmed, the following hypotheses can be done on traders' data:

- District evacuation price per kg of RCN is 39 SLL,
- Buying officer fee per kg of RCN is 264 SLL,
- Transportation cost per kg is 1,163 SLL from farm gate to retailers,
- Export charge per kg is 1,550 SLL,
- Jute bags per kg is 264 SLL,
- Tax per kg is 153 SLL
- Informal taxes at boarder

Different levels of traders must be taken into consideration: farm/village gate traders, retailers (such as Balmed in Sierra Leone) and exporters. Costs are not the same for those RCN trading actors in Sierra Leone. Indeed, cross-border trade is very constraining for farm/village gate traders. They face numerous legal and illegal taxes, especially at border posts. Consequently, they seek to avoid these posts by taking other routes, but through which they still have various types of taxes to pay, although in a proportion other than on the main roads.

Objectively, there are two types of exports:

- Formal export of cashew nuts via the port of Freetown
- Informal export of local production processed in Guinea.

The mission initiated a survey in Guinea to try to quantify informal exports. The results of this survey (presented in Annexes) failed to ensure a robust quantification of informal exports of local Sierra Leonean production to Guinea. Because of this constraint, it has been decided to consider three types of traders in the financial analysis: local traders (working at farms and villages gates), international traders or retailers such as the official one Balmed, and exporters (in this case, there is only one official exporter from the port of Freetown).

Not surprisingly, the most profitable trading activities are managed by retailers such as Balmed. This company is well implemented in the country.

3.1.3 Cashew processors (artisanal and industrial processors)

Processing activities are not widespread in Sierra Leone. They are almost always artisanal and within farms and villages that grow cashew.

Hypotheses on processors (see environmental analysis for details):

Costs are:

- RCN prices of 3,500 - 5,500 SLL per kg on average,
- transportation costs from farm gate to processing point of 6,000 SLL / kg but we considered a 30% cost for transport because generally, the processing unit is in or close to the village,
- labour wage of 40,000 SLL per 50kg bag (800 SLL per kg),
- roasting inputs (charcoal is on average sold at 6,500 SLL per 50 kg rice bag in the villages (EFO, 2015) (11,3kg/50Kg) and palm oil at 5,000 SLL / l on average (2,7l /50kg),
- packaging is not significant in terms of costs.

A production yield of 1 kg of kernel for 3 kg of RCN is considered for artisanal processing (details in the Environmental section of the report)

3.1.4 Main agents' accounts and profits (in 1000 SLL)

As explained in the previous section, main agents involved in the value chain have been identified. They are listed in the following table and details on their role in the VC are given.

Output	Function	Operation	Agent	Annual capacity	
RCN	Primary production	RCNSH	Smallholder	300.00(Kilogram)	
RCN	Primary production	RCNPP	Private Plantation	2,000.00(Kilogram)	
RCN	Primary production	RCNBF	Block Farming	63,000.00(Kilogram	
RCN	Trade	RCNTR	Farm/Village gate Trader	1,000.00(Kilogram)	
RCN	Trade	RCNTR	Farm/Village gate Trader	1,000.00(Kilogram)	
RCN	Trade	RCNR	Retailer	63,000.00(Kilogram	
Kernels	Transformation	RCNPR	Processor	1,000.00(Kilogram)	
Kernels	Transformation	RCNPR	Processor	1,000.00(Kilogram)	
	End Use	RCNSF	RCN Selfcons	30.00(Kilogram)	
RCN	End Use	RCNSF	RCN Selfcons	30.00(Kilogram)	
	End Use	RCNEx	Official exporter	63,000.00(Kilogram	
RCN	End Use	RCNEx	Official exporter	63,000.00(Kilogram	
	End Use	KSF	Kernels Selfcons	750.00(Kilogram)	
	End Use	RCNUO	Unofficial Transbordary Trader	1,000.00(Kilogram)	
RCN	End Use	RCNUO	Unofficial Transbordary Trader	1,000.00(Kilogram)	

TABLE 4: MAIN AGENTS, FUNCTIONS AND ANNUAL CAPACITY (SOURCE: AFA)

Assumptions and data have been integrated in the AFA software and the following values for the various items of individual accounts of main agents have been measured.

Agent	Total Production / Output	Total Costs	Total Intermediate consumption	Net operating Profit	Value Added
Smallholder	1.050.000	664.000	64.000	386.000	986.000
Private plantation	11.000.000	8.300.000	1.750.000	2.700.000	9.250.000
Blockfarming	409.500.000	350.960.000	27.560.000	58.540.000	381.940.000
Processor	17.250.000	17.024.000	8.580.000	226.000	8.670.000
Farm/village gate trader	10.000.000	9.025.000	4.525.000	975.000	5.475.000
Retailer	630.000.000	445.629.000	404.901.000	184.371.000	225.099.000

TABLE 5: MAIN AGENTS INDIVIDUAL ACCOUNTS (IN SLL) (SOURCE: AFA)

In terms of individual accounts, we can see in Table 5 that farm/village gate trader and smallholder have the lowest net operating profits. Blockfarming and retailers have higher benefits and costs than the ones represented in the chart, but it is because those agents are 'private' and considered as being an 'individual' in the study while other agents are entities aggregated later in the analysis. Blockfarming and retailer (as well as official exporter) are managed by the private company named Balmed.

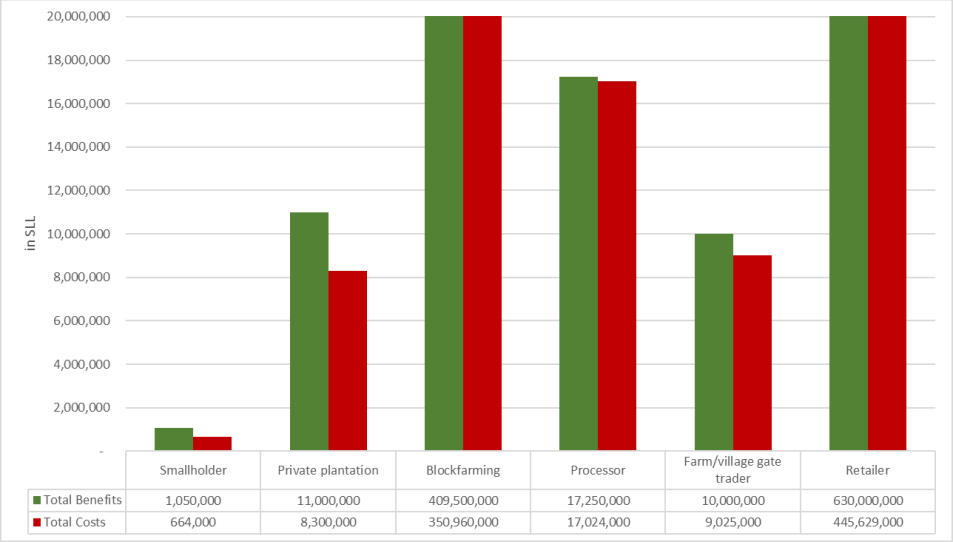


FIGURE 19: COSTS AND BENEFITS BY MAIN AGENTS IN THE VC

When accounts are aggregated on the basis of flows and products quantities exchanges between main agents, we obtain figures of Table 6.

Agent	Final output	Output in	Input in process	Good	Service	Salary	Taxes	Fixed capital	Net Operating
Smallholder	1,384,600	12,461,400	-	838,672	-	7,912,000	-	-	5,095,328
Private Plantation	-	1,545,500	-	245,875	-	428,525	-	491,750	379,350
Block Farming	-	409,500	-	27,560	-	38,400	-	285,000	58,540
Processor	1,211,813	-	302,075	300,670	-	87,391	-	505,800	15,877
Farm/Village gate Trader	50,580,000	-	18,208,800	6,322,500	-	-	12,645,000	10,116,000	3,287,700
Retailer	630,000	-	409,500	16,632	73,269	12,000	28,728	-	89,871
Value chain	**53,806,413**	----------	----------	**7,751,909**	**73,269**	**8,478,316**	**12,673,728**	**11,398,550**	**8,926,666**

TABLE 6: MAIN AGENTS AGGREGATED ACCOUNTS (IN SLL) (SOURCE: AFA)

The accounts of the main agents of the VC show that first farm/village gates traders have the highest costs and benefits. They are followed by smallholders. Both of those agents have self-employed or family work which is not considered in the costs. It is also clear in the net operating profits distribution chart by agents.

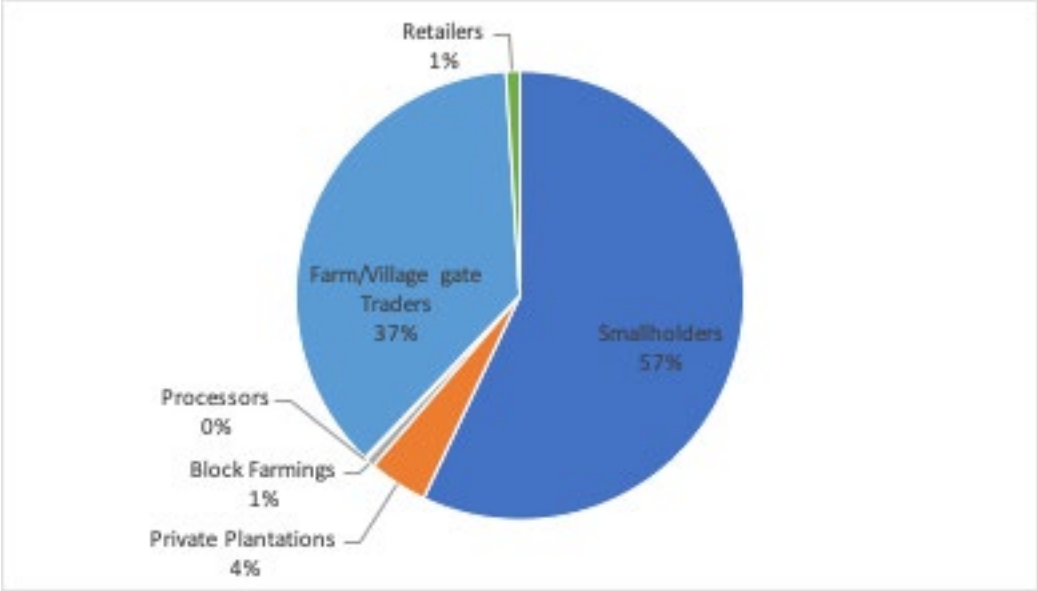


FIGURE 20: NET OPERATING PROFIT DISTRIBUTION BY MAIN GROUPS OF AGENTS OF THE VC

Other agents such as Blockfarming, Retailers, Processors are less represented in the VC and it will be observable in the following measures and charts.

3.2 Effects within the national economy

Sierra Leone is extremely poor. It is one of the least developed country in the world with a Human Development Index of 0.42 and rank 179 (on 188 countries for which HDI was measured) [21].

The territory covers 72 300 km2 and population was estimated in 2016 at 7 248 000 people. It is one of the least populated country in the world.

	1990	2000	2010	2016
World view				
Population, total (millions)	4.31	4.56	6.46	7.40
Population growth (annual %)	1.5	2.8	2.3	2.2
Surface area (sq. km) (thousands)	72.3	72.3	72.3	72.3
Population density (people per sq. km of land area)	59.7	63.2	89.5	102.5
Poverty headcount ratio at national poverty lines (% of population)	..	*66.4*	*52.9*	..
Poverty headcount ratio at $1.90 a day (2011 PPP) (% of population)	*67.7*	*62.8*	*52.2*	..
GNI, Atlas method (current US$) (billions)	0.80	0.66	2.73	3.64
GNI per capita, Atlas method (current US$)	190	140	420	490
GNI, PPP (current international $) (billions)	3.11	3.20	7.79	9.79
GNI per capita, PPP (current international $)	720	700	1,210	1,320
Economy				
GDP (current US$) (billions)	0.65	0.64	2.62	3.74
GDP growth (annual %)	3.3	6.7	5.4	6.3
Inflation, GDP deflator (annual %)	70.6	3.3	17.2	5.9
Agriculture, value added (% of GDP)	47	58	55	59
Industry, value added (% of GDP)	19	28	8	7
Services, etc., value added (% of GDP)	34	13	37	34
Exports of goods and services (% of GDP)	35	18	17	24
Imports of goods and services (% of GDP)	34	39	34	52
Gross capital formation (% of GDP)	13	1	31	19
Revenue, excluding grants (% of GDP)	5.6	11.4	9.7	*9.8*
Net lending (+) / net borrowing (-) (% of GDP)	..	..	-6.1	*-3.0*

TABLE 7: SIERRA LEONE PARTIAL DATA PROFILE (1990 – 2016)
(SOURCE: WORLD DEVELOPMENT INDICATORS DATABASE)

In Table 7, various overall data and trends are observed regarding Sierra Leone development level. For example, we can see that the population growth is hopefully lower than the GDP growth. Poverty indicators are very low but they are in a trend of improvement.

[21] http://hdr.undp.org/en/countries/profiles/SLE, consulted on May 17th, 2018.

In economic terms, the GDP is increasing and over the last few years, a positive and increasing annual growth rate is observed. According to official data from the World Development Indicators Database[22] (World Bank) presented in Table 7, in 2016, the GDP was $3.74 billion.

The same year, the *GDP per capita* was $454.6, which is less than 2013 and 2014 levels, but in 2008, the GDP per capita in Sierra Leone was $384.9[23]. Indeed, despite its steady rise over the years, GDP fell sharply in 2015, due to the Ebola epidemic and the iron ore price drop. Since then, the GDP starts to grow again.

Inflation rates are evolving in an optimistic way. Agricultural sector GDP or added value is increasing when industry and services sectors are declining. But it is influenced by the national policy. Exports are increasing but imports too. It implies a negative balance of trade. And the national accounts are in debt.

To have a better understanding of the VC contribution to the national economy, the agricultural sector, balance of trade and the public finance; it is necessary to deepen the analysis of available data on these different elements of the national economy.

3.2.1 Sierra Leone national economy

Due to the discovery of iron in Sierra Leone in 2011, the extractive sector became the main driver of growth, which reached a rate of 20.7% in 2013. Unfortunately, just after the epidemic of Ebola virus and the iron ore price drop have negatively impacted this growth rate (low rate of 4.6% in 2014 and negative rate of -20.5% in 2015). Finally, in 2016, Sierra Leone experienced a growth rate of 6.3%. Unfortunately, this rate decreased a little bit in 2017 (Figure 21).

FIGURE 21: GDP ANNUAL GROWTH RATE (2006 – 2016) [24]

[22] http://databank.worldbank.org/data/views/reports/reportwidget.aspx?Report_Name=CountryProfile&Id=b450fd57&tbar=y&dd=y&inf=n&zm=n&country=SLE

[23] https://tradingeconomics.com/sierra-leone/gdp-per-capita (consulted on May 16th, 2018)

[24] https://idea.usaid.gov/cd/sierra-leone?comparisonGroup=region, consulted on May 17th, 2018.

Nevertheless, these two shocks brought low volumes of revenue and large expenditures were made. This led to the deterioration of the public finance. The budget deficit reached 6.5% of GDP in 2016. In addition, the contraction of export earnings has created a shortage of foreign exchange and a sharp depreciation of the SLL against the US dollar, which has triggered inflation of a rate of 11.5% in 2016. Today, the inflation rate is around 15% (Figure 22). Because of these events, the State has adopted a policy of monetary discipline to avoid over-indebtedness. But today, the situation remains very precarious and worrying.

FIGURE 22: INFLATION RATES (2006 – 2016)[25]

The worst inflation rate was observed in 2009. But after that, the rate was positive and its annual average varied between 15% and 20% during the last 10 years.

In parallel to GDP growth trends, it is relevant to have a look on the GDP share of the main sectors of the national economy. In Sierra Leone, as presented in the second part of Table 7 and Figure 23, the share of the agricultural sector in the GDP was increasing over the past year and reached 59.4% in 2016.

[25] Bank of Sierra Leone (http://www.bsl.gov.sl), consulted on May 15th, 2018 and https://idea.usaid.gov/cd/sierra-leone/economy consulted on May 17th, 2018).

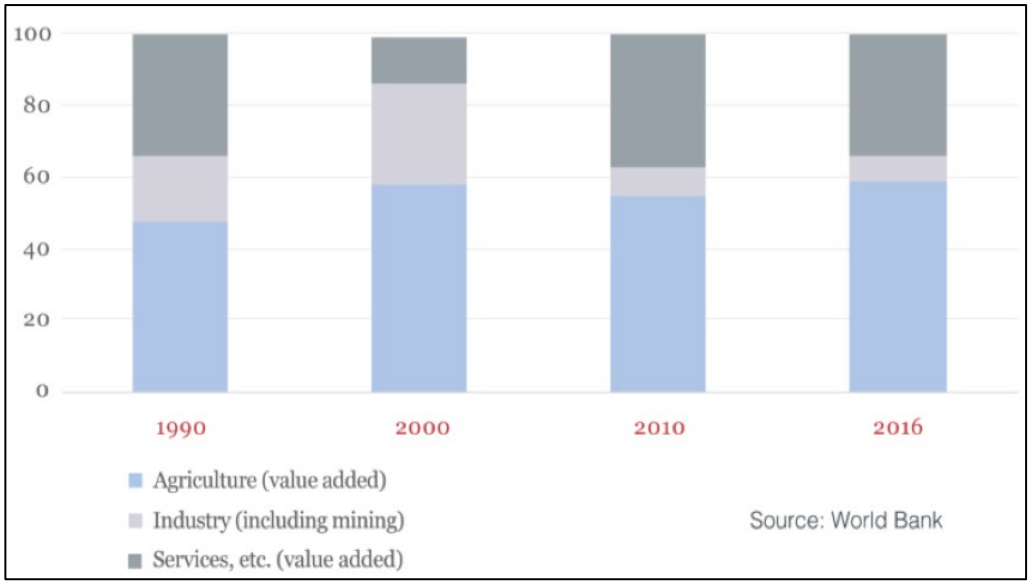


FIGURE 23: SHARES OF GDP PER SECTOR FROM 1990 TO 2016[26]

Agriculture is clearly the most significant sector in the country for growth and value added opportunities. In 2016, industry represented 7% while services represented 34% of GDP. It is confirmed by the ecological specificities of the country because there are lots of opportunities for improving agriculture profits in the country.

3.2.2 Sierra Leone agricultural sector

According to USAID[27] data for sectoral added value, the agricultural sector of Sierra Leone remained close to 60% of the GDP for a few years. In 2015, it reached 60.5% of the total GDP of the country.

[26] https://theglobalobservatory.org/2018/03/sierra-leone-election-new-opportunities-challenges/ (consulted on May 15th, 2018)

[27] Source: https://idea.usaid.gov/cd/sierra-leone?comparisonGroup=region, consulted on May 17th, 2018

FIGURE 24: VALUE ADDED OF THE AGRICULTURE SECTOR (2006 – 2016)[28]

In fact, Sierra Leone has many opportunities to develop the activities of the agricultural sector. Most actual and detailed official data on the agricultural sector and its subsectors found is data till 2013. Figures presented in the below tables are in Sierra Leone Leones (SLL) (not in USD as previously stated in the document).

Figure 40 shows the evolution of the SLL according to USD from 2009 to today.

Years	2009	2010	2011	2012	2013
Agriculture GDP in Current prices (Le'M)	4,591,100	5,429,597	6,986,660	8,355,508	10,215,234
Agriculture GDP in Constant 2006 prices (Le'M)	3,529,327	3,653,451	3,832,146	3,979,557	4,160,741
Agriculture growth rate (%)	4	3.5	4.9	3.8	4.6
Agriculture share of GDP (%)	53.8	52.9	52.3	47.2	41

Source: Statistics Sierra Leone

TABLE 8: CONTRIBUTION OF THE AGRICULTURAL SECTOR TO GDP FOR THE PERIOD 2009 – 2013 [29]

In the previous and next tables, it is especially interesting to observe trends in the increase in added values and sectoral added values between 2009 and 2013. The figures for 2013 make it possible to better understand the shares of the agricultural sector in the overall added value, but also shares of each subsector of agriculture in the sectoral added value (Table 8).

[28] Bank of Sierra Leone (http://www.bsl.gov.sl), consulted on May 15th, 2018 and https://idea.usaid.gov/cd/sierra-leone/economy consulted on May 17th, 2018).

[29] https://www.statistics.sl/images/StatisticsSL/Documents/econmic_and_financial_survey_2014.pdf

	2009	2010	2011	2012	2013
1. Agriculture, Forestry and Fishing	**4,591,100**	**5,429,597**	**6,986,660**	**8,355,508**	**10,215,234**
1.1 Crops	3,133,423	3,508,077	4,349,157	5,020,506	6,292,560
1.11 Rice	1,451,411	1,607,426	2,028,262	2,164,606	2,639,445
1.12 Fruits & Vegetable	361,644	436,477	529,950	617,938	695,991
1.13 Cassava	466,829	542,114	665,472	806,662	1,319,634
1.14 Groundnut	496,507	506,282	617,072	750,199	803,593
1.15 Maize	124,345	151,863	196,204	270,768	304,914
1.16 Sweet Potato	39,816	40,261	57,019	118,113	203,017
1.17 Cash crops (cocoa, coffee, palm oil, kolanut, etc.)	192,870	223,654	255,178	292,219	325,965
1.2 Livestock	204,849	294,397	373,838	463,642	509,855
1.3 Forestry	611,512	705,201	975,152	1,253,047	1,460,614
1.4 Fishery	641,315	921,922	1,288,514	1,618,313	1,952,204

Source: Statistics Sierra Leone

TABLE 9: GROSS DOMESTIC PRODUCT AT CURRENT PRICES (IN MILLIONS OF LEONES) – AGRICULTURAL SECTOR [30]

Food crops production is the main sub-sector and contributes to more than the half of the value added of the agricultural sector in Sierra Leone. Thanks to Figure 23, we know that the value added of the agriculture sector has increased between 2010 and 2016.

In addition, several programs[31] set up by the Ministry of Agriculture, Forestry and Food Security (MAFFS) aim to strengthen farming cash crops practices for sustaining livelihoods development and smallholders' revenues. In 2005, an Agricultural sector review has been initiated in Sierra Leone.

Indeed, because of its geography, climate and natural conditions, human resources and manpower available, Sierra Leone has concrete potential to develop food crops agriculture. Today, this sector is mainly dominated by smallholders' farmers practicing subsistence farming with traditional cultural methods and few farming inputs, but the country conditions are suitable for large scale crop production. Table 9 shows that Crop share in the GDP was significant from 2009 to 2013 and that the crop growth rate was positive and between 4 % and 5 %.

Years	2009	2010	2011	2012	2013
Crop GDP in Current prices (Le'M)	3,133,423	3,508,077	4,349,157	5,020,506	6,292,560
Crop GDP in Constant 2006 prices (Le'M)	2,451,859	2,544,441	2,691,979	2,808,057	2,952,174
Crop growth rate (%)	4.9	3.8	5.8	4.3	5.1
Crop share of GDP (%)	37.4	36.8	36.8	33.3	29.1

Source: Statistics Sierra Leone

TABLE 10: CROP SHARE TO THE NATIONAL GDP FOR THE PERIOD 2009 – 2013 [32]

Figure *25* shows that since 2004, in Sierra Leone, crop production index globally increased till 2014 when it reached a value of 170 compared to the 100 level of 2004 – 2006). The effect of the Ebola

[30] https://www.statistics.sl/images/StatisticsSL/Documents/econmic_and_financial_survey_2014.pdf
[31] http://maffs.gov.sl/projects and http://maffs.gov.sl/programs, consulted on May 17th, 2018.
[32] https://www.statistics.sl/images/StatisticsSL/Documents/econmic_and_financial_survey_2014.pdf

crisis is not represented in the chart because it was in 2015, but as agricultural GDP increased these last 10 years and crop production is the main activity of this sector, we can deduce that crop production should have continued to increase after 2015. The Sierra Leone Government has also invested in the crop production sector, by providing seeds and training over the past few years because of its potentials in terms of growth and inclusiveness.

FIGURE 25: CROP PRODUCTION INDEX[33] (USAID)

Based on data from the Agricultural Census of 2015 in Sierra Leone, the following estimates have been done on the cashew crop shares in the tree crops share of the crop production in Sierra Leone. It allows for an estimation of the share of the cashew VC in the national economy.

In Sierra Leone, untill 2015, on the 72,300,000 ha of land, only 15% was under cultivation (10,845,000 ha). 3,244,214 ha are dedicated to crop production which is represented by 2.5% (79,742 ha) for vegetable production, 74.5% (2,415,485 ha) for food crop production and 23.1% (748,988 ha) for tree crop production. It has been estimated that 0.6% of this tree crop production was covered by cashew (4,364 ha).

GDP value of Sierra Leone was 3,74 USD billion and agriculture share is 59% or around 2,21 USD billion. Crops production share of the agricultural GDP was 62% according to 2013 data. We can consider that this share increased over recent years because of agricultural and food security policies.

ComCashew Country report for Sierra Leone in February 2018 presented extrapolations from ComCashew baseline study of 2017, a National production volume of 4,300 MT of RCN and an average productivity of 150 kg/ha of RCN. We can estimate that 28,667 ha was dedicated to cashew production in 2017 in Sierra Leone.

[33] Crop production index shows agricultural production for each year relative to the base period 2004-2006. It includes all crops except fodder crops. Regional and income group aggregates for the FAO's production indexes are calculated from the underlying values in international dollars, normalized to the base period 2004-2006.

According to the *Sierra Leone Investment & Export Promotion Agency*[34], Sierra Leone has strong agricultural sector growth potential. For example, we can mention:

- The increase of the current performance that is not optimal,
- The use of more intensive methods in the farming of existing crop areas, together with increasing cultivable land, could accelerate agricultural growth from current levels.
- Infrastructures (transports and agricultural) improvement (water, transports, etc.),
- New investments attraction (access to rural finance, production diversification, private large scale investment promotion, etc.),
- The availability of arable land suitable for agriculture, the supporting ecology, the favourable climate and the adaptable topography,
- The cheap labour costs.

Because of those potentials, the government of Sierra Leone is investing heavily in the agriculture sector. Programs and projects for improving transport infrastructure to facilitate transport of goods, encouraging and supporting private sector investment, as well as lending support to farmers. Moreover, because of the declining international commodity prices, especially in iron ore which was one of the country's main export, agriculture is one of the most diversified sectors in Sierra Leone on which, the government has focused because of its growth potential.

Employment in the agricultural sector

The final results of the Population and Housing Census of 2015 in Sierra Leone give interesting indications on employment in the agricultural sector.

In Figure 26, based on census data, the agricultural sector in Sierra Leone seems to comprise more than 59% of the employment in the country. This level is confirmed by the estimates modelled by ILO and given by the World Bank (Figure 27).

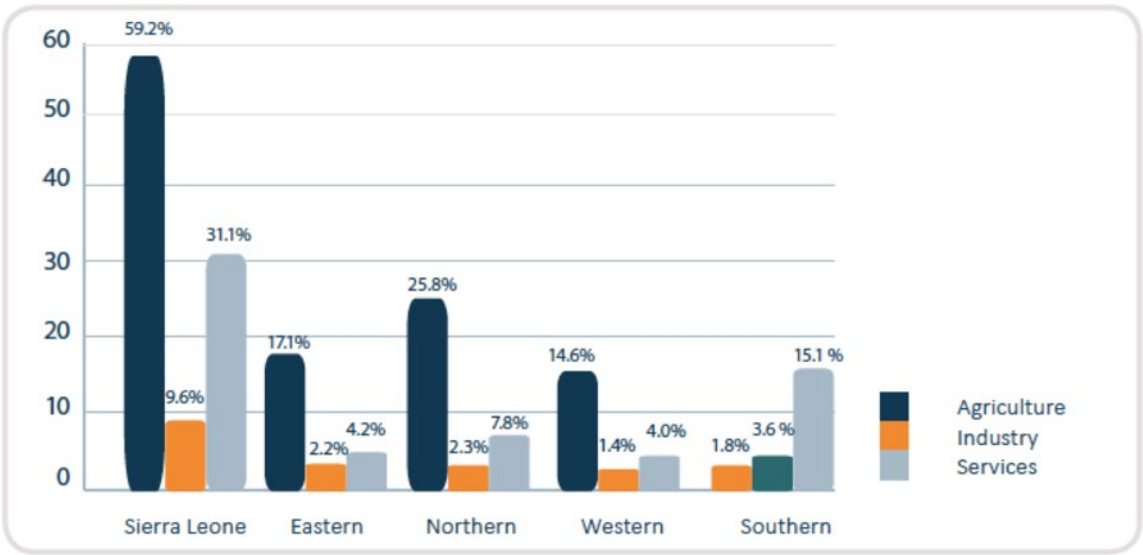


FIGURE 26: EMPLOYMENT BY INDUSTRY[35]

[34] http://sliepa.org/investment/agriculture/, consulted on May 17th, 2018.
[35] https://www.statistics.sl/images/StatisticsSL/Documents/final-results_-2015_population_and_housing_census.pdf

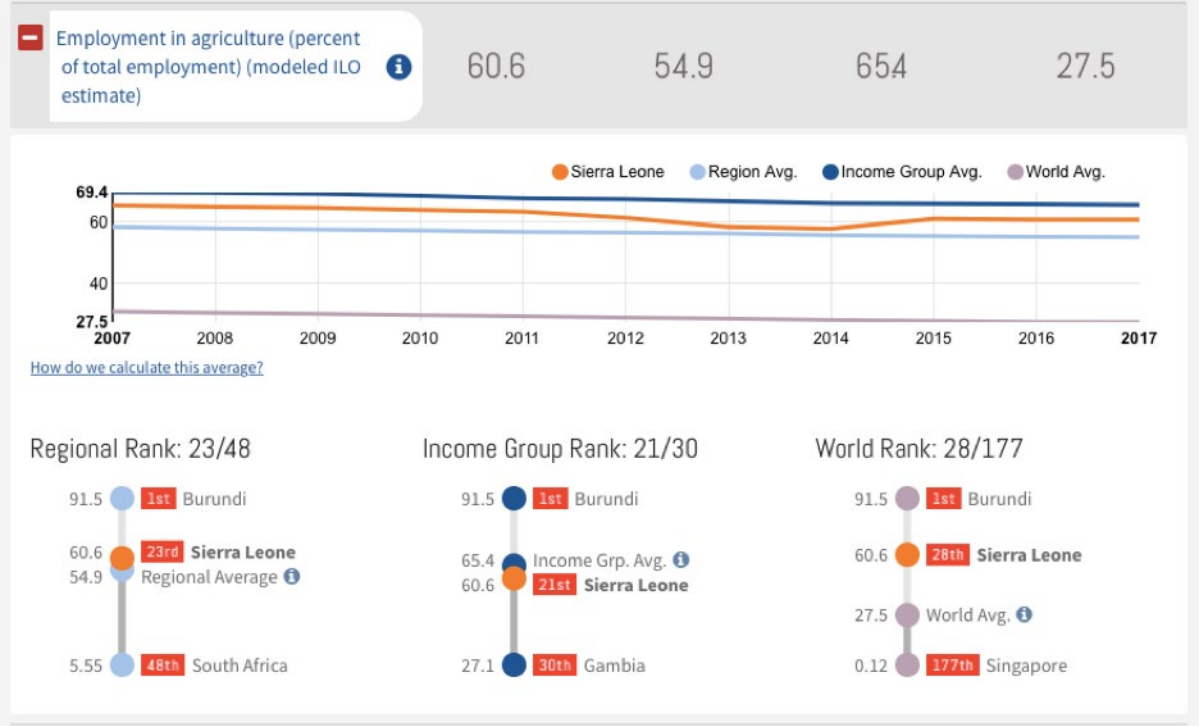


FIGURE 27: EMPLOYMENT IN THE AGRICULTURAL SECTOR[36]

In Figure 28, 83.9% of the workers in the Sierra Leone economy are self-employed. It is explained by the fact that this economy is dominated by self-sufficient agricultural activities. Moreover, in Figure 29, it is estimated that 85.4% of the households in Sierra Leone are doing crop farming.

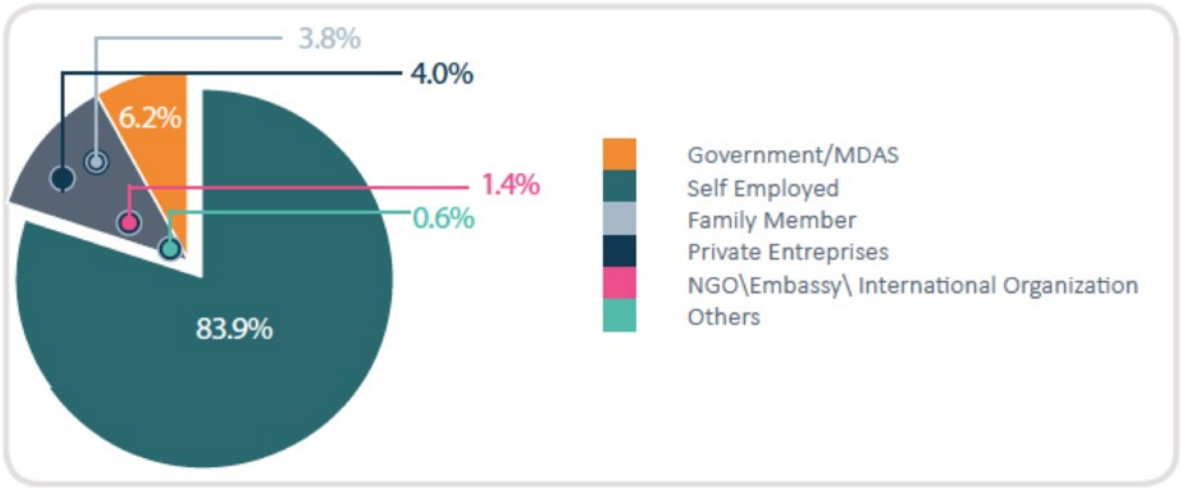


FIGURE 28: EMPLOYMENT SECTORS[37]

[36] Employment is defined as persons of working age who were engaged in any activity to produce goods or provide services for pay or profit, whether at work during the reference period or not at work due to temporary absence from a job, or to working-time arrangement... https://idea.usaid.gov/cd/sierra-leone/hunger-and-food-security

[37] https://www.statistics.sl/images/StatisticsSL/Documents/final-results_-2015_population_and_housing_census.pdf

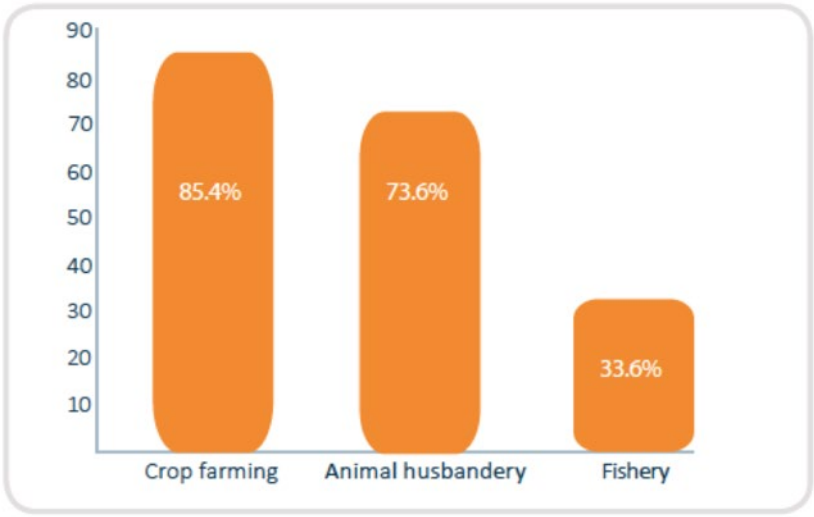


FIGURE 29: HOUSEHOLDS ACTIVITIES IN THE AGRICULTURAL SECTOR

All data and results prove that the economy of Sierra Leone operates mainly through the agricultural sector. This sector employs most the workforce, but in the form of self-employment. Since the economy is a self-subsistence economy focused on crop production, the added value of agricultural practices on workers is increasing (Figure 30) but not optimized.

The production of crops such as cashew is increasing and affecting a large part of the agricultural workers, but the added value of this type of production should be improved at the level of the workers by integrating the higher added value stages of the value chain, such as processing and direct access to the end-user market.

FIGURE 30: AGRICULTURE VALUE ADDED PER WORKER[38]

[38] Value added per worker is a measure of labor productivity value added per unit of input. Value added denotes the net output of a sector after adding up all outputs and subtracting intermediate inputs. Data are in constant 2010 USD (https://idea.usaid.gov/cd/sierra-leone/hunger-and-food-security).

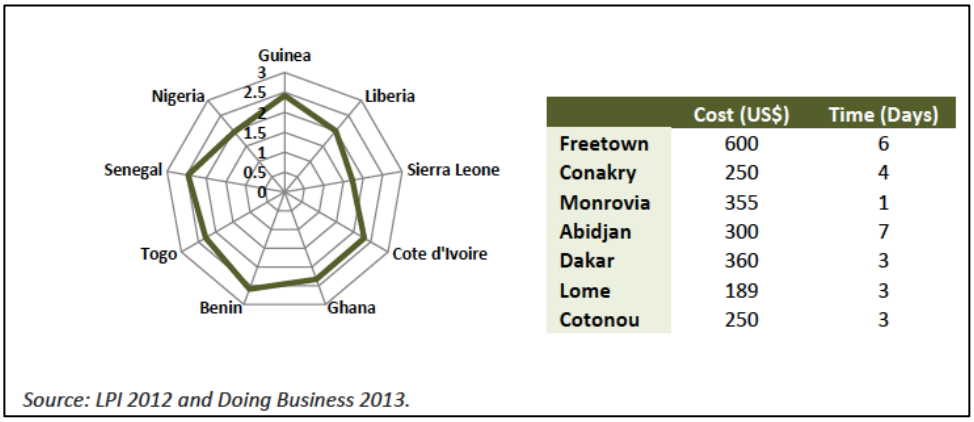
3.2.3 Balance of trade (Exports and Imports)

In Figure 31, a systemic trade deficit can be observed. It is due to the country import dependency and its weak commercial agriculture (agricultural products are not well exported). Sierra Leone's main trading partners are the Ivory Coast, United States and Benin.

Since 2015 crises, the balance of trade is still negative, but levels are increasing over time. With exports oriented supporting policies, this equilibrium will positively change.

FIGURE 31: SIERRA LEONE BALANCE OF TRADE TREND FROM 2008 TO 2017[39]

Cargo volumes are dominated by imported foodstuff and industrial and construction materials. In 2011, foodstuff accounted for 42 percent of imports, whereas industrial materials made up around 33 percent. Sierra Leone's export base through the Port of Freetown is narrow and currently dominated by agricultural products. While mineral exports are predominantly moved out of the country through dedicated port infrastructure operated and maintained by the respective mining companies.



	Cost (US$)	Time (Days)
Freetown	600	6
Conakry	250	4
Monrovia	355	1
Abidjan	300	7
Dakar	360	3
Lome	189	3
Cotonou	250	3

Source: LPI 2012 and Doing Business 2013.

FIGURE 32: CUSTOMS EFFICIENCY RANKING OF SIERRA LEONE AND NEIGHBOURS[40]

Figure 32 shows that according to 2012 and 2013 data, shipping costs to and from Freetown are the highest ones of the region. But, border taxation remains an important source of government revenue in Sierra Leone. Import duties accounted for 14.1% of total domestic revenue in 2015.

[39] https://tradingeconomics.com/sierra-leone/balance-of-trade, consulted on May 16th, 2018.
[40] Sierra Leone Diagnostic Trade Integration Study Update 2013

For a better understanding of the balance of trade effective levels and potentials, it is useful to deepen exports and imports profiles.

Exports

Since 2014, Sierra Leone exports have fallen to be very few in 2017 (Figure 33). They were at their highest levels in 2013 and 2014.

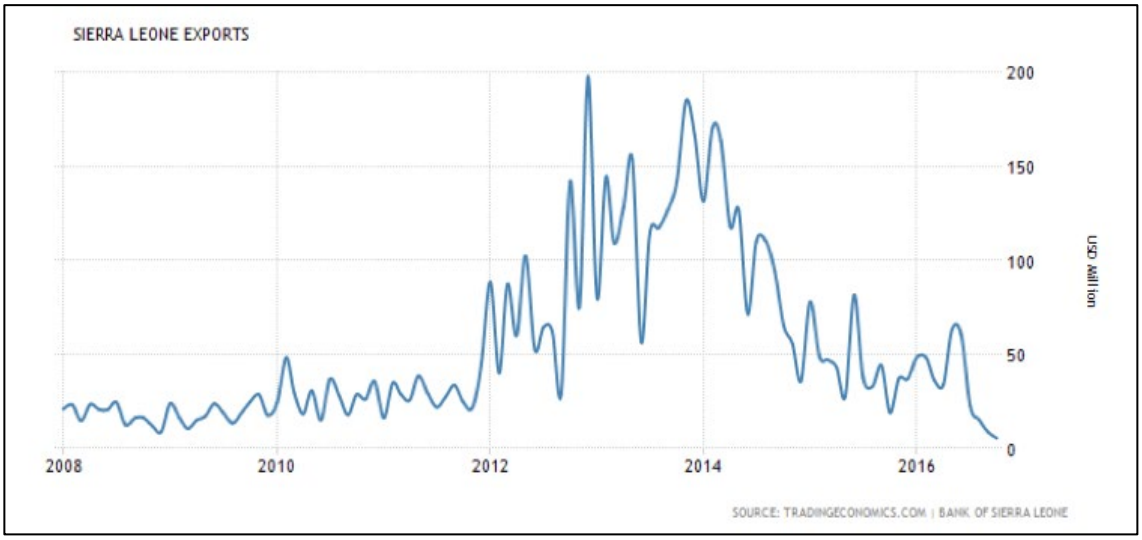


FIGURE 33: EXPORTS (2008-2017)[41]

Based on 2016 data from Trading Economics, it can be observed that exports of iron ore and diamond, which were important in previous years, are no longer the most important.

FIGURE 34: SIERRA LEONE EXPORTS BY CATEGORY (2016 DATA)

According to 2016 data given in Figure 34, the main exports categories are:

- Meat, fish and seafood preparations for 34%,
- Dairy products, eggs, honey and edible products for 31%, and

[41] https://tradingeconomics.com/sierra-leone/exports, consulted on May 16th, 2018

- Milling products, malt, starches, inlin and wheat gluten for 19%.

All those products exported are produced in the agricultural sector of Sierra Leone. As already highlighted, a governmental objective is to improve cash crops and to increase RCN and processed cashew products for export. And, the first destination is the Ivory Coast, a neighbouring country, with 35% of the exports, then the United States with 31% and then Belgium with 19% (Figure 35).

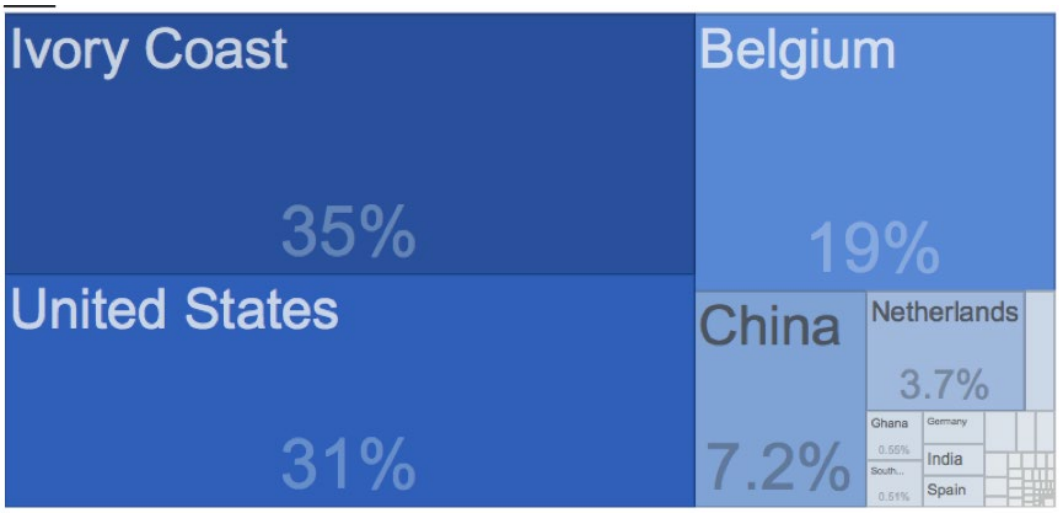


FIGURE 35: SIERRA LEONE EXPORTS BY COUNTRY (2016 DATA)

Imports

In Figure 36, it can be observed that imports are also decreasing in recent years. An import peak took place in 2015 during the Ebola crisis. Nevertheless, import levels remain higher than those of exports. It is this imbalance that implies that Sierra Leone's balance of trade is negative (Figure 31).

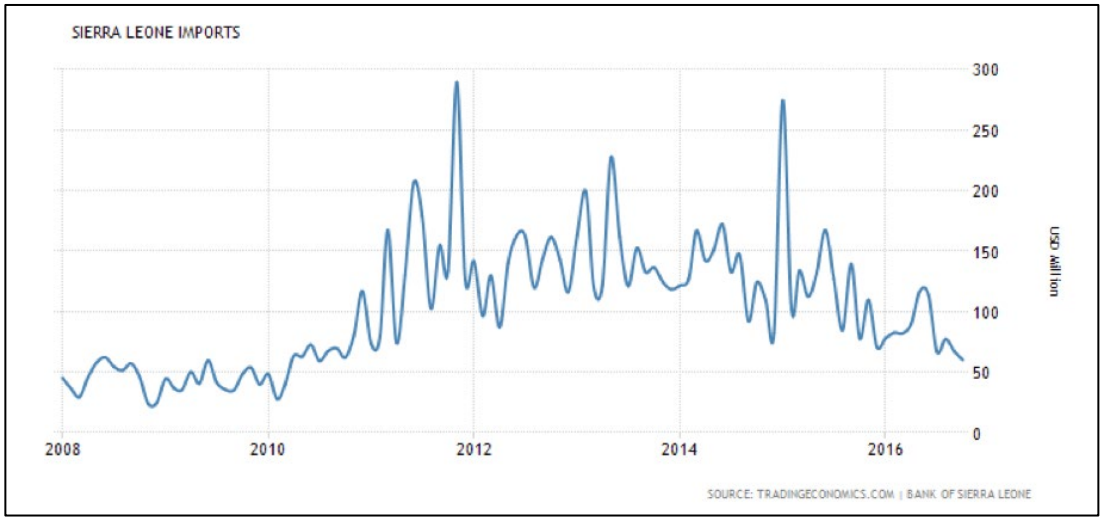


FIGURE 36: IMPORTS (2008-2017)[42]

Cereals were the most imported goods (12%) in 2016. It is followed by Vehicles (9.9%) and Machinery (9.3%).

[42] https://tradingeconomics.com/sierra-leone/imports, consulted on May 16th, 2018.

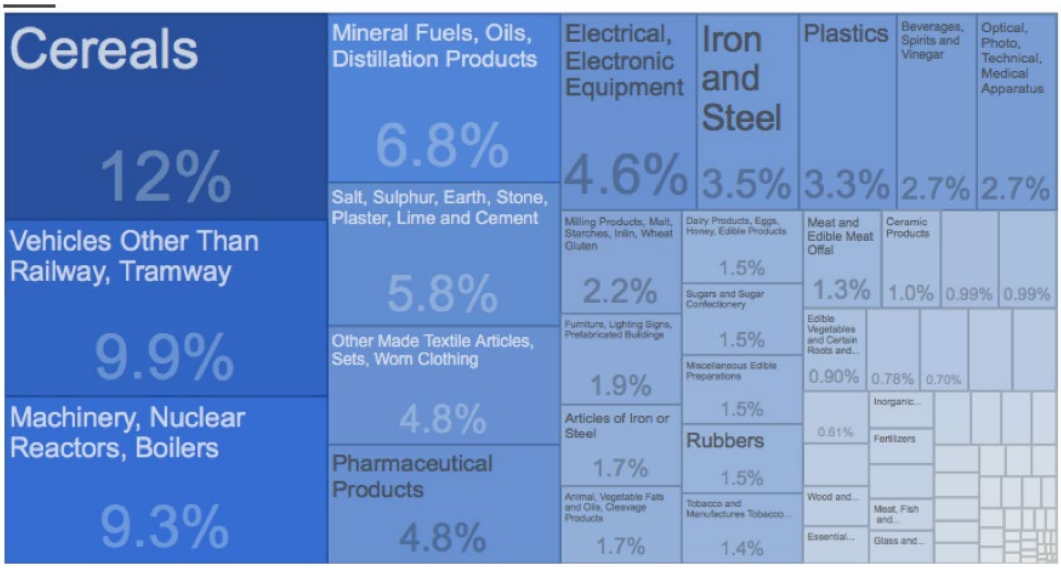


FIGURE 37: SIERRA LEONE IMPORTS BY CATEGORY (2016 DATA)

Benin is the first country of origin for imports (43%), then China (7.1%) and the United States (5.5%).

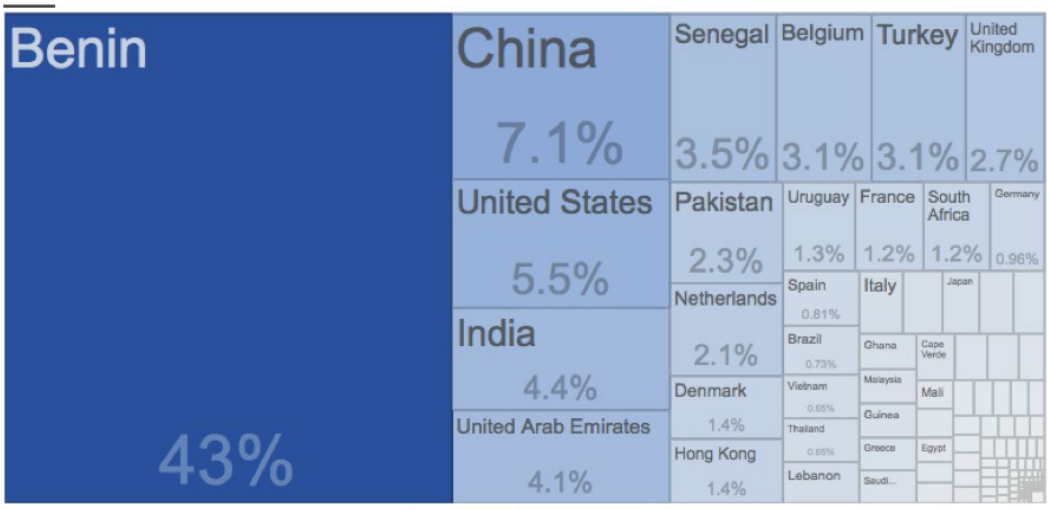


FIGURE 38: SIERRA LEONE IMPORTS BY COUNTRY (2016 DATA)

In Sierra Leone, duty taxes are subject to many changes. Border taxation remains an important source of government revenue in Sierra Leone. Import duties accounted for 14.1% of total domestic revenue in 2015.

3.2.4 Domestic accounts

As already explained, because of twin shocks since mid-2014, in Sierra Leone, growth declined dramatically from 20.7 percent in 2013, to 4.6 percent in 2014, and further to -20.5 percent in 2015 (Figure 21). The government budget was and remains under severe pressure (Figure 39). Between mid-2014 and end-2015, the Leone depreciated 22 percent against the US dollar. Consequently, banking sector vulnerabilities have increased and living standards have also deteriorated significantly since late 2014.

Since 2013, the Sierra Leone debt is continually increasing (Figure 39). In 2017, the national debt was 60.3% of the GDP.

FIGURE 39: GOVERNMENT DEBT TO GDP (2008 – 2017)[43]

According to the IMF Sierra Leone debt sustainability analysis of 2017[44], "Sierra Leone remains at a moderate risk of debt distress. *The resumption of iron ore production with related export receipts, the recovery of non-iron ore growth, and an improved fiscal revenue profile have strengthened economic performance"…"The macroeconomic outlook, though improving, hinges on the implementation of sound policies in the program period and ahead. In addition, the economic diversification strategy will take time to yield fruits. Therefore, staff reiterates the need for prudent borrowing policies grounded in sound debt management practices, continued revenue enhancement and expenditure rationalization, sustained efforts to improve public financial management, continued implementation of growth-enhancing structural reforms, and promotion of economic diversification".*

Foreign exchange rate

The USD / SLL exchange rate annually depreciates (Figure 40).

[43] https://tradingeconomics.com/sierra-leone/government-debt-to-gdp, consulted on May 16th, 2018

[44] https://www.imf.org/external/pubs/ft/dsa/pdf/2017/dsacr17154.pdf

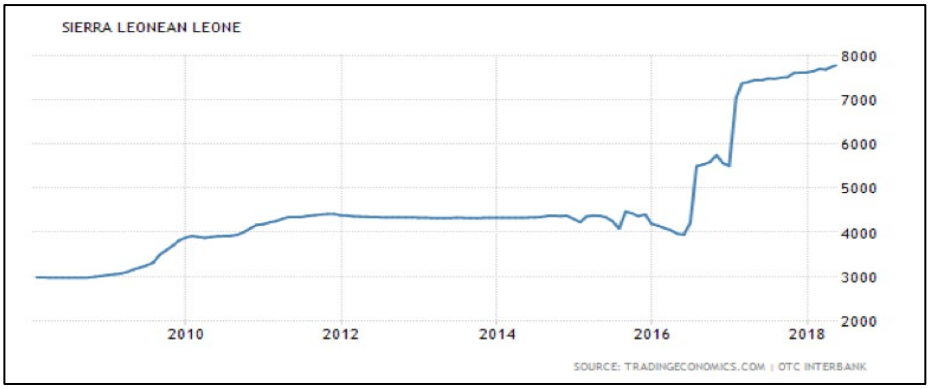


FIGURE 40: USD / SLL AVERAGE YEARLY EXCHANGE RATE FROM 2009 TO 2018[45]

The annual depreciation of SLL involves a devaluation of this money. In this economic situation, exports are more competitive and cheaper when imports are more expensive. Money devaluation is also creating inflation and it has an impact on consumption prices and wages.

This exchange rate depreciation context in Sierra Leone could have a positive impact on exports and it could boost exports to other countries. Unfortunately, it has negative effects on imports costs and it explains the continuous negative balance of trade in Sierra Leone.

The consumer price index has also been impacted by an increase till 2017 (Figure 41). This index level for Sierra Leone stayed under the world and regional levels for 10 years but it is above since 2017. It means that according to its neighbours, Sierra Leone offers more expensive baskets of goods and services to its population. Evidently, it has a negative impact on people living in Sierra Leone.

FIGURE 41: CONSUMER PRICE INDEX (2007-2017)[46]

As reported in the Endline Survey Statistical Analysis Report 2016, consumer price index (CPI) inflation has trended lower over the past two years on the back of government support to the agricultural sector, which together with favourable weather has helped to keep local food markets well supplied and kept food price pressures subdued. Moreover, a relatively stable exchange rate

[45] https://tradingeconomics.com/sierra-leone/currency, consulted on May 16th, 2018.
[46] https://idea.usaid.gov/cd/sierra-leone

and proactive monetary policy have facilitated a curbing in consumer price pressures. However, the Ebola outbreak has led to an uptick in price pressures and a depreciating Leone.

Taxes and incentives linked to the agricultural sector[47]

According to information available on the National Revenue Authority of Sierra Leone (NRA)[48], there are several taxes applicable on people and goods and services linked to the agricultural sector. There are also incentives.

In terms of taxes, the following ones are applied to individuals and partnerships:

- The Capital Gains Tax (CGT) is a tax on gains or the profit realized on the sale of a non-inventory asset that was purchased at a cost amount that was lower than the amount realized on the sale. Tax rate is 30% of the capital gain acquired from the disposal of a chargeable asset.
- **The Goods and Services Tax (GST)** is a modern form of sales tax. It is applied on the domestic consumption of imported and locally-produced goods and services, paid as a percentage of their value at the time they are imported, sold, exchanged, or delivered. From the start date of 1st September 2009, this tax is applied at a single rate of 15% on many goods and services (including imports) supplied in Sierra Leone for local use or benefit.
    - *'Standard-rated' Supplies* are those goods and services that are taxed at a standard rate of their total value in money at the point of sale, exchange or importation. There is a single standard rate of GST in Sierra Leone of fifteen per cent (15%).
    - *'Zero-rated' Supplies* are those goods and services that are taxable but for economic reasons, are taxed at zero per cent (0%). Examples of zero-rated supplies are exports (except the exports of minerals, including gold and diamonds), and goods shipped as stores on ships or aircraft leaving Sierra Leone. Zero-rating is important for exports since it maintains Sierra Leone's competitiveness in world markets.
    - *Standard rated supplies and zero-rated supplies are together known as 'taxable supplies.'*
    - *The Import Customs Duty* is a declaration related ad valorem tax collected on imports by the Customs. The payment amount is advised on an Assessment Notice generated by the system. It is also referred to as import tax and import tariff.
    - When it is a percentage of the customs value of goods (Cost, Insurance and Freight – CIF Value or tax base or statistical value), it is referred to as Ad valorem tax. When it is amount per unit or weight etc, it is referred to as specific tax.
    - The import duties are based on rates defined in the external customs tariff of the country, with more than 5,000 tariff lines, each tariff line with its own rate. Currently in use is the tariff 6 bands (0%, 5%, 10%, 15%, 20% and 30%) depending on the product description.

Sierra Leone's tax revenue increased steadily during the review period. In 2015, income taxes, goods and services tax, and taxes collected by the Customs and Excise Department accounted for about 87.6% of total government domestic revenue (Table 11).

[47] https://www.pkf.com/media/10028470/sierra-leone-tax-guide-2016-17.pdf
[48] http://nra.gov.sl, consulted on June 21st, 2018

Source/type of tax	2010	2011	2012	2013	2014	2015
Total domestic revenue (Le billion)	**987.8**	**1,462.1**	**1,873.5**	**2,280.0**	**2,226.2**	**2,330.2**
	(in % of total)					
Income taxes	**23.9**	**32.4**	**41.5**	**40.8**	**40.2**	**38.7**
Company tax	7.7	5	10.8	11.7	12.1	10.5
Personal income tax	14.9	26.9	30.5	28.8	27.8	27.9
Other taxes	1.3	0.4	0.2	0.2	0.3	0.3
Goods and services tax	**25.3**	**24**	**22.3**	**19.3**	**20.6**	**25.5**
Customs and Excise Department	**35.4**	**23.5**	**18.1**	**21.5**	**22.8**	**23.4**
Import duties	20.7	19.3	12.6	11.8	12.8	14.1
Excise duties	13.9	3.8	5.3	9.7	10.3	9.3
Other	0.8	0.4	0.2	0.1	0	0
Mines Department	**3.2**	**13.8**	**11.9**	**10.3**	**8.4**	**3.7**
Royalty on rutile	0.1	0	0.3	0.2	0.1	0.3
Royalty on bauxite	0.4	0	0.1	0.1	0.3	0.3
Royalty on diamonds and gold	0.6	1.1	1.1	1.5	1.8	1.2
Royalty on iron ore	0	0	3.3	5.5	4.3	0.3
Licences	2	12.7	7.1	3	1.8	1.6
Other departments	**6.4**	**4.7**	**4.3**	**4.4**	**4**	**4.7**
Road user charges and vehicle licences	**5.8**	**1.6**	**1.9**	**3.7**	**3.9**	**4.1**

Source: Information provided by the authorities.

TABLE 11: GOVERNMENT DOMESTIC REVENUE COMPOSITION AND EVOLUTION FROM 2010 TO 2015[49]

As mentioned, there are also a few incentives that have been implemented in the agricultural sector to foster growth. For example, the focus of the National Sustainable Agriculture Development Plan, especially the Smallholder Commercialisation Project component, is the commercialization of the sector, increasing food production to create food self-sufficiency and enable exports.

Concerning agricultural inputs imports, Sierra Leone established the Finance Act 2013 that states a 5 years' duty-free import of agricultural inputs (fertilizers; pesticides; insecticides; seeds and seedlings; hybrid tree seeds; seed animal for feeding; day-old chicks; and animal semen). Imports affect the cashew VC in Sierra Leone at the level of agricultural inputs and processing machinery, but not significantly.

Through various large-scale projects, the government is also trying to attract private investors to develop more infrastructure for crop yields and processing for the export of agricultural products.

3.2.5 Measuring the effects of the cashew VC within the national economy

To measure the effect of the cashew VC on Sierra Leone national economy, operating accounts of the main agents identified in the VC have been consolidated. Because of this merging of individual operating accounts, the consolidated value added and the intermediary consumptions in the VC have been measured (Table 12).

[49] WTO, Sierra Leone - Trade Policy Review, 10th January 2017.

Agent	Total income	Total intermediate consumption	Value added (VA)
Smallholder	13,846,000	838,672	13,007,328
Private Plantation	1,545,500	245,875	1,299,625
Block Farming	409,500	27,560	381,940
Processor	1,211,813	602,745	609,068
Farm/Village gate Trader	50,580,000	24,531,300	26,048,700
Retailer	630,000	499,401	130,599
Value chain	53,806,413	7,825,178	45,981,235

TABLE 12: AGENTS INCOMES, INTERMEDIARY CONSUMPTIONS AND VALUE ADDED (IN 1000 SLL)

To measure the value chain growth generation, it is relevant to have a look on the value-added creation by agents directly in the VC and indirectly.

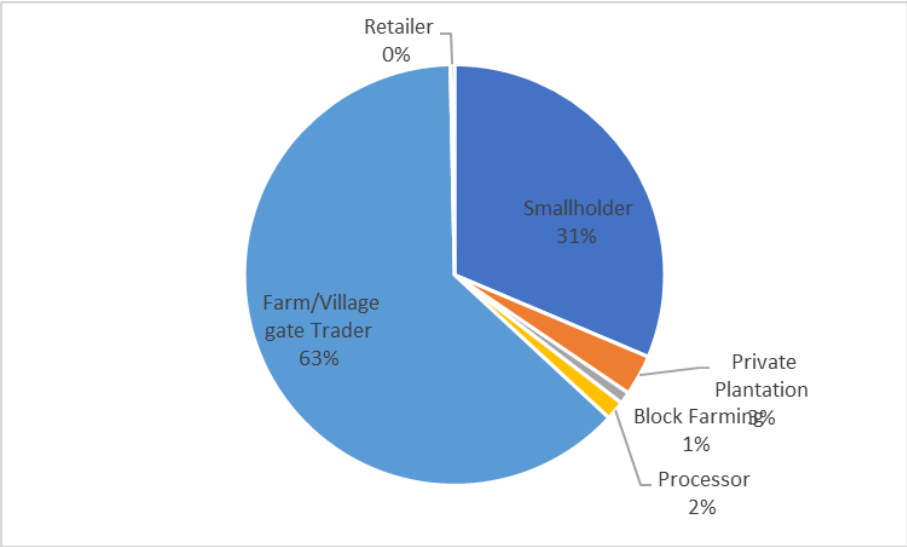


FIGURE 42: DIRECT VALUE ADDED DISTRIBUTION IN THE VC

Growth within the VC is mainly generated (63%) by farm/village gates traders. Then, smallholders producing cashew as primary production are generating 31% of the direct value added in the VC. Both those groups of agents are the biggest ones in the value chain. Other agents are generating value added but at a smaller scale because they are not very well represented in the VC according to their activity and impact in the overall cashew VC in Sierra Leone.

	Direct effect	Indirect effect	Totals
Imports	7.333.181	0	7.333.181
Labor	8.478.316	0	8.478.316
Tax	12.673.728	0	12.673.728
Finance	0	0	0
Depreciation	11.398.550	0	11.398.550
Net Operating Profit	8.926.666	0	8.926.666
AV Not Ventilated		491.997	491.997
IC Not Ventilated		0	0

TABLE 13: SUMMARY TABLE OF EFFECTS OF THE VALUE CHAIN

Effects are the sum of direct and indirect effects generated in the value chain. Based on these values, it is relevant to measure the level of integration within the national economy (total VA / Production of the value chain): 45,981,235,000 SLL / 53,806,413,000 SLL = 85.46 %.

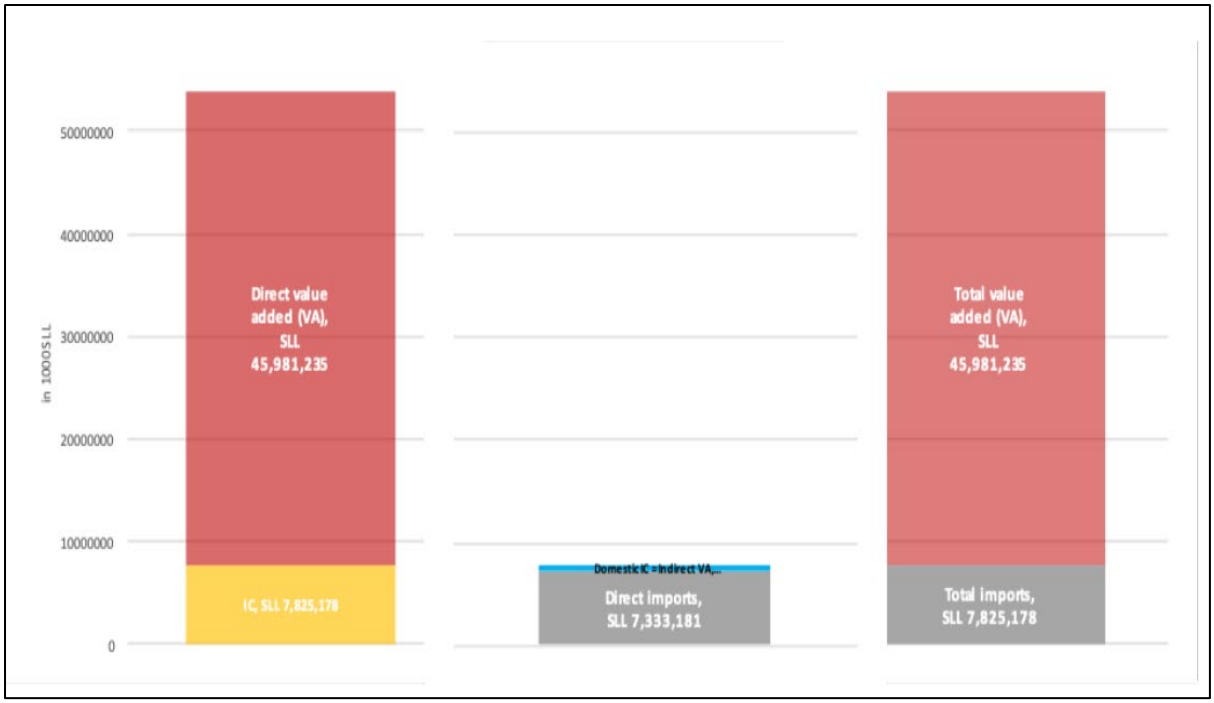


FIGURE 43: TOTAL VALUE ADDED, DIRECT AND INDIRECT EFFECTS MEASURED FOR THE CASHEW VC IN SIERRA LEONE[50]

The analysis of the total value added of the cashew VC in Sierra Leone allows informing on the VC level of integration within the national economy. It gives an indication on the potential of growth generation of the VC.

In the cashew value chain in Sierra Leone, growth is mainly generated by direct value added created by the main agents of the VC. As observed earlier (Figure 42) farm/village gates traders are the biggest VA generators. Domestic Intermediate consumption or indirect value added is very low, quite insignificant. Total imports value is very close to Direct imports value. In this value chain, indirect effects are not significant.

Processing value added generation is not significant because it is often integrated in the smallholders or communities' agricultural activities and self-consumed. Other agents are not functioning at the same scale than smallholders and traders. It explains why they do not stand out in terms of growth generation. The major part of imports is dedicated to transport activities by traders (vehicles, fuel, ...) and machines for processors.

In the next sections, we will analyse if the value chain is sustainable and viable in the national economy of Sierra Leone and if growth is inclusively distributed.

3.3 Sustainability and viability within the global economy

The situation of the national economy of Sierra Leone, as well as its agricultural sector were analysed. Opportunities for growth generation in the subsector of cash crops in agriculture exist and are generative of growth.

50 Order of magnitude of the estimates based on data and analysis of this report

Data analysed in the previous sections demonstrate that the Sierra Leone economy is creating growth. This growth comes from the agricultural sector and mainly because of crops subsector.

The real dark spot of the national economy at the level of the global economy is the balance of trade. Several negative effects are converging: the exchange rate depreciation, the inflation, the level of imports compared to the level of exports, etc.

Implementing strategies that enhance crop yields and exports would be appropriate to make the economy more sustainable.

In this perspective, increasing cashew production and especially investing in the links of the most valuable and growth providing value chain such as processing, would be relevant in the case of Sierra Leone.

Viability of the VC within the global economy is estimated according to the values of the Nominal Protection Coefficient (NPC) and the Domestic Resources Cost (DRC).

The team measured the same indicators and obtained the following values:

Based on data and information gathered for the study, the NPC has been measured as following:

> Total value of VC production at country boarder = total production at market price = 53,806,413,000 SLL
>
> Total FOB value (at port gate) of 4,300,000 kg of RCN = RCN Production at international price
> * (FOB price in USD = 1,75[51] USD/kg) * (real exchange rate of 7500*1.1) = 4,300,000 * 14,437.5 SLL = 62,081,250,000 SLL
>
> NPC = 53,806,413,000 SLL / 62,081,250,000 SLL = 0,87.

And the DRC:

> Non tradeable domestic factors at market price (without transfers) : 11,105,696,000 SLL
> / Production at international Price – Tradeable goods and services used in the VC at international prices (62,081,250,000 SLL - 4,627,915,000 SLL)
> = 0,19.

Both measuring systems gave similar values that are comparable in order of magnitude and bring the same conclusions.

[51] Source: N'kalo, Cashew market report 2017, https://docs.wixstatic.com/ugd/d6c806_59c3be8403fb4042b1732cef514ff904.pdf

3.4 Growth inclusiveness

In Sierra Leone, the Income Gini Coefficient was estimated at 62.9 in 1989 and the most actual estimated level was 34 in 2011 and 35.4 in 2013[52]. It means that the distribution of income becomes better and more equal in the country.

Based on what has been analysed in terms of growth of the GDP and then of the agricultural sector and finally of the crops, the growth clearly touches a value chain like cashew. In addition, in 2017, it was estimated that 60.0% of workers are in the agriculture sector.

Income (Net operating surplus) distribution within the cashew VC

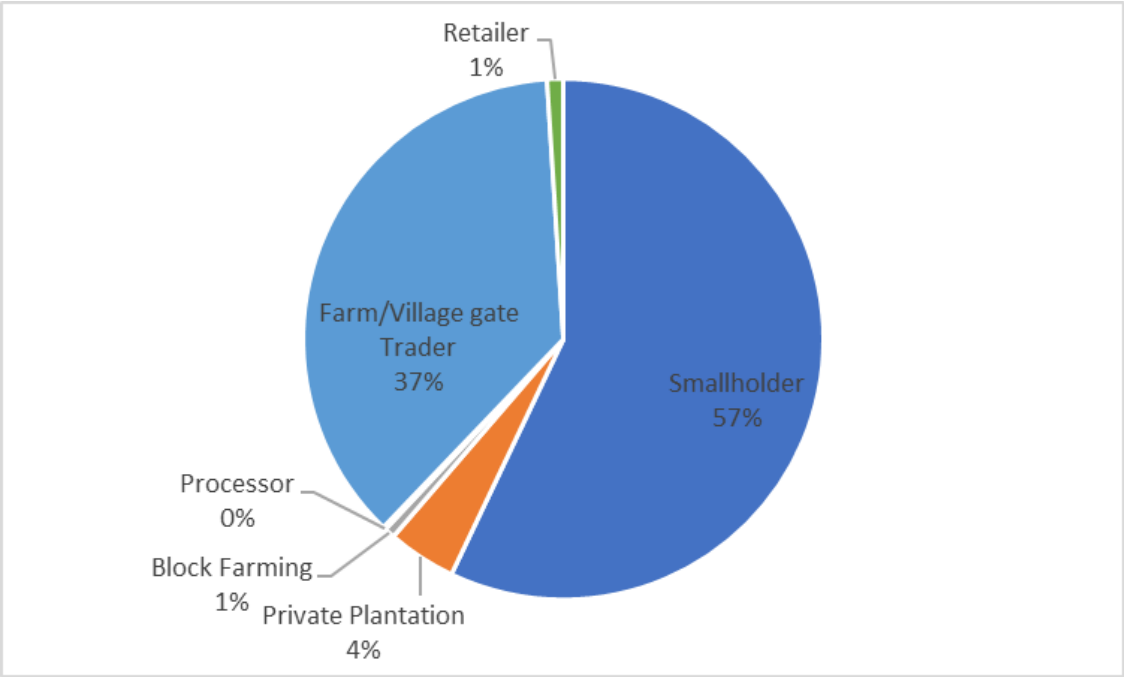


FIGURE 44: NET OPERATING SURPLUS DISTRIBUTION WITHIN THE CASHEW VC

To complete this growth inclusiveness analysis of the cashew VC in Sierra Leone and its effects on agents and labour, it is relevant to read the section of the Social Analysis about working conditions (Working conditions).

52 http://hdr.undp.org/en/content/income-gini-coefficient, consulted on May 25th, 2018.

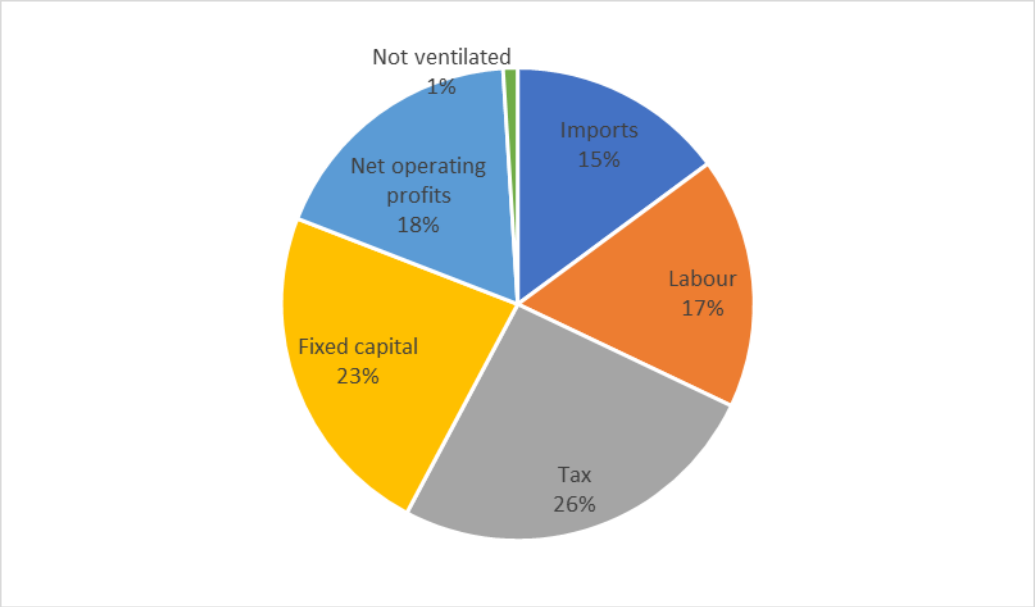


FIGURE 45: EFFECTS DISTRIBUTION WITHIN THE CASHEW VC

Conclusion of the economic analysis

VARIABLE	VALUE (UNIT)	DATA	SOURCE
Number of cashew farmers	14,500	2015	ComCashew
National production of rcn	4,300 MT	2017	ComCashew
Cashew productivity	150 kg/ha	2017	ComCashew
Agricultural land	3,435,000 ha	2015	Agricultural Survey 2015
Land under cultivation	10,845,000 ha	2015	Agricultural Survey 2015
Crop land	3,244,214 ha	2015	Agricultural Survey 2015
Tree crop cultivation	3,164,472 ha	2015	Agricultural Survey 2015
Estimation of cashew land (own)	4,300,000 kg / 150 kg = 28,667 ha	2017	Own
Maximum land for cashew smallholders	2 ha	2018	Field Survey De Nori (2017)
Agriculture va per ha of agricultural land	449 (Constant 2010 USD)	2017	Africa Agricultural Status Report 2017
National gdp	3,74 billion USD	2016	UNDP – USAID
Gdp growth rate	6.3 %	2016	USAID
Share of agricultural sector in gdp	59 % (increasing)	2016	USAID
Smallholders doing crop farming activity	85.4 %	2015	Agricultural Survey 2015
Average income for smallholder from cashew	729,468 SLL / holding 1,560,000 SLL / smallholder	2016 2017	Endline Survey Statistical Analysis Report Cashew, Cocoa and Coffee production In the A4D intervention regions ProAct – Sierra Leone, Baseline Survey, 2017
Average income for agricultural skilled worker	253,957 SLL / month 10,000 – 15,000 SLL/day	2014 2018	Economic and Financial Survey 2014 Field work
Employment rate in agriculture	59 %	2015	Population and Housing Census
Self-employment rate in agriculture	76.9 %	2015	Agricultural Survey 2015
IMPORTS IN THE VC	Insignificant	-	-
EXPORTS OF THE VC	63,000 kg of RCN	2017	Balmed 2018
TAXES ON PRODUCERS	none	-	-

Fees and taxes on retailers / exporters	FEES OF 303 SLL / KG TAX OF 153 SLL / KG EXPORT CHARGES OF 1,550 SLL / KG	2018	BALMED COST-BENEFIT ANALYSIS 2018

TABLE 14: SUMMARY OF RELEVANT INFORMATION / DATA ON THE VC USEFUL IN THE ECONOMIC ANALYSIS

The purpose of the economic analysis is to collect and analyse as much and as recent as possible data to answer the Framing Question 1: What is the contribution of the Cashew VC in Sierra Leone to economic growth? And Framing Question 2: Is this economic growth inclusive?

Framing questions / answers for the economic analysis

Much of the data and information needed to measure or assign numerical value to indicators has been presented in both the functional and economic analyses. The elements listed in the table below are synthetic and conclusive.

Framing Question 1: What is the contribution of the VC to economic growth?	
CQ1.1	**How profitable and sustainable are the VC activities for the entities involved?** **Indicators:** Operating accounts available in AFA and in the financial analysis section of the report. Smallholders and Traders have the highest profits in the VC. Processors do not have high profit, but at this stage actors of the VC are no well represented in Sierra Leone.

Framing Question 1: What is the contribution of the VC to economic growth?	
CQ1.2	**What is the contribution of the VC to the GDP?** **Indicators:** Total Value of production according to AFA figures = Final Output = 53,806,413,000 SLL Total Value Added = 45,981,235,000 including 8,478,316,000 SLL of wages + 8,926,666,000 SLL of operating profits + 12,673,728,000 SLL of taxes, … (according to AFA). Value Added share of the GDP: (45,981,235,000 SLL / 27,614,660,000,000 SLL (value of GDP 2016 in SLL[53])) = 0.17 % Rate of integration within the national economy (total VA / Production of the value chain): 45,981,235,000 SLL / 53,806,413,000 SLL = 85.46 %
CQ1.3	**What is the contribution of the VC to the agriculture sector GDP?** **Indicators:** The agricultural sector share of the GDP was 59.4% in 2016. It has been estimated that from 2009 to 2013, the average agricultural sector share of GDP was 49,44% and the average crop

[53] Report on the 2016 and 2017 real gross domestic product (RGDP) figures at 2006 prices, Statistics Sierra Leone National Accounts Units, August 2018.

	sector share of national GDP was 35%. Both sector and subsector had the same range of growth rates. Value Added share of the Agriculture sector GDP in 2016[54] = 45,981,235,000 SLL / 14,030,313,000,000 SLL = 0.33 % In Sierra Leone, 60.6% of the work force is working in the agricultural sector. Around 83.9% of this workforce is self-employed and according to 2015 Agricultural Survey, 85.4% workers are working in crops agriculture.
CQ1.4	**What is the contribution of the VC to the public finances?** **Indicators:** Taxes are not collected on agricultural activities incomes. Taxes affect traders because of unofficial and official taxes collected at different locations in the country. Farm/village gate traders avoid crossing the official boarder through Guinea and use alternative roads with unofficial but lower taxes applied. The official retailer / exporter is taxed. There is no subsidy programme financed by the Government. According to AFA data and measures, there is an amount of 12,673,728,000 SLL of taxes collected through the cashew VC. Because there is no subsidies, it is favourable for the public funds. Public Funds Balance: Since 2013, the Sierra Leone debt is continually increasing (Figure 39). In 2017, the national debt was 60.3% of the GDP.
CQ1.5	**What is the contribution of the VC to the balance of trade?** **Indicators:** The Balance of Trade of Sierra Leone is negative since 2014. In 2016 it was -50 million USD. In Sierra Leone, the main imports are Cereals for 12% and Vehicles for 9.9%. 48% of imports come from Benin. Nevertheless, direct imports in the Cashew VC are estimated at 7,333,181,000 SLL, which is not very high. Main imported goods in the VC are used for transportation (trucks and fuel for retailers) and for machineries in processing, which is not well developed in the country. Exports of raw cashew nuts (RCN) are increasing but still very few. VC Balance of trade: Imports value = 7,333,181,000 SLL - Exports value =39.603.420.000 SLL (Official exports value = 903,420,000 SLL). VC Balance of Trade = 39,603,420,000 SLL - 7,333,181,000 SLL = 32,270,239,000 SLL of trade surplus and a positive balance of trade for the cashew VC of Sierra Leone. In the VC, there are more official and unofficial exports of RCN than imports. Total Imports/VC Production: 7,333,181,000 SLL / 53,806,413,000 SLL = 13.6 %

[54] Report on the 2016 and 2017 real gross domestic product (RGDP) figures at 2006 prices, Statistics Sierra Leone National Accounts Units, August 2018.

Framing Question 1: What is the contribution of the VC to economic growth?	
CQ1.6	**Is the VC viable in the international economy?** **Indicators:** Nominal Protection Coefficient (NPC) = 0,87 The purpose was to translate farm gate prices into export prices to compare them with FOB prices of RCN. The NPC is < 1. Market domestic price in Sierra Leone is less than the international parity price for cashew. It means that cashew producers in Sierra Leone are not well protected according to the international market. Domestic Resource Cost Ratio (DRC) =0,19. It means that the Value of domestic resources used in production is less than the value they contribute to create. It is a comparative advantage for the Cashew VC in Sierra Leone.

Framing Question 2: Is this economic growth inclusive?	
To be completed with Social Analysis results	
CQ2.1	**How is income distributed across actors of the VC?** **Indicators:** % final price at farm gate: around 30% The farm gate price for RCN, according to nuts quality is generally 3,500 – 5,500 SLL / kg of RCN. While retailers price is on average around 10,000 SLL / kg of RCN. Total Wages and salaries (at every stage, all activities) according to the AFA analysis: Total salary for the VC = 8,478,316,000 SLL (7,912,000,000 SLL paid for smallholders activities, 38,400,000 SLL for BlockFarming activities, 428,525,000 SLL for private plantations activities, 87,391,000 SLL for processors activities. Self-sufficiency economy. Agricultural workers' wage = 10,000 to 15,000 SLL / day. Specialized workers in nursery / farming, attendant wage = 25,000 to 30,000 SLL / day.
CQ2.2	**What is the impact of the governance systems on income distribution?** **Indicators:** Income distribution: 57% for smallholders and around 37% for farm/village gate traders.
CQ2.3	**How is employment distributed across the VC?** **Indicators:** Number of jobs and self-employment at different stages (different types): More precisely concerning the cashew VC in Sierra Leone, we can present the relevant part of the summary table of Workers and working conditions developed in the social analysis section of the report:

RCN producers	Estimated number of workers
Smallholders	10,000 workers (self-employed and seasonal)
Private plantations	Between 500 and 750 workers (fixed and seasonal)
Blockfarmings	500 workers (fixed and seasonal)

	And more generally for Sierra Leone, employment rate in agriculture is 59 %, self-employment rate in agriculture is 76.9 % and smallholders having crop activities share is 85.4 %. It is also estimated that around 14,000 smallholders are involved in cashew production in Sierra Leone.

TABLE 15: CONCLUSIVE SUMMARY AND FRAMING QUESTIONS ANSWERS FOR THE ECONOMIC ANALYSIS

4. Social analysis

4.1 Introduction

The social analysis of cashew value chain in Sierra Leone broadly addresses the question of whether the value chain is socially sustainable (VCA4D framing question 3). The social analysis also sheds light on cross cutting its view with the economic analysis, and the inclusivity of economic growth catalysed by the value chain (framing question 2). It investigates the social landscape of the cashew value chain, with a view to assessing both the existing social conditions and social relationships in the value chain. The value chain analysis finds out the positive and negative social impacts, potential risks and benefits of future value chain development under different production systems – smallholders' production, private plantation of different sizes - mid and large size, and block farming model (different variants). The purpose of the overall analysis is to inform decision makers on the social outcomes and impacts of different production models of the value chain coming into operations in the country. The analysis can function as a baseline for future monitoring of the value chains development. The approach is based on the generation of evidence on the status of the value chain, to inform decision making and lesson learning.

4.2 Methodology

The social analysis examines existing social conditions and social relationships in the value chains, considering the institutional and policy context for agriculture in general and the cashew value chain in particular. It assesses the potential risks and benefits of future development of the value chain for improving farmers' income, reducing poverty and improving nutrition. It complements the economic analysis in considering income and wage distribution in the value chain, the roles and employment of different social groups and gender.

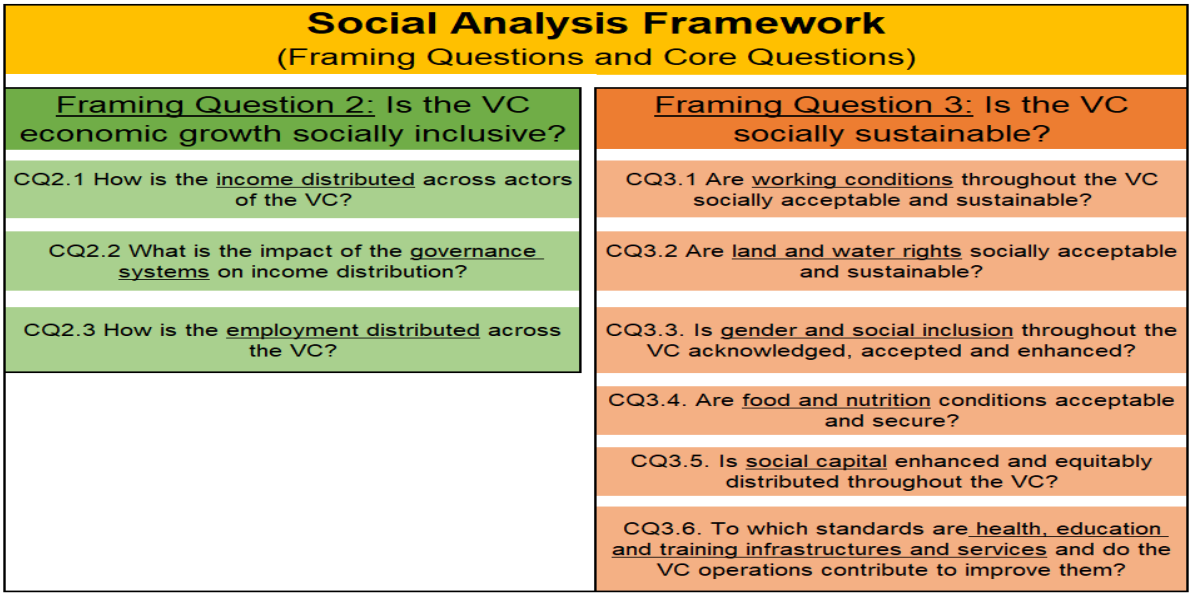


FIGURE 46 : SOCIAL ANALYSIS QUESTIONS

The social analysis draws on multiple sources of information. It requires a combination of data gathering from secondary data sources such as policy and strategy documents, national statistics, agriculture statistics, census data, research reports and studies, as well as field data collection from cashew stakeholders e.g. producers at different scales, processors, traders, transporters,

loaders, input suppliers, wholesalers, retailers, exporters, service providers, government agencies, bi-lateral and multi-lateral agencies, private companies and NGOs.

The social analysis requires information which cross-cuts different sectors and government departments; for example, on working conditions, gender, nutrition, health, education, producers' organisations. Some issues needed sensitive handling, for example, gender relations, child labour, nutrition and hygiene practices. The methods of inquiry were largely qualitative, focusing on the main questions defined in the six domains, drawing on existing data, where available, but triangulating, validating and adding information from field visits and subsequent survey in different locations in Sierra Leone. The main tools were *key informant interviews* (with stakeholders in the value chains) and *focus group discussions* with men and women producers and processors across different districts and chiefdoms. These exercises have used various participatory tools such as problem ranking, gender division of labour, seasonality analysis, food consumption analysis etc. The social analysis has also collated quantitative data / evidence to provide justifications to the ratings on various social profile parameters. The quantitative data from survey - initiated after a mission in the country - have been utilised in analysing on different parameter of social analysis. Secondary data sources have also been used to this end. Wherever possible and needed, some quantification has also been attempted through using traffic lights and other rating scales.

Social Domains	Sub Domains and Questions	Tools /methods used
1. **Working Conditions** Are working Conditions throughout the VC socially acceptable and sustainable?	1.1 **Respect of labour rights** (labour standards; freedom of association, employment conditions, discrimination) 1.2 **Child labour**; school attendance, exposure to harmful jobs 1.3 **Job safety**; accidents, damage to health? 1.4 **Job attractiveness**; wages, conditions attractive to youth?	• Review of Labour policies and laws • Key informant interviews with administrative leaders at different tiers (Central, district and chiefdom) Key informant interviews with NGOs /CSOs personnel, education officers, health workers, social workers. • Focus group discussions with men and women producers and processors • Interviews with owners and workers of mid and large size cashew plantations • Interviews with labourers in different parts of the value chains
2. **Land and water rights** Are land and water rights socially acceptable and sustainable?	2.1 **Adherence to voluntary guidelines;** land, responsible fisheries**.** 2.2 **Transparency and consultation**; in planning and decision making? 2.3 **Equity and compensation**; tenure rights, access to land and water, compensation, complaints procedures and arbitration?	• Review of VGGT in the context of country situation • Key informant interviews with administrative leaders at different tiers (Central, district and chiefdom) • Key informant interviews with NGOs /CSOs personnel, education officers, health workers, social workers. • Focus group discussions with men and women producers and processors • Review of National Land Policy and other associated documents
3. **Gender Equality** Is Gender and social inclusion throughout the VC acknowledged, accepted and enhanced?	3.1 **Economic activities and inclusion in VC**; women & vulnerable groups 3.2 **Access to resources and services**; women's ownership of assets, land rights, access to credit and services? 3.3**. Decision making**; women participation in decisions on production, income, assets? 3.4 **Leadership and empowerment**; women in groups, leadership positions, influence, speak in public? 3.5 **Gender roles and division of labour**; workloads of men and women,	• Review of Gender policy and strategy • Key informant interviews with administrative leaders at different tiers (Central, district and chiefdom) • Key informant interviews with NGOs /CSOs personnel, education officers, health workers, social workers. • Focus group discussions with men and women producers and processors • Interviews with producer group leaders. • Interviews with labourers. • Survey with cashew traders /intermediaries in the marketing chain

Social Domains	Sub Domains and Questions	Tools /methods used
	strenuous work minimised?	
4. **Food and nutrition** Are Food and nutrition conditions acceptable and secure?	4.1 **Availability of food**; local food production and supplies increasing? 4.2 **Accessibility**; more income to allocate to food, consumer food prices decreasing? 4.3 **Utilisation and nutritional adequacy**; nutritional quality of food and nutritional practices improving, dietary diversity increasing? 4.4 **Stability**. Is risk of periodic food shortage reduced, food price variation reduced?	• Market data on food prices • Review of secondary data and literature on food and nutrition surveys • Key informant interviews with administrative leaders at different tiers (Central, district and chiefdom) • Key informant interviews with NGOs /CSOs personnel, education officers, health workers, social workers. • Focus group discussions with men and women producers on food purchases and consumption.
5. **Social capital** Is Social capital enhanced and equitably distributed throughout the VC?	5.1 **Producer organizations**; Organisations in VC? Inclusive membership, accountable leadership, negotiate in input/output markets? 5.2 **Trust and confidence**; extent of trust in the community, trust in value chain actors outside the community? 5.3 **Social involvement;** participation in decisions; traditional knowledge/ resources, communal activities?	• Focus group discussions with Agriculture Business Centres and Farmer Based Organisations - group members and leadership. • Key informant interviews with NGOs and projects. • Survey with cashew traders /intermediaries in the marketing chain
6. **Living conditions**	6.1 **Health services;** households access to health facilities and services in rural areas, health services affordable? 6.2 **Living conditions;** households access to good quality accommodation, water, and sanitation facilities 6.3 **Education, training & information;** primary, secondary and vocational	• Review of secondary data and surveys on living standards, Demographic and health surveys. National statistics • Key informant interviews with health workers and education officers. • Key informant interviews with administrative leaders at different tiers (Central, district, and chiefdom) • Focus group discussions with men and women producers and processors

Social Domains	Sub Domains and Questions	Tools /methods used
	education/training, information on technologies, policies, markets? 6.4 **Livelihood opportunities and mobility;** does VC provide opportunities for men, women, and youth? Alternatives ? Migration to other areas/countries ?	

TABLE 16: SUMMARY OF SOCIAL DOMAINS, QUESTION TOPICS AND TOOLS OF ENQUIRY

4.3 Findings - Social Analysis - Framing question 2

The study analysed the potential of the cashew value chain development in Sierra Leone in addressing the dire situation of food and nutrition insecurity. The study results show that with a 2.5 ha cashew farm (median cashew holding of a cashew farmer as per Comcashew baseline survey, 2017), a farmer in Sierra Leone can, in many likelihoods, earn annual profits (after deducting cost of production) almost equivalent to the living wage (USD 800) in the country. Cashew can, therefore, be a poverty alleviation tool. This is achievable if high quality planting material is provided to the farmers along with the needed management inputs and easy finance. Comcashew survey (2018) stated access to finance as 'almost a precondition' to achieve the overall objective.

Further economic growth induced by cashew value chain development is expected to be economically inclusive as most cashew processing enterprises are run single-handedly by women that contribute average of 30% to total family income in processing families. The cashew value chain offers many other economic opportunities (such as cashew apple processing, bee keeping, and nursery management) for women.

The study also uncovered areas where 'inclusivity' of the value chain can be improved:

- Majority of workers across different parts of the value chain are probably earning much less than the minimum wages (~800 USD per annum), as data from sample investigations in the four districts shows. The worse-off are farm workers involved in cashew production.
- The prevailing rate of annual compensation from land-lease is $12.5 /hectares. If large-scale land investments in cashew sector become a reality (which it may), then there is a need to rethink and revise the compensation for the land owners. More so, as alternative business model of block farming can provide much better returns (~100 to 240 USD per ha.[55]) to land owners.
- Lower technical capacities (at MAFFS, SLARI etc.) in cashew, low access to finance and labour could constrain efforts to increase cashew yields in the country. Agriculture productivity can remain low in the absence of strong information and extension services to the farmers. Also, improper /unregulated marketing structures may continue to bring the sector down, in terms of its contribution to farmers' incomes and economic growth of the country. The marketing structure in the sector is evolving. A need has emerged for streamlining marketing structures.

[55] Computed by the study, based on assumptions and basic data collected on block farm model from Balmed

Overall, the Cashew value chain is showing signs of exemplary pro-poor and inclusive value chain development. However, this is at present at small scale and needs many efforts for inclusive and sustainable expansion of the sector, for which a very large potential[56] exist.

Framing question 3

Overall assessment (2018) of social sustainability of the cashew value chain in Sierra Leone generates a profile (web diagram) as presented below. The assessment has provided scores from 1 to 4, where score of 1 means that the VC carries high risk on a parameter. A score of 4 means that the VC carries no or little risks. As shown in figure 45, the social analysis conducted in 2018 shows that the cashew value chain, at the present juncture, carries moderate to low social risks and offers vast opportunities for pro-poor and inclusive economic development in the country. Overall, the Cashew value chain is showing signs of exemplary pro-poor and inclusive value chain development. However, this is at present at small scale and needs many efforts for inclusive and sustainable expansion of the sector, for which a very large potential[57] exist.

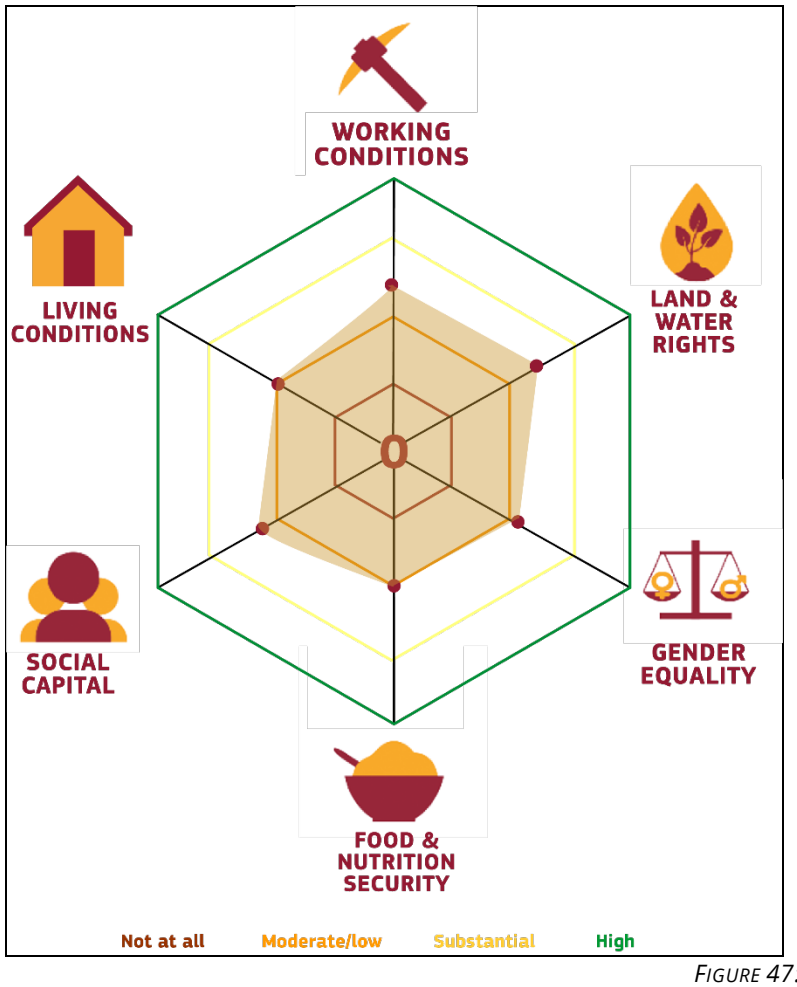


FIGURE 47: THE SOCIAL PROFILE

4.3.1 Working conditions

The assessment summary on the working conditions in the cashew value chain in Sierra Leone is captured in the table below.

[56] A World Bank study analysed cashew sector export potential in Sierra Leone to be about 10000 t per annum
[57] A World Bank study analysed cashew sector export potential in Sierra Leone to be about 10000 t per annum

1.1 Respect of labour rights	**Moderate/Low**
1.1.1 To what extent do companies involved in the value chain respect international labour conventions?	Moderate/Low
1.1.2 Is freedom of association allowed and effective (collective bargaining)?	Moderate/Low
1.1.3 To what extent do workers benefit from enforceable and fair contracts	Moderate/Low
1.1.4 To what extent are risks of forced labour in any segment of the value chain minimised?	High
1.1.5 To what extent are any risks of discrimination in employment for specific categories of the population minimised?	High
1.2 Child Labour	**Substantial**
1.2.1 Degree of school attendance in case children are working (in any segment of the value chain)?	Moderate/Low
1.2.2 Are children protected from exposure to harmful jobs?	Substantial
1.3 Job safety	**Moderate/Low**
1.3.1 Degree of protection from accidents and health damages (in any segment of the value chain)?	Moderate/Low
1.4 Attractiveness	**Moderate/Low**
1.4.1 To what extent are remunerations in accordance with local standards?	Moderate/Low
1.4.2 Are conditions of activities attractive for youth?	Moderate/Low

Rating Scale used:	
Meaning	***Scale***
High likelihoods of this happening, no or little risks in the VC	**High**
Substantial likelihoods of this happening, low risks in the VC	**Substantial**
Moderate to low likelihoods of this happening, medium risks in the VC	**Moderate/Low**
Unlikely of this happening, high risks in the VC	**Not at all**
The parameter is not applicable for the VC	**n/a**

TABLE 17: SUMMARY OF SOCIAL ANALYSIS ON WORKING CONDITIONS IN THE CASHEW VALUE CHAIN IN SIERRA LEONE

Respect of labour rights

Sierra Leone has ratified 30 conventions including the 8 fundamental conventions[58]. While the laws are in place, the country is largely and predominantly an informal and factor-driven[59] economy. Over 35 percent of wage work and over 88 percent of non-agricultural employment are informal (Labour survey, 2014). The informality of the labour force is captured well by the Labour Survey (2014), as per which the most workers are employed in relatively low productivity jobs in farm and non-farm self-employment; fewer than 10 percent are in wage employment. The majority (59.2 percent) of employed individuals aged 15–64 work in agricultural self-employment.

58 www.ilo.org/addisababa/countries-covered/sierra-leone/lang--en/index.htm . The details of fundamental conventions ratified by the country are given at the ILO website: http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:11200:0::NO::P11200_COUNTRY_ID:103269

59 As per World Economic Forum – the global competitiveness index, factor-driven economies mostly compete based on their factor endowments -primarily unskilled labour and natural resources. Maintaining competitiveness at this stage primarily hinges on well-functioning public or private institutions, a well-developed infrastructure, a stable macro-economic environment and a healthy work-force that has received at least a basic education. With low achievements on all these counts, the global competitiveness index places Sierra Leone at the bottom of the pile at 137 out of 140 countries.

Another 31.3 percent work in non-agricultural self-employment, mostly in micro-enterprises as traders or shopkeepers. Unpaid workers add an additional 7 percent to total employment.

Whether the labour laws are effective or fit for purpose is difficult to gauge in the context of large sphere of the economy operating informally. Also, it is widely-acknowledged fact that the implementation and enforcement of existing labour rules and regulations in the country are weak. "The Employers and Employed Ordinance" of 1960 was framed prior to independence. The Act regulates relations between employers and employed, and safeguards heath of the employed. The Ministry of Labour and Social Security does not have a public platform or a website yet. All information on country labour laws can only be accessed through the ILO website. The tracking of compliances to labour laws and conventions are non-existent or non-visible though ILO is working with the Ministry of Labour and Social Security on implementing child labour conventions (138, 182).

Who are the workers in the cashew value chain?

The workers in the cashew VC are found at production, processing and trading levels, the majority being at the 'production' level. The processing of RCN is currently very limited in the country. The processing is mostly artisanal with about 50 to 100 female entrepreneurs involved in it across four main cashew districts - Kambia, Port Loko, Bombali, Tonkalli. Industrial scale processing is not significant with only two main players involved - KamCashew[60] and National Agriculture Development Export Co (NaDeCo) - and their processing operations are running haltingly. It is estimated - by a survey carried out by this study - that only about 10% of RCN produced in the country is locally processed. Most of the rest is traded across the border to Guinea, involving traders /intermediaries. Given the small volumes being handled, the workers (mostly transporters) engaged at trading points are low in number.

What is the status of workers and their working conditions?

Majority of workers across different parts of the value chain are probably earning much less than the minimum wages (~800 USD per annum), as data from sample investigations in the four districts shows. The worse-off are farm workers involved in cashew production. The study estimates[61] that the farm level workers (both men and women) are probably earning between 1.8 million to 2.4 million SLL (240 to 320 USD) per annum. The women processors (running their own processing enterprise) and staff employed at processing factories (such as Kamcashew and NaDeCo) are probably earning between 2.5 to 5 million SLL (320 to 640 USD), which is relatively better than the cashew farm workers.

The cashew VC in Sierra Leone currently have three main production systems:

60 Kamcashew factory has good infrastructure and could be readied for attracting potential investors who can modernise it and run efficiently (source: factory observations and discussions with key informants)
61 Estimations are based on interviews with workers across the value chain.

BOX 1: WORKERS IN A LARGE-SCALE PRIVATE CASHEW FARM IN SIERRA LEONE

This is a 100-acre (40.48 ha) farm. Farm owner is Mr. Abdul M who works in Freetown. The land belongs to ex permanent secy who has given it to his son for farming. It was earlier a mango garden which got degraded and is now being converted to cashew. Cashew plantation was started some 3 years ago. 60 plants per acre have been planted. The farm is trying to establish its own nursery. The farm is developed for producing cashew for export. The farm has 17 full-time workers with each are reportedly paid around 400,000 Le per month (~615 USD per year). Some casual workers are also employed and are reportedly paid around 15000 Le/day+ food (~230 USD per year). Most workers are relatives or part of extended family and hence the farm manager told us that there is no need to have a contract with workers. Workers are reportedly provided some health benefits. The farm manager says that more benefit to workers could be provided once cashew start bearing /generating returns. Though no clarity exists on marketing of cashew, but the farm manager anticipate that some buyer will come in time as they have seen buyers going around in other districts. This shows that local private investors are willing to take risk in anticipation of returns from cashew.

Based on face to face interview with the farm workers and telephonic interview with the farm owner

- Small holder cashew production, with size of cashew plantation, *less than 2 ha*
- Private cashew plantation of different sizes - mid size up to 10 ha cashew, large size > *10 ha (generally 50 to 500 ha)*
- Block farm of approx. 40.48 ha (also 20.24 ha in some cases) – by Balmed and in few cases, replication of some features of block farm model by COOPI (can be called as a semi-block farm model)

Among the three cashew production systems, respect of labour rights is observably better in the block farming model[62] initiated in cashew by the Balmed company (through the support of the EU by COOPI/ProAct). The workers in the cashew plantation (either 40.48 ha or 20.24 ha) established as a 'block farm' are the youth group of 25-50 persons. In here, a proper procedure is adopted, and a MoU is signed with the land owner and community /youth group before initiating a block farm establishment. In a 'block farm', workers have a beneficial stake in the profits arising from the sale of cashew. The daily wages from this beneficial stake work out around 41,678 SLL (~5.3 USD) per person day, which is more than double of the daily wages of conventional agriculture labour. Learning from the Balmed approach, COOPI have also initiated (through the support of the EU by COOPI/ProAct) a 'semi-block farming' with a group of land owners and youth workers. This is in initial stages of design and experimentation as COOPI is exploring options for input and output linkages for effective implementation of this approach. However, number of workers in such a beneficial (and somewhat 'formal') engagement is less than 1000 of more than 11,000 workers engaged in the cashew value chain.

The study discussions with cashew farmers suggest that small holder cashew production sparingly utilises farm labourers. Corroborating this, Comcashew baseline survey (2018) found out that only

[62] Balmed first introduced block farming model in Cocoa and coffee in the eastern province. Learning from experience, Balmed have now adapted and replicated the model in cashew in the northern province of Sierra Leone

about 15% households paid for hired manual labour[63] and/or service providers to do some of the more labour-intensive work associated with cashew farming. The ProAct baseline survey (2017) throws up a different picture as it found out that 89% of all farmers hire labour which suggest that the farm size is not as relevant as expected as 87% of the smallholders with less than 5 acres hire labour. The hired labour is used in planting (44%), brushing (41%) mainly, but also for intercropping (22%), fire belt (6%) and harvesting (3%).

The study team spoke to a few mid-size cashew farm owners. These types of farms are managed mostly by family labour or labour from extended relatives' network though some seasonal labour is employed for planting, brushing and harvesting.

[63] In Comcashew survey (2018) reported that most of hired labour is utilised for weeding operations.

Production system	Type of workers	Number of workers *(study estimates -2018)*	Wages of workers *(estimated per month, based on per day wages and level of involvement)*	Respect of labour rights				
				Respect of Intl. conventions	Freedom of association	Enforcable & fair contract	No forced labour	Minimised risk of discrimination
Small holders cashew production *(< 2 ha)*	Mostly family labour; hired labour in some cases	10000	Seasonal workers: SLL 200,000 (~USD 26)	n/a	n/a	Not at all	High	High
Mid-size private plantations *(up to 10 ha)*	Family and relatives constitute labour in addition to hired labour	500	Seasonal workers: SLL 225,000 (~USD 28)	n/a	n/a	Not at all	High	High
Large size private plantations/large size nucleus plantation by investor	Hired labourers - Permanent and seasonal part time workers	250	Permanent workers: SLL 400,000 (~USD 51) Seasonal workers: SLL 300,000 (~USD 38)	Moderate/ Low	Moderate/ Low	Not at all	High	High
Block farming model *Any size, generally around 40.48 ha. of one block farm*	Farm owner and youth group together constitute the labour; both have a beneficial stake	500	Paid as a profit share based on a formula *(on the basis of 60% of international price of cashew sold, minus the costs)*	Substantial	Substantial	High	High	High

Rating Scale used:	
Meaning	***Scale***
High likelihoods of this happening, no or little risks in the VC	**High**
Substantial likelihoods of this happening, low risks in the VC	**Substantial**
Moderate to low likelihoods of this happening, medium risks	**Moderate/Low**
Unlikely of this happening, high risks in the VC	**Not at all**
The parameter is not applicable for the VC	**n/a**

TABLE 18: WORKERS AND WORKING CONDITIONS IN THE CASHEW VALUE CHAIN

No forced labour /no bonded labour is observed in the value chain. Youth are involved in collecting, baggage and transportation but they generally belong to the family or are part of extended family network. The discrimination in employment based on kinship, sex, other affiliations was not observed in the value chain.

FIGURE 48 : FARM OWNER AND WORKERS (YOUTH GROUP) IN A CASHEW BLOCK FARM

Child labour

Sierra Leone is a signatory to the Convention on the Rights of the Child (SLG, 2007) and ILO conventions 138 and 182 related to child labour and worst form of child labour. In compliance to these conventions, lot of sensitisation has happened, and children are going to school regularly (KII). This is evident in data collected in many large-scale household surveys e.g. a WFP (CFSVA, 2015) report states that primary school participation survival rate to the last grade is high at 92.5 percent[64]. However, attainment dramatically reduces at the secondary level, where net attendance ratios are 39.9 percent and 33.2 percent for boys and girls respectively. The report further says that the low levels of education attainment are an economic phenomenon, with 37.0 percent of children from the poorest quintile out of primary school compared to only 7.0 percent of the richest quintile. Also, some of the progress made has been reversed in the last three years due to EVD. The primary completion rate (% of relevant age group) as per the World Bank – World Development Indicators is 66%, which is a reduction from 75% achieved in 2010. The percentage of children who have never been enrolled in school is much higher in rural areas, at 21.9 percent of boys and 20.5 percent of girls (CFSVA, 2015). The main reason given for not enrolling children in school was a lack of money to pay for school fees and other costs (34.4 percent). Further, in this survey, it was discovered that more than one-third of the villages have no functioning primary school.

The secondary data from DHS (2013) point outs the existence of child labour[65] in agriculture in general. It says that overall, 37 percent of children age 5-14 in Sierra Leone are involved in child

[64] This data is based on UNICEF Multi Indicator Cluster Survey, 2011

[65] The DHS definition of child labour includes (a) children age 5-11 who in the seven days preceding the survey worked for someone who is not a member of the household, with or without pay, or engaged in any other family

labour—44 percent of children age 5-11 and 16 percent of children age 12-14. For all children age 5-14, the percentage engaged in labour is about the same among males (38 percent) and females (37 percent). However, the proportion of children engaged in labour is substantially higher among rural children (43 percent) than urban children (24 percent). The survey further reported that among children involved in child labour, only 68 percent are attending school.

Child labour in cashew value chain

The WFP report states that the children who never receive an education face significant constraint in accessing better paid employment opportunities when they enter the labour force, and they are highly vulnerable to becoming engaged in child labour activities, though this phenomenon is not specifically seen in cashew value chain. The children of age 12-17 are commonly seen to be working on the cashew farm but these are family farms. There is some likelihood that these children are school dropouts. ComCashew baseline survey (2018) have reported about 64% of boys and 63% of girls in this age group have completed primary school (grade P6). In a country with very high level of food insecurity and where children are expected to earn something for contributing to family's food requirements, young people are forced to work from a very early age.

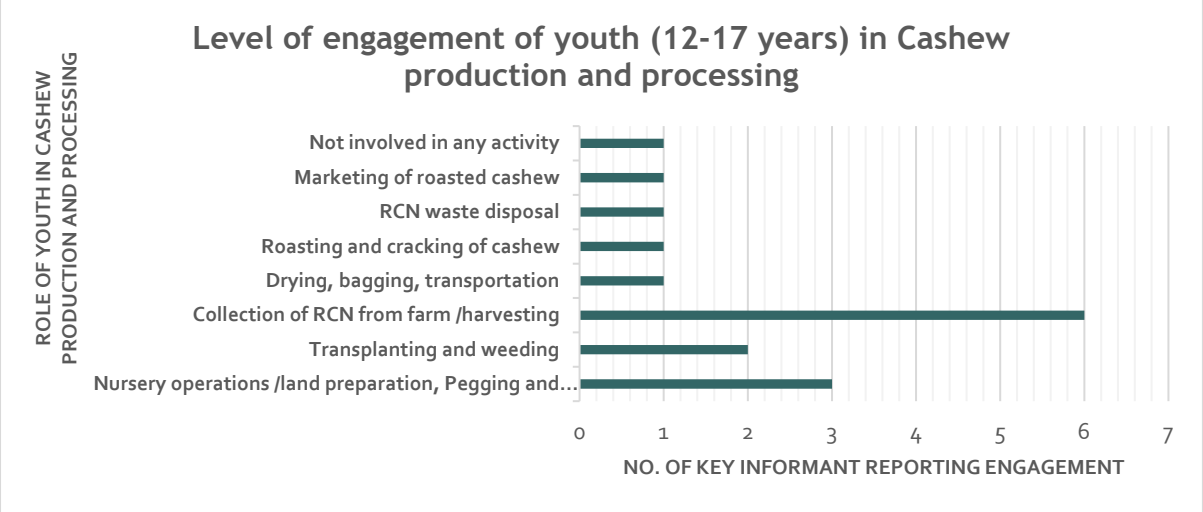


FIGURE 49: LEVEL OF ENGAGEMENT OF YOUTH (12-17 YEARS) IN CASHEW PRODUCTION AND PROCESSING

We conducted 10 key informant interviews to understand the role of youth (12-17 year) in cashew production and processing. Most of the key informant (6 out of 10) stated collection of RCN from farm and harvesting as the main role of youth. Nursery operations /land preparation and pegging was reported as main role by 3 key informants. Transplanting and weeding was reported as main role of youth by 2 key informants. Only one key informant stated that youth of 12-17 age group are not involved in any cashew production and processing activity. The wages, as reported by the key informants interviewed, earned by youth (when not working on family farms) are in the range of 7,000 to 10,000 SLL (0.9 to 1.2 USD) per day. It is observed that the children (aged 12-17) who gets involved in cashew production and processing are generally not given the most hazardous activities such as brushing, pruning, etc. A report from African Cashew Initiative (ACi, 2010) state that the work children do in cashew farming cannot be seen as mentally or physically harmful or as being exploitative. Children start with potentially less harmful activities and then build up their skills and experiences to do all other activities around age of 17-18 years.

work or did household chores for 28 hours or more, and (b) children age 12-14 who in the seven days preceding the survey worked for someone who is not a member of the household, with or without pay, or engaged in any other family work for 14 hours or more or did household chores for 28 hours or more.

Large companies in cashew (Balmed, KamCashew and NaDeCo) reported that there is no child labour on their plantations. The policies against child labour are strictly enforced by these companies.

Job safety

The working definition of 'job safety' for this social analysis is "the degree of protection from accidents and health damages in any segment of the value chain". The job safety in the value chain is assessed based on the working conditions (occupational health & safety, hygiene and environmental conditions) of the work spaces at farm, small-scale processing and industrial scale processing. The interviews with key informants provide some assessment on this issue, as is stated below:

- Many a times, most workers receive no protection or safety gears against hazards experienced though in some cases, safety working gears /rain gears are provided to workers on the farm
- In small-scale processing, where mainly women workers are involved, use of hand gloves in roasting and cracking of cashew is observed, though not in all cases.
- In industrial scale processing, including processing at COOPI supported units, basic safety standards are duly followed.

The main occupational health and safety risk in the value chain are observed at processing segment. As women are the main workers at processing sites, they could be potential target for occupational harm as is seen in other countries such as India and Vietnam both of which are world processing hubs. An A4D cashew project evaluation report (2016) cite an example of a research on Indian cashew, wherein it is reported that in most cashew processing units' workers face several health problems and 90% of workers suffer health hazards (cited in the report from a research published in Journal of Food Research and Technology, 2014). As the cashew value chain develops in Sierra Leone, processing activities will naturally be expanded, leading to higher likelihoods of occupational health and safety risks for the women. This suggest tackling of 'job safety' issues from the beginning, as part of ongoing cashew value chain development to not let them become bigger in due course of time as has happened in other countries.

Job attractiveness

The attractiveness of the job, if assessed based on remunerations received is not high as most of the workers across the value chain receive less than minimum wages (as stated earlier in this section). This level of income does not constitute a living wage in the country. Therefore, chances are that these workers and their families are vulnerable to high level of food and nutrition insecurity.

As per ProAct baseline survey (2017), the average age of the cashew farm owner is 44 years. Younger farmers below 35 years are a minority (11%). In a limited survey (20 farmers) carried out this study, the median age of cashew farmers is 52 years. Cashew, a tree crop, clearly need youth involvement. This is in contrast to a general situation in the country where the major work force is youth of age 19-35 years. The block farming model of Balmed encourage youth participation through forming a farm group of youth workers. The block farming model offer earning potential of about 300-400 USD per year from a part-time engagement (3 days a week for 24 weeks). This could be an attractive proposition to youth, some 500 of which have already become part of cashew block farms being established (~2000 ha). Young girls and boys are also seen selling cashew on the street (in Waterloo, Freetown) and are earning about 30,000 SLL (3.8 USD) a day.

Key messages on 'Working Conditions' in the VC:

The workers in the cashew VC are found at production, processing and trading levels, the majority being at the 'production' level. The processing of RCN is currently very limited in the country. The processing is mostly artisanal with about 50 to 100 women entrepreneurs involved in it across four main cashew districts - Kambia, Port Loko, Bombali, Tonkalli. Industrial scale processing is not significant with only two main players involved - KamCashew and National Agriculture Development Export Co (NaDeCo) - and their processing operations are running haltingly.

Among the three cashew production systems (small holder, mid & large size plantations, block farm), respect of labour rights is observably better in the block farming model initiated in cashew by the Balmed company. The workers in the cashew plantation (either 40.48 ha or 20.24 ha) established as a 'block farm' are the youth group of 25-50 persons.

Three clear risks are present in the value chain: a) The wages of farm level workers, working on farms and mid-size /large size cashew plantations are very low - much less than minimum wages (~800 USD per annum) prescribed, b) Overall, 'informal' nature of wage employment in cashew value chain makes it difficult to implement or monitor compliances to labour standards. The workers associations or collective bargaining possibilities can not be expected to exist in this set up, c) The main occupational health and safety risk in the value chain are observed at processing segment. As women are the main workers at processing sites, they could be potential target for occupational harm as is seen in other countries such as India and Vietnam both of which are world processing hubs.

- Agrinatura Cashew VC study in Sierra Leone, 2018

4.3.2 Land and Water Rights

The social analysis on land and water rights in the cashew value chain in Sierra Leone provides the following picture:

2.1 Adherence to VGGT	**Substantial**
2.1.1 Do the companies/institutions involved in the value chain declare adhering to the VGGT?	Substantial
2.1.2 In large scale investments for land aquisition, do the involved companies/institutions apply the due diligence guide?	Substantial
2.2 Transparency, participation and consultation	**Substantial**
2.2.1 Level of prior disclosure of project related information to local stakeholders?	Substantial
2.2.2 Level of accessibility of intervention policies, laws, procedures and decisions to all stakeholders of the value chain?	Moderate/Low
2.2.3 Level of participation and consultation of all individuals and groups in the decision-making process?	Substantial
2.2.4 To what extent prior consent of those affected by the decisions was reached?	Substantial
2.3 Equity,compensation and justice	**Moderate/Low**
2.3.1 Do the locally applied rules promote secure and equitable tenure rights or access to land and water?	Moderate/Low
2.3.2 In case disruption of livelihoods is expected, have alternative strategies been considered?	Moderate/Low
2.3.3 Where expropriation is indispensable: is a system for ensuring fair and prompt compensation in place?	Moderate/Low
2.3.4 Are there provisions foreseen to address stakeholder complains and for arbitration of possible conflicts ?	Moderate/Low

Rating Scale used:	
Meaning	***Scale***
High likelihoods of this happening, no or little risks in the VC	**High**
Substantial likelihoods of this happening, low risks in the VC	**Substantial**
Moderate to low likelihoods of this happening, medium risks in the VC	**Moderate/Low**
Unlikely of this happening, high risks in the VC	**Not at all**
The parameter is not applicable for the VC	**n/a**

TABLE 19: SUMMARY OF SOCIAL ANALYSIS ON LAND AND WATER RIGHTS IN THE CASHEW VALUE CHAIN IN SIERRA LEONE

Adherence to VGGT

The general context

"Land tenure is ambiguous", says MAFFS tree crop officer. Provincial land generally belongs to the community. Land tenure is in fact vested in the Paramount Chief for the benefit of future generations. Provincial land cannot be sold; it can only be leased, the potential timeframe for a lease is 50 to 71 years.

The GoSL through SLIEPA and other arms of the Government have invited and promoted large-scale land-based investments in many agricultural commodities – sugarcane, rice, cashew, palm oil, rubber, forestry etc. Large tract of lands[66] are under land concessions for different commodities. Many of these concessions /large scale land acquisitions have not followed due diligence /VGGT principles[67]. There have been many factors responsible for this state of affair:

- Negotiation of the terms of the lease comes last in the generic described process by SLEIPA. Landowners also comes into the picture at the very last step of the land acquisition process. Free, Prior and Informed Consent (FPIC) are conspicuous by their absence in this generically

[66] GoSL estimate - 11-15% of arable land under land concessions

[67] Many earlier research – including one on palm oil value chain in Sierra Leone by Agrinatura, have established this finding.

described process. The land acquisition that materialised during this period have clearly followed this guideline.

- The negotiation as per this policy are generally expected to be done with Govt Ministries, Departments and Authorities (MDAs) at different administrative tiers (Central, District and Chiefdom). This approach violated many VGGT principles including FPIC.

As per SLIEPA own admission[68], most of international investments ("95%") are facilitated by a third party. The multiplication of intermediaries added to the lack of means and reactivity of governmental authorities still discourage most of the investors. A legal analysis of the land lease agreement commissioned by the German NGO Welthungerhilfe (WHH) also questioned the legality of the land deal under Article 21 of the Constitution of Sierra Leone (Protection from deprivation of property) and the Provinces Land Act (CAP 122). The legal analysis concluded that "there are strong indications that due to legal inconsistencies the signed lease agreements are in effect voidable" and that there is "an urgent need for a review and amendments of both the lease and the sub-lease agreement to ease the tension and to prevent the tension generating a conflict that would likely escalate"[69].

The new land policy is designed based on learning from these experiences to not allow a repeat of the mistakes made. However, implementation of the NLP is another challenge to be conquered.

The situation in the cashew value chain

In the cashew value chain, the scenario depicted above is not seen so far, primarily due to the fact that the VC has not seen large-scale land acquisitions. This presents a clean slate to begin cashew VC development – learning from experiences in other crops (e.g. oil palm, sugarcane in Sierra Leone) and from other countries (in cashew). Arrival of investors and large-scale land investments in cashew is a distinct possibility in the next few years. Conditions are favourable for investments – lands are available, district and chiefdom authorities are willing to welcome investors, farmers are willing to lease land to the investors, district level agriculture administration are aware of past mistakes and are keen to be facilitators for overseeing smooth land acquisition processes, complying with VGGT and new land policy. The cashew value chain development needs to take a path based on learning from past experiences of VGGT violations in other commodities in the country. It also needs to capitalise on promising business models such as the ones being developed by Balmed and COOPI, which could provide an alternative to large-scale land acquisition by 'non-natives'.

[68] Mr. Shiaka KAWA – Director of Export Development, SLEIPA

[69] Source: http://www.fian.org/fileadmin/media/publications_2016/Annex_Background_information_HR_Obligations.pdf

BOX 2: BALMED BLOCK FARMING MODEL: MADINA LOKO BLOCK FARM

This area is composed of Madingo ethnic group and have a union which is seeking welfare of Madingo. The idea started with Mohammad Jallore of Balmed sharing a block farming model with his friend, who is a worker in an NGO. The land block of 100 acres is owned by the Turey family. The process of consultation involved them as well a section chief and potential workers (mobilised into a youth farm management group) who would like to work on the farm. 85 members group were formed involving owners and workers.

Balmed provisioned to provide seeds, farm tools, technical knowhow, and a buy back guarantee, for 25 years. Draft MoU shared with the owners and workers (yet to be signed). First seedling distribution started on 31st August 2017. Group leadership from among 85 members is being chosen. Similarly, executive committee is being established.

Based on focus group discussions with land owners and a group of farm workers (youth group)

Balmed goes first to the farmer and talks to them about the potential of establishing a 100-acre (40.48 ha) block farm. Once the negotiation is successful, they then inform different tiers of the Government. The block-farm approach is not about leasing or acquiring large-scale land for private plantation /estate. Instead, the company engages with land owners to collectivise a 50 to 100-acre plot of land for establishing cashew plantation. The company convinces land owners and youth groups about the return potential from a cashew block farm established from un-used /under-used land. Once the people are convinced, then a management agreement is signed and Balmed carry out mapping (GPS) of the land. Balmed gains the trust by working directly with farmers and chiefdom authorities. Balmed calls this a 'development attitude' needed to do business responsibly. There are many examples of 'irresponsible business' in other commodities where lands were acquired without adherence to VGGT and without winning people's trust. Ultimately, many of these companies were not successful in doing business in the country. Balmed purportedly do not want to work against farmers interest. In the block farming model, land continues to be owned by land owners, the company support the farmers with seedlings, tools and management inputs. Once the harvest is realised, it is shared between the company, land owners and youth groups /workers, using a formula based on international price of the produce.

The working of the model is documented through discussions and agreements signed by both parties with blessings from chiefdom (paramount chief, section chiefs). In northern provinces, large-scale abandoned /under-used land is available. This is an enabling context for block farming to be established. The way it is designed can help protect from fire and theft. It is, therefore, a promising business model. The model is established or in the process of being established in 2000 ha, in Northern provinces of Sierra Leone, involving more than 500 land owners and farm workers. **COOPI,** one of the main development organisation promoting cashew value chain in the country, has taken up experimentation with a semi-block farming model in an action research mode. Many features – such as group of land owners collectivizing their lands for establishing cashew plantation – of the COOPI model are similar to that of Balmed's block farm. COOPI still need to think through and devise strategies for benefit sharing arrangement, produce marketing linkages in the semi-block farms being established by farmer groups.

Transparency, participation and consultation

"You can not continue to do business with farmers if only you are progressing", says Balmed's chief executive, Sierra Leone. The statement describes the spirit with which Balmed's block farming model ensures transparency, participation and consultation, with land owners, farm workers and other key stakeholders in the community. Land owners provide the land and sign an agreement (they get a % stake in the profits). Farm groups work on the farm and earn their percentage stake from the profits. Local customary authorities also get a share of profits. Balmed's staff says that only few block farms fail using this approach. Balmed is working out strategies to help cashew farmers graduate out of poverty. Balmed ensures that a clear MOU is signed with the land owners, youth (farm management group) and they are made aware of responsibilities of the company and themselves in establishing the plantations. The study team interacted with two block farms (Medina Loko and Anokgle) wherein the youth were 85 and 50 respectively. In both cases, 100-acre plantation is being established and a due process, as described above, is being followed.

Balmed's model is demonstrating an instance of a transparent and alternative approach to large-scale land acquisition for private sector investors in agricultural commodities. The study team noticed an instance, where some other company acquired land – for establishing cashew plantation - from two land owners through connections with paramount chief. The company stated that it is possible for them to acquire land as much as they want through this influential process. Clearly, compromises on transparency, participation and consultation can happen in the cashew sector as well. In the prevailing context, the process of transparency, participation and consultation in land acquisition can easily be compromised if companies do not follow self-regulation and /or if VGGT framework is not applied.

The country rankings on protection of property rights by various international indices provide some general (not specific to cashew VC) indication of transparency of and adherence to rules and procedures in large-scale land acquisition processes.

Ranking by	Year	 Country Rank; *progress over the years*
World Economic Forum Global Competitiveness Report	2015-16	**122nd** out of 140 countries; *Overall ranking on competitiveness is at 137 among 140 countries*
Ibrahim Index of African Governance (IIAG)	2017	**32nd** out of 54 African countries; *Significant annual Average Improvement are seen over the last decade and over last five years are both positive*
World Bank – Ease of Doing Business	2018	**165th** out of 190 countries on registering property; *Improvement seen over the years, 160th overall ranking on ease of doing business in the country*

TABLE 20: RANKING OF THE COUNTRY ON PROTECTION OF PROPERTY RIGHTS BY INTERNATIONAL INDICES

There is no law regulating private company-smallholder partnerships. A National Land Policy developed in 2015 was launched by the President in March 2017 but a land act based on the policy is yet to be promulgated. In practice, "companies are learning to work with the smallholders through trial and error", according to a key person in MAFFs. He suggested that the private companies should negotiate the land lease directly with the land owners.

The Environmental Impact Assessments (EIA) are being done in the country, however, no such assessment has been done for investments in cashew plantations. EIA experiences in other value chains in the country though give an indication that these are more of a barrier to improving investment climate. An official from SLIEPA told us that for improving investment climate, the first obstacle is the long delay in Government response to investors' solicitation for supports and

second is the high costs charged by the Government to carry out preliminary studies such as Environmental Impact Assessment (~100k€). Lessons from other value chain can guide investment-friendly EIA processes in the cashew value chain.

The challenge in increasing transparency, participation and consultation lies in the existing legal and regulatory framework for land governance. The approach to build up a strong legal and regulatory framework for land governance is to have a longer term, broader vision for the country. Many NGOs (such as WHH) and organisations like Namati are acting on behalf of community for training primary and secondary stakeholders on voluntary guidelines and for ensuring adherence to the principles of VGGT.

Equity, compensation and justice

Equity in securing land tenure and access to land:

In Sierra Leone, ~95 percent of land is governed by customary law. This means that for most citizens, the unwritten traditional rules and practices of tribes or communities determine who is able to hold, use or transfer land (LGAF, 2015). In this dispensation, generally, it is seen that equity, compensation and justice have been held hostage to the discretions of MDAs and have led to compromises on legitimate tenure rights of individuals and communities. The cashew value chain is too nascent to assess whether this can happen or not happen. However, if past experiences are any guide to the future and in the absence of proper awareness, capacities and bargaining power, the land-owners in cashew value chain could also find themselves short-shrifted. To guard against this happening in the cashew sector, a key functionary from WHH says that the regulatory framework needs to allow alternative business models for land investors to ensure proper tenure assessments and tenure security. Balmed through its block farm model is one such alternative, under which already 2000 ha of cashew plantations have been (or are in the process of being) established. Under this arrangement, land remains with the land owners. In fact, land parcel of 100-acre or so is properly mapped and documented, thereby increasing land tenure security for the land owners. A profit-sharing formula is agreed upon (generally produce harvested is sold to the company at 60% of the FOB price of the day, the day sales are conducted). The model has considerable potential to improve land access and utilisation for youth group who gets involved as farm workers. It is envisaged that after a stipulated period, Balmed can leave the block farm to the youth group to manage and enjoy higher proportion of benefits from the established farm. However, that will happen far into thefuture and cannot be assessed or guaranteed at present. A similar business model is being tried out by COOPI as explained in the sections above.

Another potential business model could be the master farmer approach as that can help build up larger holdings. Promoting master farmer and medium size holdings (~10 Ha) can facilitate sourcing from the point of view of investors. Investors can strengthen master farmers and help them become stronger financially. This business model is also recommended by a review of African commercial farming models (2017) by Prof Ruth Lall from University of Western Cape. This ESRC study was focused on answering, “What commercial farming model should African policymakers pursue?” It says that medium-scale commercial farms (which can arise from local accumulation also) produce more local economy stimulus than the other two models - large plantation estates and out-grower schemes. This will need policy advocacy for it to become possible within next 10 to 15 years as the Government have to invest in education, strengthening capacities of master farmers /commercial farm entrepreneurs and groups.

Compensation for disruption of livelihoods and /or expropriation:

The new National Land Policy document (version 6, August 2015) contains the same formula as proposed by MAFFs for Private Sector Promotion in Agriculture in January 2009, wherein the rent paid for the leasing of private land by investors for large scale agricultural use be divided into four parts as depicted in the graph below.

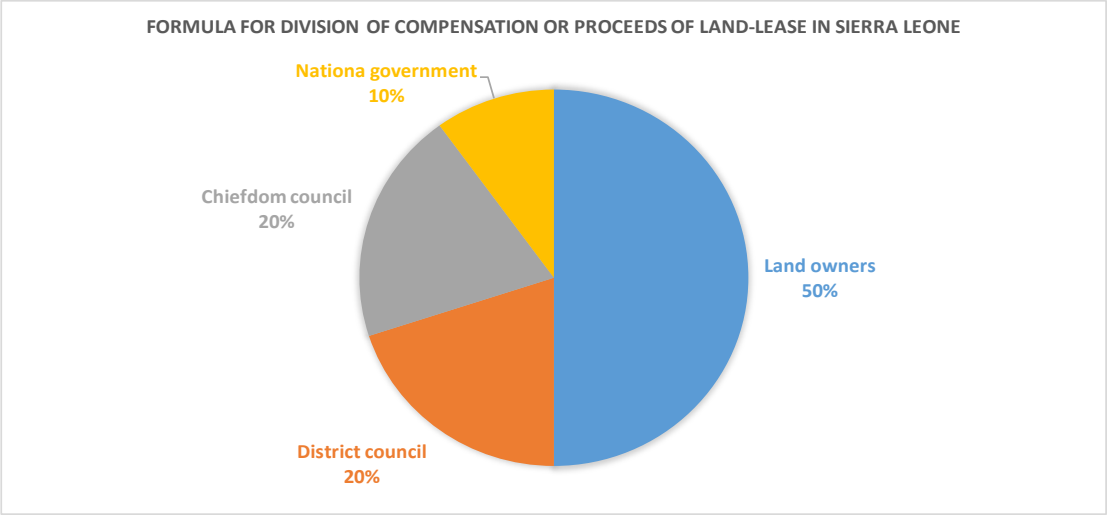


FIGURE 50: FORMULA FOR DIVISION OF COMPENSATION OR PROCEEDS OF LAND-LEASE IN SIERRA LEONE

The prevailing rate of annual compensation is $12.5 /hectares. Experience from other value chains (such as palm oil) suggest that this formula leads to a very small actual compensation in the hands of the land-owners who are parting away with their lands and livelihoods. Namati and many other stakeholders interviewed consider it unconscionable for landowners to forfeit 50% of their rental income to various arms of the government. So, if large-scale land investments in cashew sector become a reality (which it may), then there is a need to rethink and revise the compensation for the land owners. More so, as alternative business model of block farming can provide much better returns (~100 to 240 USD per ha.[70]) to land owners.

Currently, two main investors in the cashew value chain are Kamcashew and NaDeCo. Both has near about 500 ha each of cashew plantation which needs better upkeep and management. Community involvement in management of these plantations is a possible way out and a win-win solution for ensuring higher and better produce for the companies and a share of benefit (from intercropping and harvest) to the community.

Justice: Provisions to address stakeholders' complaints and conflict resolution

The new land policy (NLP) will have high relevance for the cashew value chain as it can help the cashew sector avoid the pitfalls already experienced by other commodity sectors. New agri-business investments in land acquisitions for cashew plantations and for setting up cashew processing plants could be guided by an enabling NLP. The NLP contains some provisions to address stakeholders' complaints and conflict resolution. But it falls short on many accounts. For instance, Namati says that the policy needs to set out (i) a mechanism for mapping local resources and land use patterns (ii) the category of lands that would be available for land-banking (iii) a transparent and inclusive process for community consultation and decision-making (iv) how common resources would be shared (v) the right of families and communities to opt in or out of the land bank (vi) directly enforceable environmental and social obligations (vii) mechanisms for

[70] Computed by the study, based on assumptions and basic data collected on block farm model from Balmed

addressing grievances. The draft policy should also rule out the use of eminent domain to acquire land for investors.

Further, the NLP need to design mechanisms that can support communities seeking compliance or redress. As per Namati, this would mean facilitating fair and transparent community decision-making processes, independent legal assistance and representation during negotiations and accessible complaint mechanisms for non-compliance by investors. An academic paper by GT Yengoh (2014) says that the structures are needed to ensure full representation of local parties in land related disputes with land investing companies.

The added challenge is to develop an implementation framework and to find the resources needed for effective implementation. As per one estimate by FAO and UNDP, the land reform implementation will require $69 million over 10 years. In 2016, GoSL allocated the sum of Le 3.1 billion (about US$ 492,000) in its annual budget to the Ministry of Lands to "support land planning and management and the "execution of the national land policy". This is just 7% of the annual requirements. However, as one senior functionary of Namati[71] pointed out the allocated money also is not released till the last quarter of the year, which has severely hampered development planning and programmes in the country.

[71]http://slconcordtimes.com/lack-of-funding-may-derail-implementation-of-sierra-leones-progressive-land-policy/

Key messages on 'Land and Water Rights' in the VC:

The examples of large-scale land leases in other commodities in the country suggest history of violations and non-compliances with the principles of VGGT. This is not the case in cashew value chain. This presents a clean slate to begin cashew VC development – learning from experiences in other crops (e.g. oil palm, sugarcane in Sierra Leone) and from other countries (in cashew).

Large-scale land investments in cashew is a distinct possibility in next few years. Conditions are favourable for investments. In addition, promising business models are being developed, which could provide an alternative to large-scale land acquisition by 'non-natives'. However, it is to be seen, whether past mistakes would not be repeated.

Balmed's block farm or COOPI's semi-block farm models are demonstrating a transparent approach. Nonetheless, compromises on transparency, participation and consultation can happen in the cashew sector as well (instances seen). In the prevailing context, the process of transparency, participation and consultation in land acquisition can easily be compromised if companies do not follow self-regulation and /or VGGT framework is not applied.

The iniquitous and inadequate compensation for land-leases, if not reformed, can potentially generate conflicts and confrontations in cashew sector as well, leading to low socio-economic benefits realised by communities. The new land policy (NLP) will have high relevance in this context. New agri-business investments for cashew plantations and for setting up cashew processing plants could be guided by an enabling NLP.

- Agrinatura Cashew VC study in Sierra Leone, 2018

4.3.3 Gender Equality

The summary of social analysis on gender equality is presented in the table below.

3.1 Economic activities	**Substantial**
3.1.1 Are risks of women being excluded minimised?	Substantial
3.1.2 To what extent are women active in the value chain?	Substantial
3.2 Access to resources and services	**Moderate/Low**
3.2.1 Do women have ownership of assets (other than land)?	Moderate/Low
3.2.2 Do women have equal land rights as men?	Moderate/Low
3.2.3 Do women have access to credit?	Moderate/Low
3.2.4 Do women have access to other services?	Moderate/Low
3.3 Decision making	**Moderate/Low**
3.3.1 To what extent do women take part in production decisions?	Substantial
3.3.2 To what extent are women autonomous ?	Substantial
3.3.3 Do women have control over income?	Moderate/Low
3.3.4 Do women earn independent income?	Moderate/Low
3.2.5 Do women take part in decisions on the purchase, sale or transfer of assets?	Not at all
3.4 Leadership and empowerment	**Moderate/Low**
3.4.1 Are women members of groups, farmers' organisations?	Substantial
3.4.2 Do women have leadership positions within organisations?	Moderate/Low
3.4.3 Do women have the power to influence services, territorial power and policy decision making?	Moderate/Low
3.4.4 Do women speak in public?	Moderate/Low
3.5 Hardship and division of labour	**Moderate/Low**
3.5.1 To what extent are the overall work loads of men and women equal (including domestic work and child care)?	Moderate/Low
3.5.2 Are risks of women being subject to strenuous work minimised (e.g. using labour saving technologies…)?	Moderate/Low

Rating Scale used:	
Meaning	***Scale***
High likelihoods of this happening, no or little risks in the VC	**High**
Substantial likelihoods of this happening, low risks in the VC	**Substantial**
Moderate to low likelihoods of this happening, medium risks in the VC	**Moderate/Low**
Unlikely of this happening, high risks in the VC	**Not at all**
The parameter is not applicable for the VC	**n/a**

TABLE 21: SUMMARY OF SOCIAL ANALYSIS ON GENDER EQUALITY IN CASHEW VALUE CHAIN IN SIERRA LEONE

Though the current Constitution of Sierra Leone (1991, amended 2001) provides for equal rights for men and women in Article 27, but the principle of non-discrimination does not apply in all areas.[72] The constitution review was commissioned in 2013 and a draft submitted to the Government in 2016, which is waiting for enactment. Similarly, laws related to Gender Equality and Women's Empowerment are being drafted. In 2007 Sierra Leone passed a set of "gender laws": The Domestic Violence Act, the Registration of Customary Marriage and Divorce Act, and the Devolution of Estates Act. The gender policy situation in the country is in a state of constant flux. The specific situation of gender equality in the value chain is reflective of existing status (and progress achieved over the years) on some generic indicators of gender equality, as captured by many international databases, shown below.

[72] Source: https://www.genderindex.org/country/sierra-leone/

Indicator	What it measures	Source	Year	Country Status /Rank; *progress over the years*
Gender Development Index (GDI)	Ratio of female to male Human Development Index (HDI) values.	UNDP	2015	**HDI rank - 179 out of 190 countries** *GDI value have improved from 0.802 (2000) to 0.871 (2015)*
Gender Inequality Index (GII)	A composite measure reflecting inequality in achievement between women and men in three dimensions: reproductive health, empowerment and the labour market	UNDP	2015	**GII Value – 0.650** *The index value has improved from 0.695 in year 2000*
Gender - Ibrahim Index of African Governance (IIAG)	The Gender score looks at gender equality, women's political participation, Gender balance in education, women's labour force participation, work place gender equality, women in the judiciary, laws on violence against women, women's political empowerment	IIAG	2017	**Gender ranking 13 out of 54** African countries *Showing increasing improvement since 2007*
Social Institution and Gender Index	The SIGI covers five dimensions of discriminatory social institutions, spanning major socio-economic areas that affect women's lives	SIGI	2014	SIGI Value: 0.372; *meaning* ***Very high gender- discrimination in social institutions***

TABLE 22: SIERRA LEONE - GENDER EQUALITY STATUS

Economic Activities

The women are economically very active in cashew value chain and play significant roles throughout the VC. The general belief that 'cashew is men's crop' is far from the truth as the table below illustrate women's economic participation in various segments of the VC:

VC segment	Women's role	Description of role	Significance and recognition of the role
Farm level production	As farm worker, working on family farm, wage labour in some cases	Women play significant role in planting and harvesting of cashew (KII, FGDs).	Women play main role in harvesting and play subsidiary roles in other activities as part of family farming; Women are also part of the farm management group in block farming model; Men mostly control incomes from cashew farming.
Small-scale processing	Women as processor /entrepreneur running cashew processing enterprise on a small scale	Women carry out most of processing operations such as cracking, roasting, baking, packaging, marketing etc. Men contribute in operations such as gathering, transporting and roasting.	Most processing enterprises are run single-handedly by women that contribute average of 30% to total family income in processing families. Overall contribution is about 200 to 800 USD per year (based on a limited survey of 12 processors). Women have direct control of incomes earned.
Industrial-scale processing	As factory workers or worker at CPU	Supporting processing operations	Women carry out specific functions in processing factories of Kamcashew and NaDeCo. Women are main workers running the CPUs supported by COOPI. Women have direct control of income earned.
Trading	Trader /intermediary Retailing cashew kernels	Buying cashew from farmers and selling it onwards to other traders in Sierra Leone /Guinea, also to local processors Retailing cashew kernels in small packaging at various points	Women play dominant role as trader /intermediary in cashew supply chain that goes to India via Guinea. They have direct control over income earned. Women, girls and boys are observed selling small packets of cashew at various points, earning about 30,000 to 40,000 Le (USD 3.8 to 5.1) per day.

TABLE 23: WOMEN'S ECONOMIC INCLUSION AND EXCLUSION IN THE CASHEW VALUE CHAIN

Women's economic role in cashew production

Cashew production is a family enterprise, involving men, women and children. Men play significant roles in many cashew operations while women's role in dominant in harvesting. Children have only limited involvement. The table below captures the gender division of roles in family farming.

Cashew farming task	Men	women	Children
Planting the seeds	PPP	P	
Cutting/correct spacing	PPP	P	
Mixed cropping	PPP	PP	
Pruning			
Weeding under trees	P	P	
Pesticide spraying			
Grafting on young trees			
Harvesting		PPP	P
Separation of nut using nylon thread			
Fire belt around plantations	PPP		P
Selling RCN	PPP	P	P
Keeping the money from this sale	PPP		
PPP	*Main involvement*		
PP	*Subsidiary involvement*		
P	*Limited involvement*		
	No involvement		
**Source: adapted from Comcashew Baseline Survey, 2017*			

TABLE 24: GENDER DIVISION OF LABOUR IN THE FAMILY (NOT ACCOUNTING FOR HIRED LABOUR)*

The secondary data from various surveys confirms the above findings from the VC study. The WFP-CFSVA (2015) survey reported that the majority of households reported that both women and men worked together to tend to their farms (82.6 percent).

There is another, generally overlooked, dimension of women' role in contributing to family income and food security. The wives of cashew farmers are involved in petty trading and vegetable trading which brings enough for ensuring food on the table for these families. The men farmers being involved in tree crops (with long gestation period). In many cases, these crops have not started bearing and so women's role in the interim is clearly very strong in ensuring that family gets to eat something. The study team spoke to many such cashew families where women are ensuring food security through petty trading. In the WFP-CFSVA (2015) survey, far more women (47.4 percent) reported their involvement in petty trading compared to men (15.4 percent). Petty trading in rural areas is also predominantly a female income-generating activity (27.2 percent of women compared to 4.1 percent of men). The Labour Survey (2014) reported that most of the country's working-age population is in the labour force, and women participate almost as much as men - 65.7 percent participation among men; 64.7 percent participation among women. Young women are much more likely than young men to be in the labor market - 39.4 percent versus 29.5 percent, using the ILO definition, although this gap fades with age.

As depicted in the story (above) of a cashew grower family, ground nut and pigeon pea (*Cajanus cajan*) production is gender-based activity, for which extension services can be provided directly to women. Research on inter-cropping system in cashew could be a future initiative more so on *Cajanus cajan* which is an important inter crop for small scale farmers. This, besides providing

extra income, can contribute to family nutrition as *Cajanus cajan* contain high level of protein and important B vitamins[73].

Women's economic role in cashew processing

Cashew processing in the country is currently very limited – both at small-scale and at industrial level. Small scale processing is carried out mostly by women. These women are entrepreneurs who have started their own cashew business and in some cases are also trading in RCN (selling to other processors). Our estimate is that there could be around 50 to 100 such women across four main cashew districts. Number of these women may increase in future as COOPI and Comcashew are focusing on supporting women processors. COOPI, for example, has trained 180 women in Port Loko in small scale processing under the umbrella of CPU.

The study team surveyed 12 processors (11 women, 1 man) to understand their processing business. One of the women processors is Mobinty Koroma (Port Loko) who started in the cashew processing business some 10 years ago. She procures cashew from nearby villages. She has a good network /trading relationship with cashew farmers. She is very well known to nearby growers who supply RCN to her. She buys RCN for self- processing as well as selling to other processors. The processing is manual (head pan roasting, drying, cracking and roasting in oil) with no machines used. The processed cashew (10 kernels) are packed in a polythene bag and sold in retail for 2000 Le. The processing operations are mostly carried out by the family members. Generally, no outside labour is hired. Cashew consumption is seasonal (Feb-Mar). 20 bags of RCN were processed last year. Processing volumes are limited by the finance availability and many other constraints. The processors expressed many areas of support through which they will be able to expand their businesses. These are listed in the table below.

[73] Source: http://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:1152177-2#uses

Name of processor ---->	Mabinty Koroma (Female)	Alimamy Kamara (Male)	Aminata Koroma (Female)
Location	Gbere Junction	Kalangba, Magbema Chiefdom	Rolakoh Village, Makari
District	Port Loko	Kambia	Bombali
Cashew business details	Cashew Business since 2008 (Ten Years) - Buys from farmers and sells to bigger buyers; Acts as intermediary for other farmers; Processes RCN and retails locally (nuts only).	Started processing since 2003	Started processing 2013
Volumes handled	- 2017: Processed about 20 bags (50 kgs) of RCN - 2018: Rising farm gate prices have limited her to about 15 bags	10 – 20 bags (50 kgs) per annum	5-8 bags per annum
Source of RCN	Cashew farmers in 25 miles radius	Own cashew farm (20 ha)	Cashew farmers in the vicinity
Workers involved	Family labour + relatives	Hires 4 women who receive Le40,000 (USD 5.12) for every 50Kg bag processed	Family labour
Market	Product in high demand; Outlets include Gbere Junction, Masiaka and Freetown	High demand, buyers within district and Freetown	High demand locally and nearby Makeni Town
Gross incomes	Between 10 to 15 million SLL (~1300 to 1900 USD) a year		
Profits	Profitable - around 2-3 million SLL (~250 to 400 USD) per annum	Profitable - around 1-2 million SLL (~120 to 250 USD) per annum	Profitable but scanty details available
Assistance needed for expanding processing enterprise	- Capital to procure RCN early in the harvesting period - Cracking equipment and roasting facility - Secure storage of RCN to enable scaling up of processing enterprise, currently only done in dry season - Protective gear to avoid fire hazards - Improved packaging		

TABLE 25: SNAPSHOT OF SMALL-SCALE CASHEW PROCESSING BUSINESSES IN SIERRA LEONE

Access to resources and services

Women's access to resources and services generally and in the VC specifically are predisposed by the historical context, socio-cultural norms and systems of the Sierra Leonean society. The gender profile of Sierra Leone (produced by African Development Bank, 2013) says that the Sierra Leone is a patrilineal society with pockets of matrilineality among the Mende and Sherbro ethnic groups in the southern and eastern parts of the country. Within Sierra Leone's patrilineage system, descent and inheritance practices are male-centred and marital residence is patrilocal. The report further notes that irrespective of the lineage system that is recognised and practiced in society, women are subordinated and discriminated against in the decision-making process, as it is men who dominate the governance structure in both traditional and modern political systems. The fact that about one-third of the men have polygamous relationships (WHH Spiral project survey) adds to the complexity of access to land and other resources for women. The study team met a group of cashew growers in Kambia. Out of 7 members of the group, 2 men are in polygamous union – one man has two wives, and another has 3.

As stated above, women play significant economic roles in the cashew value chain and, yet they have very limited access to resources and services. Land is inherited by men and women do not have any formal rights of their land. The men in a cashew growers group told the study team that in their village, only one woman has land in her name. The DHS survey (2013) suggest that only 5% women have ownership of house. As per labour survey (2014), of all plots, 67.8 percent are owned by men; 20.7 percent are owned by women, and 11.6 percent are owned jointly by men and women. In the WFP-CFSVA (2015), over 42.0 percent of women reported that they had access to land, with 20% women owning land. The new land policy provides for "joint spousal registration

and documentation of land rights". It also stipulates "joint spousal consent to land disposals". The implementation of the policy is yet to be promulgated. The LGAF report states that women are not present at consultations with investors; and when they are present, they have no voice. As a result, women are not entitled to a share of land rental fees on their own.

This is clearly manifested in the VC e.g. the financial inclusion of women is reduced due to lack of ownership of land. Her abilities and confidence are reduced in accessing agriculture extension, financial and other services from formal government and other institutions. The data from the World Bank Global Financial Index (FINDEX) for Sierra Leone suggest that 12% women have an account at a financial institution, which is only 7% in rural areas. Only 5% women have received any transfers from the Government in past one year. Only 3% have borrowed from a financial institution. Another important finding of this data is that the emergency funds (surplus savings) are not at all available with about 60% of households in Sierra Leone. This explains their reliance on borrowings at high interest rates (~50% annually) from informal sources.

The discriminatory access of resources and services is well-captured by Sierra Leone Social Institution and Gender Index (SIGI), key notable points from which are:

- **Discriminatory family code** (involving issues such as early marriage, inheritance rights etc.) is rated at 'medium' level, with score of 0.33
- **Restricted physical integrity** (involving issues such as violence against women, female genital mutilation, reproductive autonomy etc.) is rated at 'very high' level of discrimination with score of 0.85
- **Son-bias** is reported at 'low' level of discrimination, with score of 0.03
- **Restricted resources and assets** (involving issues such as access of land, non-land assets and financial services) is rated at 'very high' level of discrimination, with score of 0.80
- **Restricted civil liberties** (involving issues such as access to public spaces, political participation etc.) is rated 'high', with score of 0.61

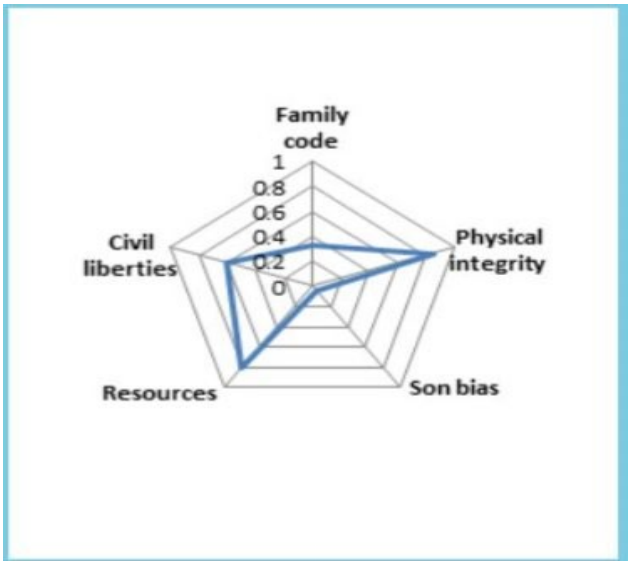


FIGURE 51: LEVEL OF DISCRIMINATION FOR WOMEN IN SOCIAL INSTITUTIONS IN SIERRA LEONE (SOURCE: HTTPS://WWW.GENDERINDEX.ORG/COUNTRY/SIERRA-LEONE/

The women are actively involved economically in all parts of the VC, yet their access to financial and agriculture extension services are very poor. A gender analysis from Africa Cashew Initiative (2010) suggested that if men continue to be more involved in trainings, power relations will prevail since men will maintain their status of being more knowledgeable and experienced in farm work. It is, therefore, a good investment to reach more women in training activities to ensure gender equality and encourage women to be more involved and take advantage of the benefits of cashew farming.

The discussions with producers and processors of cashew indicate that the cashew value chain development will critically depend on how access to finance is secured for the producers and processors. Women processor would have more cashew to process if she had money to lend to the farmers before the crop comes out to ensure the supply of RCN. Block farm model is interesting as it takes care of all farm investments with farmers only putting in labour. But semi-block farming model, small holder model and commercial farming models are also feasible and scalable if the farmers can get resources to invest. This will also reduce negative consequences of exploitative trading relationships that farmers have with informal guinea traders (KII).

In this study, we asked 20 cashew farmers (men) and 11 cashew processors (10 women, 1 men), about whether they have ever received any assistance or participated in a rural development programme undertaken by an external organisation (government, NGO, etc.). In response, 65% men and 45% women indicated 'yes'. This indicate gender-disparity in access to assistance and services from government /NGOs.

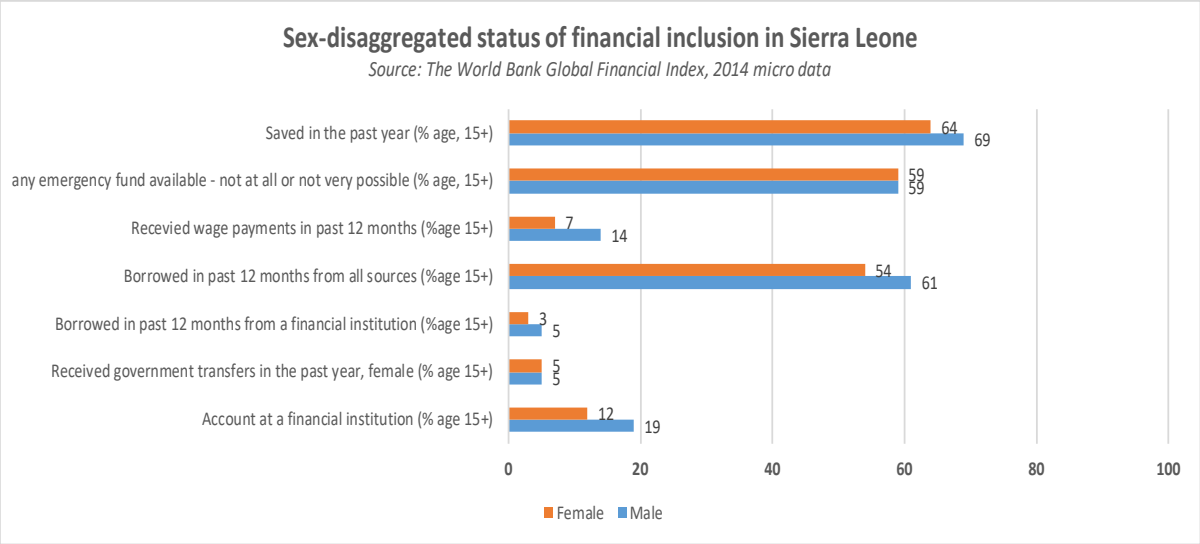


FIGURE 52: STATUS OF FINANCIAL INCLUSION OF WOMEN IN SIERRA LEONE

In the VC, the financial inclusion and access to agriculture extension services in relatively much better for women who are involved as members of CPU /FBOs/ ABCs. This showcases how women's access to resources and services can be enhanced in the value chain.

Decision-making

Different pattern of decision-making can be observed in the value chain based on the economic role of the women. Women are relatively more independent and have a more say in household decision-making when they are working at 'processing' segment of the VC. Women have relatively less involvement in the household decision-making at 'production' segment of the VC. Women's

role in 'trading' segment of the VC is in balance with men presumably because they control the income.

The DHS (2013) data throws more light on women's control over income - 42 percent of women say that they mainly decide how their cash earnings are used, 31 percent of women indicate that the decision is made jointly with their husbands, and 27 percent say that use of their earnings is decided mainly by their husbands. This tallies with the observation for women who are active in 'processing' segment of the VC as they are better-off in terms of deciding on use of their income than their counterpart in 'production' segment of the VC, where men are the main decision-makers. Local trade and processing in cashew are mostly carried out by women (Kambia to Bambali to Waterloo). The lesson here is that the women running their own business will have a better chance of controlling their income than the women who are doing joint farming operations with their husbands. The cashew value chain offers many opportunities for women to increase their independent incomes and consequently enhance their economic standing and decision-making role within the family /community. African Cashew Initiative (2006, 2012) have identified and experimented with following options:

- **Cashew apple processing** as an income-generating activity has been identified as a viable activity in several feasibility studies by ACi. Cashew apples can be used for – juice, alcoholic beverages, marmalade etc. However, as ACi found out in many countries cashew producers are rarely know that cashew apples have a value and can be processed into sellable goods.
- **Bee keeping** also have a huge potential for income diversification and women's empowerment. ACi reports says that beekeeping can be easily and effectively done alongside cashew production. This can not only create an independent income source for the women giving them more power in household decision-making but also increases the cashew nut yield and quality due to the bees pollination of the trees. COOPI, Bombali is planning to start up to 20 farmers with 2 beehives each.
- ACi has trained women in **grafting and nursery management** to grow good quality cashew seedlings which they can use on their farms to increase yields. ACi has also established women nursery groups. Like in beekeeping, selling the seedlings provides an additional income source for an individual and for the group. ACi document says that being a member of a grafting (or beekeeping) group brings women (and men) together and offers a space where they can gain knowledge, freely share their opinions and speak out. This opportunity is generally not available in community meetings or other traditionally male-dominated groups and gatherings. COOPI Bombali is supporting women farmers with skills so that they can run and own nurseries.

Apart from economic reasons, social construct also defines women's decision-making and control over incomes. Being in a polygamous relationship reduces women's say in household decision-making. The DHS (2013) data shows that thirty-five percent of currently married women (15-49 age) are married to men who are in a polygynous union. The DHS data further shows that proportion of women living in polygynous unions declines as women's level of education increases. With education, women's control over income and household decision-making also increases.

The decision-making role of women is also predicated by the type of decision to be taken. Less than 11 percent of women are the main decision-makers for their own health care, household purchases, and visits to their own family. Most women report that these decisions are made jointly with their husbands (between 46 and 51 percent) while substantial numbers of women report their husbands are the main decision-makers.

Leadership and empowerment

The women are very significant contributors to their household economy though, as explained above, their role is less recognised or rewarded in 'production' segment of the value chain. GoSL and international organisation like FAO are promoting women participation in FBOs and ABCs. As per one estimate (KII), women constitute about a quarter of members in FBOs /ABCs. The study team interacted with many women, who are active members and /or leaders of their FBOs /ABCs. These FBOs /ABCs are called CPU/cashew processing unit and they were established under the EU COOPI/A4D project; there are also engaged in cashew processing and trading. The data from a survey of women processors suggest that 7 out of 12 women processors (58%) are part of FBOs /farmer groups. COOPI has also promoted women membership in CPUs/FBOs/ ABCs. This presents a good starting point for next phase of cashew value chain development. Interactions with CPU members in Kambia and Port Loko suggest that women are integral part of CPU business plans though their role and benefit could be more succinctly stated in the business plan document.

This is important as CPUs stand at a vantage point for promoting women inclusion, leadership and empowerment which necessitate strongly gendered business planning approach.

Key messages on 'Gender Equality' in the VC:

The women are economically very active in cashew value chain and play significant roles throughout the VC. Women play main role in harvesting and play subsidiary roles in other activities as part of family farming; Women are also part of the farm management group in block farming /semi block farming models. However, women's access to resources and services are not commensurate to their economic role in the VC. This indicate gender-disparity in access to assistance and services from government /NGOs. This is also manifested in the fact that women and families have either no or low economic surplus available to them as emergency funds, which in turn makes them prone to higher risk of further impoverishment when something goes wrong. Men mostly control incomes from cashew farming while women have relatively better control of incomes earned from processing and trading engagements. Barriers to greater decision-making role of women in the VC are related to prevailing economic (limited opportunities for earning independent incomes), social (polygamous relationships, lack of education) and policy (lack of land ownership) constructs.

Women ownership of assets (such as housing) are very low, which is partly explained by historical context, socio-cultural norms and patrilineal systems of the Sierra Leonean society. The new National Land Policy provide specific provisions for "joint spousal consent to land disposals". The implementation of the policy is yet to be promulgated.
The forums like CPUs/FBO/ABC provide voice and public profile to women. The challenge, however, remains of promoting increased women's participation and leadership roles in these groups as currently it is very limited.

Cashew value chain development can improve women's income, leadership and empowerment, while at the same time, it can increase women's work load, as it will seek to increase participation and engagement of women in various training, enterprises (CPUs, income generating activities - cashew apple processing, bee keeping, nursery etc.). This clearly demands a nuanced approach

The CPU example illustrate the point that increasing women's agency requires an enabling opportunity structure. In the value chain, better enabling conditions are becoming available to women through these CPUs, FBOs, ABCs, Women Forum and other women-centric organisations. It demonstrates that 'women in development' requires 'women in groups'. Women's ability to speak in public is dependent upon their abilities and on enabling opportunities available to them. Participation in different type of groups enhances both their abilities and opportunities as is seen in the cases studied. Some of women are now becoming members in Chiefdom land committee. These fora provide voice and public profile to women. The challenge, however, remains of promoting increased women's participation and leadership roles in these groups as currently, it is very limited.

Hardship and division of labour

As depicted above, women' role is pervasive and dominant in many segments of the cashew value chain. Women work on the cashew farm, do cashew processing, are traders /intermediaries in cashew sale and at the same time are running petty businesses. Women take on most of responsibilities related to domestic work and child care as men play very limited role in these spheres. The strenuous activities in cashew production are mostly carried out by men. However, given the women's work load, there is considerable scope for labour savings technologies in cashew production (e.g. for cashew harvesting) and processing (e.g. mechanical processing tools) as also in other spheres of women's activities.

4.3.4 Food and Nutrition Security

The summary of social analysis on food and nutrition security in cashew value chain in Sierra Leone is presented in the table below.

4.1 Availability of food	**Moderate/Low**
4.1.1 Does the local production of food increase?	Moderate/Low
4.1.2 Are food supplies increasing on local markets?	Moderate/Low
4.2 Accessibility of food	**Moderate/Low**
4.2.1 Do people have more income to allocate to food?	Moderate/Low
4.2.2 Are (relative) consumers food prices decreasing?	Moderate/Low
4.3 Utilisation and nutritional adequacy	**Moderate/Low**
4.3.1 Is the nutritional quality of available food improving?	Moderate/Low
4.3.2 Are nutritional practices being improved?	Moderate/Low
4.3.3 Is dietary diversity increased?	Moderate/Low
4.4 Stability	**Moderate/Low**
4.4.1 Is risk of periodic food shortage for household reduced?	Moderate/Low
4.4.2 Is excessive food price variation reduced?	Moderate/Low

Rating Scale used:	
Meaning	***Scale***
High likelihoods of this happening, no or little risks in the VC	**High**
Substantial likelihoods of this happening, low risks in the VC	**Substantial**
Moderate to low likelihoods of this happening, medium risks in the VC	**Moderate/Low**
Unlikely of this happening, high risks in the VC	**Not at all**
The parameter is not applicable for the VC	**n/a**

TABLE 26 : SUMMARY OF SOCIAL ANALYSIS ON FOOD AND NUTRITION SECURITY IN THE CASHEW VALUE CHAIN IN SIERRA LEONE

Before getting into the specific situation in the cashew value chain, understanding of status on key general indicators which affect food and nutrition security provide a useful context. As per Global Food Security Index (GFSI), 80% of the population is under the global poverty line ($3.10 /day) and Sierra Leone is ranked at 24 among 28 regional (SSA) countries. Food consumption as a share of household expenditure is as high as 42%. Post-harvest food loss is around 35% and only 63% of

the population have access to potable water. As per WFP-CFSVA (2015), the Ebola outbreak accounted for the decline in food security in some districts. In the majority of districts, food insecurity is a chronic problem, caused by structural factors (such as low agricultural productivity, poverty and a lack of resilience, poor road and market accessibility, poor access to potable water, gender inequality and a lack of income generation diversification) that affect the food production system and limit the ability of households to produce or buy enough food.

Availability of Food

Local production of food and trends in food supplies in local markets can be deduced from household expenditure on food. If the household food expenditure is increasing, then it can indicate decreasing local production of food and local food supplies. This is indeed the case. In a survey, with 30 cashew growers and 13 cashew processors, we collected average monthly /annual food expenditure data. It shows that household food expenditure is on the upturn and shows 70 to 140% increase over last five years. This probably means that cashew producers and processors have experienced an annual food inflation of about 15 to 28%. This generally indicates that decreasing local production and supply of food to local markets over the years. A household's ability to buy same food basket from the market, irrespective of costs, is clearly dependent on household inflows and outflows of money. In the same survey, we asked these 33 cashew producers and processors regarding whether their family faced any deficit situation in terms of inflows and outflows (which can potentially lead to reduced food consumption, indebtedness or other coping strategies – s*ee Table 27)*. 17 of these respondents (53%) replied 'yes'. This is possibly indicative of food deficit situation being faced by these many families.

Annual food expenditure	Status in 2017	Change since last 5-years
Family /Household	Average: 7.4 million SLL (950 USD) Median: 7.2 million SLL (923 USD) Range: 1.2 to 15 million USD (153 to 1923 USD)	70 to 140% increase; resulting in an annual food inflation of 15 to 28%
Per capita	Average: 1.05 million SLL (135 USD) Median: 0.93 million SLL (120 USD) Range: 0.39 to 2.15 million SLL (51 to 276 USD)	

TABLE 27: TREND IN ANNUAL FOOD EXPENDITURE AMONG CASHEW PRODUCERS AND PROCESSORS

This dataset, as well as general trends in the economy,[74] shows a reduction in local production and food supplies in Sierra Leone, with increasing reliance on imports.

Accessibility of Food

As per one estimate[75], rice represents 40.9% of food consumption spending for the rural poor. Farming investments are very low (max 10-15% of income). The WFP CFSVA (2015) data shows that rural households spend on average 63% of their total expenditure on food. Borrowing money to buy food is common (52%). Three quarters of the population rely on markets as their main source of food as about 60% of farmers consume their own production for six months or less. The consumer food prices are increasing at higher rates than even the overall rate of inflation in the

[74] consumer food prices are increasing at higher rate (~18%) than even the overall rate of inflation (~16%) in the country.

[75] https://www.statistics.sl/wp-content/uploads/2017/04/rice_prices_in_sierra_leone.pdf

country. The food inflation was under 10% up to September 2015 when it started rising and went up to 22% in March 2017. The food inflation rate[76] currently (April 2018) hovers around 17%. Correspondingly, the overall inflation rate was around 8% in September 2015 when it kept rising to 20% in March 2017. The overall inflation rate currently (April 2018) hovers around 16%.

Cashew value chain development assumes significance in this context of decline in absolute availability of staple food[77] over the years. The main months of food-scarcity are June-September, as during this time reserve food stocks are finished. Cashew farmers tend to resort to loans from traders and other informal lenders to whom they are then obliged to sell their RCN later in the season. This trading relationship is unfavourable for the farmers as they have to pay almost 50% interest in kind (RCN) or cash. Cashew communities have experienced hungry season and have adopted various coping strategies as the table below highlights.

Coping Strategy Employed	Percentage of Households *That Had a Hungry Season* That Occasionally Used This Coping Strategy
During the *Hungry Season*	
Did Not Eat Usual Foods	16%
Ate *Smaller* Meals	29%
Ate *Fewer* Meals	92%
Sold Assets that Household Did Not Want to Sell	55%
Source: ComCashew baseline survey (2017)	

TABLE 28: COPING STRATEGIES TO HUNGRY SEASON

This situation is well reflected in the food consumption data, collected by WFP CFSVA (2015).

Classification	Score range	Port Loko	Bombali	Kambia	National Average
Poor	1 to 21	28.8%	24.8%	47.4%	19.9%
Borderline	>21 to 35	24.7%	35.6%	20.4%	33.5%
Acceptable	>35	46.6%	39.6%	32.1%	46.5%

As per this survey, food consumption scores are much below the national average in cashew growing districts (Kambia, Port Loko, Bombali). Close to two-third households in these districts are either poor or on the borderline of food consumption scores.

Utilisation and nutritional adequacy

Rice is the staple food of all Sierra Leoneans. Some of the artisanal farmers diets are more cassava based while commercial farmers diets are more rice based. Interactions with cashew farmers about their diet suggest that most eat rice with soup most of the time. Some cashew families eat fish with potato chips. Many times, most family members just eat rice with palm oil. No or very

[76] Source: https://ieconomics.com/sierra-leone-inflation-rate#

[77] Rice and cassava are part of main diet of palm growers and processors. Fish is also consumed once a week on an average. Both cassava and fish are largely locally produced and consumed while local production of rice is not sufficient for annual consumption needs. The local production of rice has also seen considerable variations over the years, partly due to climatic variability. In the event of a good harvest, farmers generally sell half of their crop and keep the rest for consumption. This meets the family consumption needs for about 3-months. The selling price of rice is 60000Le /Bushes, they then buy the rice at 230,000 Le/bag of 50 kg. The rice imports have been increasing over the years, from around 8% of total requirements to around quarter of total requirements in 2017.

limited amount of fruits and vegetables are there in the diet, similarly not much animal sourced protein is consumed. Clearly, the diet of cashew producers and processors generally lack proteins and vitamins. About 60 to 70 % of cashew farmers are suffering from dietary deficiency, which have deteriorated over last five years (key informant interviews). The WFP study (CFSVA, 2015) found that proteins are almost zero in diets of moderately or severely food insecure HHs. The severely food insecure group mostly eat cereals and vegetables (e.g. cassava leaves and potato leaves) every day, whereas they fail to consume all other remaining food groups as part of their regular diet. FAO has developed Sierra Leone Food-Based Dietary Guidelines for Healthy Eating (FAO 2016). The guideline suggest that the Sierra Leonean food should comprise of six food groups, based on their availability and accessibility. These are: 1) Grains, roots and tubers, 2) vegetables and dark green leafy vegetables, 3) fruits, 4) beans, peas and lentils, 5) fish, poultry, meat, milk and eggs, 6) oil, nuts and seeds. The WFP study (CFSVA, 2015) found out that food insecure households consume a diet insufficiently diverse for good health and wellbeing, with 56.8 percent of households consuming four or less food groups on a weekly basis, and 13.9 percent of households consuming two food groups or less on a weekly basis. A significant percentage (36.9 percent) of the population reported that they had not consumed food rich in protein during the last one week, whilst the majority (67.7 percent) of households reported that they had not eaten foods rich in iron.

Cashew and its products have potential to address some of these nutritional deficiencies cited above. A report on promoting the production of cashew in West Africa ((Bass, Hans-Heinrich, et al 2013) states that cashew kernel is very rich in fat (46 per cent) and protein (18 per cent) and a good source of calcium, phosphorus, and iron. The tart apple is a source of vitamin C, calcium and iron. To date in West Africa, less than 10 per cent of the cashew apple is consumed either as fresh fruit or in few cases processed into fruit drinks the rest gets wasted – although the apple is rich in ascorbic acid, thiamine, niacin and riboflavin and thrice as rich in vitamin C as sweet orange (Akinwale 1996). The report further states that as cashew apples are harvested over a period of four months during the year, there is still a wide scope for value added products. Cashew apples can be processed to several products such as juice, wine and dried cashew nut.

COOPI is developing nutrition specific programming in its cashew areas, chiefly working with women. Many options are being promoted under this initiative – vegetable growing, backyard garden, growing oranges, potato leaves, leafy vegetable, consuming some fruits and vegetables instead of selling it all, intercrop plantation of nutritious crops such as *Cajanus cajan* (pigeon pea), ground nut, promoting traditional and developing new nutritious recipes etc. COOPI has started implementing awareness and nutrition specific programming recently, with a small pilot of few women selected from each FBOs to receive training, awareness and other support (Interview – COOPI staff member). A women cashew farmer, interviewed during the study, explained how the nutrition training received from COOPI is beneficial in her efforts to improve family nutrition. She elaborated on her key learnings from the trainings such as not over cooking, eating fruits and vegetables, eating less palm oil, diversifying diets from cassava and carbs, preparing new dishes which can enhance nutrition, growing vegetables and fruits etc. Many field observations and interactions suggest that strategy of nutritional integration in cashew value chain development (as is done by COOPI) is worth scaling up.

Stability

As reported above, the food shortages during June-Sep are commonplace, as not enough storage is left for this period. The cashew producers and processors are resorting to taking loans at that time. The average loan size is 60,000 Le with a year payback of 50% in kind. About 75% families take loans to cope with food shortage and to pay school fees. Cashew currently contributes – on

average – 35% of total income of the family (survey data, 2018). Does the development of the cashew value chain in Sierra Leone have a potential to address this dire situation of food and nutrition insecurity? This study sought to answer this through analysis on three fronts:

- Potential of cashew production system to generate profits for cashew farmers for an 2.5 ha cashew plantation
- Potential of Balmed's block farm model to generate profits for farm owner and farm workers
- Benchmarking the above potentials against the actual returns realised by smallholder farmers in other West African countries - Cote d'Ivoire, Burkina Faso and Ghana. The returns are realised as a result of cashew value chain development over the years in these countries. Data on this comes from recent (2017/18) ComCashew surveys / GiZ studies.

The caveat here is that the Comcashew data is the **actual** profit realisation from small holder cashew production system in other West African countries while the study data is estimated **potential** realisation from small holder production system and block farming model in Sierra Leone.

Model parameter	Unit	Scanerio 1: Most promising	Scanerio 2: Less promising	Scanerio 3: Most conservative
		Cashew plantation under intensive management	*Cashew plantation under less intensive management*	*Cashew plantation under very low maintenance (almost existing situation)*
Small holder production system:				
Yield assumption	Kg /ha	750	375	175
RCN price assumption	SLL /kg	6000	6000	6000
Revenue	million SLL per ha	4.5	2.3	1.1
Cost of production* *(with seedlings provided free by COOPI /MAFFS)*	million SLL per ha	2	1	0.5
Profit	million SLL per ha	2.5	1.25	0.55
Profit (2.5 ha)	million SLL for 2.5 ha	6.3	3.1	1.4
Profit (2.5 ha)	**USD**	**801**	**401**	**176**
Block Farm production model:				
Estimated profits for farm owner (2.5 ha)	USD	**600**		
Estimated wages for a farm worker per year	USD	**400**		
Benchmarking above potential scanerios with actual achievements across other countries in West Africa:				
Profit (2.5 ha)- Cote d'Ivoire (GiZ study)	USD	1020		
Profit (2.5 ha)- Burkina Faso (GiZ study)	USD	468		
Profit (2.5 ha)- Ghana - 900 kg/ha yield (GiZ study)	USD	3445		

cost of production is derived from data collected during the study, with validation from Comcashew, Kamcashew and Aci survey estimates

TABLE 29: ESTIMATED POTENTIAL OF CASHEW VALUE CHAIN DEVELOPMENT IN ALLEVIATING FOOD AND NUTRITION INSECURITY

Key messages on 'Food and Nutrition Security' in the VC:

As per our survey data, cashew household food expenditure is on the upturn and have shown 70 to 140% increase over last five years, resulting in an annual food inflation of 15 to 28%. This generally indicate that decreasing local production and supply of food to local markets over the years. Main months of food-scarcity are June-September as during this time reserve food stocks are finished. Cashew farmers tend to resort to loans from traders and other informal lenders to whom they are then obliged to sell their RCN later in the season. This trading relationship is unfavourable for the farmers as they have to pay almost 50% interest in kind (RCN) or cash.

Cashew communities have experienced hungry season and have adopted various coping strategies. Food consumption scores are much below the national average in cashew growing districts (Kambia, Port Loko, Bombali). Close to two-third households in these districts are either poor or on the borderline of food consumption scores (CFSVA, 2015). The diet of cashew producers and processors generally lack proteins and vitamins. About 60 to 70 % of cashew farmers are suffering from dietary deficiency, which have deteriorated over last five years. Cashew and its products have potential to address some of these nutritional deficiencies as cashew kernel is rich in fat (46 per cent) and protein (18 per cent) and a good source of calcium, phosphorus, and iron.

Food price variations have increased over the last 5 years, putting additional pressures on household economy. Cashew value chain development, in this context, has the potential to increase stability of incomes and food security for cashew producers and processors. Many field observations and interactions suggest that the strategy of nutritional integration in cashew value chain development (as is done by COOPI) could be a potential answer. The stakeholders interviewed by the study team are very positive about the potential of cashew in terms of increasing gross earning of farm families which will translate into increased incomes and thereby improved food consumption – both quantity and quality. Further scenario modelling corroborates this potential as it indicates that a 2.5 ha cashew plantation farmer in Sierra Leone can potentially earn annual profits (after deducting cost of production) almost equivalent to the living wage (USD 800) in the country.

- Agrinatura Cashew VC study in Sierra Leone, 2018

With a 2.5 ha cashew farm (median cashew holding of a cashew farmer as per Comcashew baseline survey, 2017), a farmer in Sierra Leone can, in all likelihood, earn annual profits (after deducting cost of production) almost equivalent to the living wage (USD 800) in the country. Cashew can, therefore, be a poverty alleviation tool. This is achievable if high quality planting material is provided to the farmers along with the needed management inputs and easy finance. Comcashew survey (2018) stated access to finance as 'almost a precondition' to achieve the overall objective.

An ACi project evaluation report (2014) corroborates this potential of cashew. As per the report, evidence from a cashew development program in Ghana showed that potential was strong, as Ghanaian farmers using improved planting material were able to reach yields of more than 800 kg/ha (In comparison to 413 kg/ ha in Benin, 234 kg/ ha in Burkina Faso and 416 kg/ ha in Côte d'Ivoire). It states that cashew, typically harvested during the so-called "hungry season", help rural poor households diversify their incomes to manage the period of food insecurity. It goes on to suggest that on average, farmers earned USD 120 – 450 per year from cashews, which represented about 20 to 50 % of farmers' cash income.

Cashew's case for increasing stability of incomes and food security is strengthened by the concept of intercropping. An A4D cashew project final evaluation report has stressed the contribution of intercropping practices. A4D project carried out a campaign amongst all farmers on the advantages of intercropping and included technical support through the monitoring and the mobilization activities. As per this report, intercropping provided the motivation for farmers to take up cashew farming as they were assured of income inflows during the transition when cashew is growing and is not bearing yet. The stakeholders interviewed by the study team are very positive about the potential of cashew in terms of increasing gross earning of farm families which will translate into increased incomes and thereby improved food consumption – both quantity and quality.

4.3.5 Social Capital

The summary of social analysis on social capital in the cashew value chain in Sierra Leone is presented in the table below.

5.1 Strength of producer organisations	**Substantial**
5.1.1 Do formal and informal farmer organisations /cooperatives participate in the value chain?	Substantial
5.1.2 How inclusive is group/cooperative membership?	Substantial
5.1.3 Do groups have representative and accountable leadership?	Moderate/Low
5.1.4 Are farmer groups, cooperatives and associations able to negotiate in input or output markets?	Moderate/Low
5.2 Information and confidence	**Moderate/Low**
5.2.1 Do farmers in the value chain have access to information on agricultural practices, agricultural policies, and market prices?	Moderate/Low
5.2.2 To what extent is the relation between value chain actors perceived as trustworthy?	Moderate/Low
5.3 Social involvement	**Substantial**
5.3.1 Do communities participate in decisions that impact their livelihood?	Substantial
5.3.2 Are there actions to ensure respect of traditional knowledge and resources?	Moderate/Low
5.3.3 Is there participation in voluntary communal activities for benefit of the community	Substantial

Rating Scale used:	
Meaning	***Scale***
High likelihoods of this happening, no or little risks in the VC	**High**
Substantial likelihoods of this happening, low risks in the VC	**Substantial**
Moderate to low likelihoods of this happening, medium risks in the VC	**Moderate/Low**
Unlikely of this happening, high risks in the VC	**Not at all**
The parameter is not applicable for the VC	**n/a**

TABLE 30: SUMMARY OF SOCIAL ANALYSIS ON SOCIAL CAPITAL IN THE CASHEW VALUE CHAIN IN SIERRA LEONE

Strength of producer organisations

Sierra Leone has following main types of farmers or producer organisations:

- Farmer Based Organisation (FBOs)
- Farmer Field School (FFS)
- Agriculture Business Centres (ABCs)
- Others - trade unions, cooperative societies and grower societies

The WFP data (CFSVA, 2015) says that the most popular type of association is FBOs with 44.2 percent households as members. Farmer based organisation are not agricultural commodity specific, and generally, have 25 to 30 members with about 25 to 40% of them being women. Through the FAO supported Smallholders' Commercialisation Programme (SCP), MAFFs have promoted ABCs across the country. The purpose of the ABCs is to support rural populations to organize themselves as producers' organisations and cooperatives and to link them with national markets. The SCP programme has led to creation of agribusiness investment and increased value addition by groups and companies owned by the farmers. The ABCs are engaged in rice trading and milling, palm oil trading, vegetable growing and selling and other businesses.

In the cashew value chain, another type of institutional development seen is the formation of Community Processing Units (CPUs). These are purportedly business entities, owned and run by cashew communities, under management guidance from COOPI team. COOPI has established 5 CPUs under the A4D project in Kambia, Bombali and Port-Loko districts. Each CPU has been built around an ABC to synergise and capitalise on the operations of both entities. The MoU with ABC is such that it defines the mutual roles, with one person from ABC part of the CPU board. A4D project evaluation report (2016) stresses that CPUs should become a point of collection to transport the processed cashew to the other markets, especially the international market of Kambia. This will require strengthening CPUs capacities. The study team visited the CPUs in Port Loko and Kambia districts. These CPUs have a business plan which is early stages of implementation. The CPU of the Great Scarcies in Kambia covers an area of 5 chiefdoms (Magbema, Mansomgbala, Gbinleh, Disxon, Samu, Mambola). 15 FBOs are part of it with 375 farmers and 800 ha of plantation. The CPU will need infusion of both technology and finance to make headway on the business plan as otherwise, grant-based initiative will fail to become a profitable social venture.

One of the key constraints observed in the cashew value chain is the availability of finance to producers and processers. Comcashew baseline survey (2018) found that 57% of the surveyed households' member are part of a formal, registered farmers' association or cooperative. This could provide a good base for easy source of finance for cashew producers and processors as FBOs, in general, are providing loan at 15% interest to their members. This loan is generally provided in time when peak activities are going on and are for 4-6 months duration. This loan is a better-way for farmers to avoid the debt-trap from 50% interest loan they are compelled to take from traders when no other cheaper sources of finance are available. The FBOs /ABCs can potentially participate in output markets through RCN /cashew kernel trading. Comcashew baseline survey (2018) report confirm this potential role of FBOs in cashew value chain. It talks about the need for strengthening FBOs capacities to link farmers with local markets/traders and CPUs, and to organize logistic support (transport, storage and other facilities). The report says that capacity of FBOs should be built to acquire loans for farmers. Although the link between community banks and FBOs was limited to opening bank accounts, the report recommends strengthening the link and capacities of FBOs in this direction. A4D project evaluation report (2016) has commended the project on its strategy to intersect CPUs and FBOs through their board

Box 3: COOPI's semi block farming model: Farmer groups developing new approach to collective farming in Cashew

In a community in Kambia district, Coopi has motivated a group of 33 farmers to form a cashew group. Each group member has been given 100 cashew seedlings. They have harvested the cassava crop to plant cashew crop. But they have not given up on cassava as they have lands at other places, where they continue to do cassava. They have *boli* lands where there do rice cultivation. However, for rice they face challenge of finding money and labour. With no mechanisation support available (Sonalika tractors from India used to be used here), land clearing and preparation for rice cultivation has become a problem to the extent that some farmers have not planted this year (2018). Meantime, awareness on cashew potential has increased due to COOPI interventions. COOPI has promoted a group of cashew farmers collectivizing their land for establishing cashew plantation. This is a kind of a 'semi-block farm'. The cashew farming for this group is a joint and collective effort, accumulating their land and planting trees together. Though so far, they have not decided how the proceeds from the sale of cashew will be shared among the group members. They are learning this step-by-step. Some farmers have donated their excess land to the group to cultivate. Even though, 'semi block farming' is at experimentation stage as of now, more and more communities /farmer groups are getting motivated /inspired to take it up. To move forward, it may be useful to have a marketing plan and benefit sharing system agreed within the group. COOPI team also need business orientation as this is a business enterprise which if managed well can appreciably enhance the farmers' incomes. Achieving that is dependent on how farmers remain motivated and how COOPI provides them business thinking and enterprise support. Meantime, as the cashew has not started generating income, most farmers are earning cash through selling water melon, cucumber, Agushi (kind of bean) and other minor crops. Mostly women are involved in doing that and so women are making sure that their family is fed while they are doing tree crop cultivation, with long gestation period.

The study team visited another semi-block farming model of 7 farmers group, newly initiated into cashew. COOPI has provided the group with 100 seedlings per year per farmer. The first two attempts of seedling distribution have not resulted in much success as these have been damaged by fire, theft etc. Farmers were motivated by COOPI and fellow farmers to continue their cashew plantation. Farmers have shown courage and have re-dedicated themselves third time. This time, some success is being seen as no damages are noticed so far. Group members do collective labour for each other. Farmers are doing intercropping with cassava. Farmers perceive a great future in cashew and are expecting income to start rolling in next few years. They are now very serious about cashew farming business. One of the farmers told the study team that, "*cashew farm is our garden, if we do hard work on our garden now, one day it will become our guardian*"

Based on focus group discussions with cashew farmer groups in Kambia and Port Loko district

members so that CPUs can be conceived as buyers, or as a marketing point. The report has recommended at the strategy should be further strengthened during the next phase through follow up, further training and technical support.

The ABCs and FBOs met by the study team have cited one common reason for their success – strength and transparency of their leaders. The WHH household data (Spiral project, 2016) suggest that high levels of cronyism and less democratic governance has led to deeper inequality. While

all stakeholders interviewed during the study agreed that it is really good time for FBOs and ABCs as all government schemes are being implemented through these farmer organisations, they also concurred that these organisations face many challenges, some of which are related to transparent governance, hard-working leadership, gender-balance, access to inputs (seeds, fertiliser) and mechanisation tools, and finance for large scale production and trading (including cashew). A key informant interviewed by the study stated that that the difference between ~70% ABCs in the country who are not successful to the rest 30% who are successful is the 'accountable leadership', lack of which generally leads to disgruntled, disinterested members. The trustworthiness of relationship depends upon the quality of the group and strength of its leadership.

MAFFS and COOPI are currently supporting Ladeka ABC in Bombali district as a unique experiment. This is first, mostly women, targeted ABC for cashew value chain development. The ABC consist of 15 FBOs with 450 members, 60% of whom are women. The ABC is dealing in cashew (RCN) procurement and trading business. It is also selling cashew kernels processed by its women members. The ABC has basic infrastructure available such as storage facility, processing equipment, protective gears etc. Clearly, experiments like this demonstrate how cashew value chain can be developed through institutional strengthening.

The study found out that there is no defined market place for cashew in the district, no organisation of the farmers to get fair price. So, farmers get discouraged on not getting a good price. This could be one of the factors that de-motivate farmers to take care of their cashew farm. The value chain may need some institutional interventions such as cashew commodity association at district level and cashew development board at national level to steer and coordinate all cashew value chain upgradation activities at respective levels. At the same time, PMB could play an important role in organising and governing the value chain (in areas such as transparent price discovery, cashew quality standards setting and regulation, regional trade regulation, producer support programme etc.). Realisation of cashew's full potential demand such structural improvement actions.

Information and Confidence

The situation in the value chain is similar to what the WFP CFSVA survey (2015) found out. In the survey, farmers reported several reasons constraining them from achieving higher agricultural productivity including the unavailability of improved seeds (45.5 percent), lack of access to credit/money (38.8 percent), natural disasters/EVD (37.7 percent), insufficient household labourers (31.5 percent), pest/crop diseases (27.3 percent), lack of tools (24.9 percent) and the unavailability of fertiliser (19.2 percent). The use of agricultural inputs in Sierra Leone is far below requirements. Only 10.3 percent of farmers use improved seeds. Adoption of improved agricultural practices is still at an early stage in Sierra Leone and will take more time to be realised.

Extension and other services to the cashew farmers

In the cashew sector, ComCashew baseline survey (2018) found that only 21% of the 231 responding households have had some training on cashew within the last 5 years. COOPI is working towards a making a difference in this area through range of interventions such as:

- Mobilising farmers into FBOs
- Conducting farmers' sensitisation programme and establishing demonstration plots
- Setting up of cashew small-scale processing centres
- Guiding farmers in rehabilitation, pruning and under-brushing

- Helping farmers to open bank account and access loan from the bank
- Marking GPS of the farm to track the impact of the interventions
- Preparing database of farmers to facilitate the certification

COOPI has an advantage, being the first mover in the sector and is rightly placed in district MAFFS offices aiding close coordination, and joint implementation where required.

A cashew farmer and the chairman of the CPU in Port Loko shared his experience about challenges and opportunities in cashew farming.

> *"...we now have 1000 farmers supported by the COOPI project. One of our biggest problem is access to finance. Besides investment in cashew operations, we need cash for intercropping. No financial institution is supporting us for providing loan. We have passed this message to government many times. I have 7 ha of farm, I am training my labour. Another challenge we face is in finding the labour which are mainly engaged in mining and other activities while youth are preferring 'bike riding' business in cities. So, two main problem we face is capital and labour. Another issue is coming up as well. As we know, coffee and cocoa are now well-structured with good capacity in MAFFS to promote these crops, however, this is not the case with cashew. We need to have a specialist in cashew in MAFFS offices and at SLARI so that we can get regular technical guidance. Cashew farmers need energy and enthusiasm to continue. As a chairman for a CPU, I want to contribute meaningfully as cashew is the new economic crop and future for us..."*

Marketing structure of cashew

A4D project evaluation report (2016) stated that only 12% of the respondents reported that they thought that the price they are paid for their RCN was fair, while 60% declared that they did not think it was fair (the rest either did not respond to the question or said they do not know). The dominant buyers of RCN are traders that come to the village (52%) and 32% that go to the farm gate.

The COOPI team stated that earlier they were constrained in marketing of cashew but now they have seen interest from Balmed and many traders coming from Guinea (including Indians). Farmers seem to prefer Guinea traders as they pay more money. Farmers are also tied in trading relationship with them through loans taken earlier in the season. Cross boundary ethnicity (susu tribe) in Kambia and Guinea (being the same) may also be a contributing factor to the farmers placing trust in Guinea traders. There is another phenomenon seen of village-based agent getting trusted more by the cashew growers. COOPI has also started promoting this structure of village-based buying agents (just like the way it happens in cocoa and coffee) in the cashew value chain. COOPI team acknowledges that this is needed as the sector is poorly organised and unless all components (production, marketing, standardisation etc.) are brought together, it will be a challenge to upgrade value chain operations. A need has emerged for streamlining marketing structures. Doing this require more structural /institutional actions as is highlighted in the above section.

Social involvement

Cashew value chain has seen many novel experiments of working with cashew producers and processors. Balmed's block farm model, COOPI's semi block farming concept, COOPI's CPUs, women-centric ABC working on cashew trading and processing (Ladeka ABC) are some examples of on-going value chain experiments of social involvement at small-scale. Further development and strengthening of these initiatives can improve their effectiveness and can potentially lead to scaling up in the next few years. Despite many challenges, it is possible to achieve country's export

potential of cashew (~10,000 t)[78]. Making that happen will require continuous improvisation (based on experience) and consistent support to these models. If that happens, it will be an exemplary pro-poor and inclusive value chain development. However, all these experiments have seen many challenges and some failures. Balmed has lost money in initial trials of establishing block farm model in cashew even though they engaged with local community youth and chiefdom chiefs to ensure a smooth and conflict-free process. COOPI in Kambia, under A4D project, supported 600 farmers and 1200 ha cashew plantations. Because of a time-gap in the continuity of project – transition from A4D to ProAct - farmers left the plantation and afire occured and most of the plantations did not survive. Clearly follow-up monitoring and continued advisory and motivation to farmers is very necessary in cashew value chain development.

Kamcashew's cashew farm has not been productive due to many factors. Apart from management under-sight, community involvement has not been adequate to ensure farm protection and proper farm management. Kamcashew understand this as for the factory to be fully operational, they must have ready raw material. Currently, number of months in recess is more than the number of months in operations. Kamcashew is working up a plan for community involvement, learning from WHH (tools and cash to the community to do pruning, benefit sharing) and other initiatives (Balmed, COOPI). Now that the cashew market is becoming attractive, it is important for Kamcashew to lift itself up, more so as some investors are showing interest.

Key messages on 'Social Capital' in the VC:

Comcashew baseline survey (2018) found that 57% of the surveyed households' member are part of a formal, registered farmers' association or cooperative. More participation for cashew producers and processors in existing FBOs /ABCs can be encouraged as these organisations can provide various services to their members, including easy source of finance for cashew producers and processors.

CPUs are starting to play a role in input and output markets. However, this requires strengthening CPUs capacities. The CPU will need infusion of both technology and finance to make headway on the business plan as otherwise grant-based initiative will fail to become a profitable social venture.

The study found out that there is not a defined market place for cashew in the district, nor a farmers' organisation so that they can get a fair price. So, farmers get discouraged and this could be one of the factors why farmers generally do not take care of their farm. The value chain may need some institutional interventions such as cashew commodity association at district level and cashew development board at national level to steer and coordinate all cashew value chain upgradation activities at respective levels.

At the same time, PMB could play a hugely important role in organising and governing the value chain (in areas such as transparent price discovery, cashew quality standards setting and regulation, regional trade regulation, producer support programme etc.). Realisation of cashew's full potential demand such structural improvement actions.

The farmers in the value chain have very poor access to information and agriculture extension services. In the cashew sector, ComCashew baseline survey (2018) found that only 21% of the 231 responding households have had some training on cashew within the last 5 years. Cashew farmers

[78] Source: Cashew have 10,000 t export potential, contributing 7.3 million USD to the economy. Quoted from - Sierra Leone: Adding Value through Trade for Poverty Reduction - Diagnostic Trade Integration Study, November, 2006; updated in 2012

are facing constraints related to capital and labour availability. Technical support capacity at MAFFS and SLARI needs to be upgraded as well. These are constraining to farmers for achieving higher agricultural productivity.

The cashew value chain have seen many novel experiments such as Balmed's block farm model, COOPI's semi block farming concept, COOPI's CPUs, women-centric ABC working on cashew trading and processing (Ladeka ABC) are some examples of on-going value chain experiments of social involvement at small-scale. Further development and strengthening of these initiatives are important for achieving country's export potential of cashew (~10,000 t).

4.3.6 Living conditions

The summary of social analysis on living conditions in the cashew value chain in Sierra Leone is presented in the table below.

6.1 Health services	**Moderate/Low**
6.1.1 Do households have access to health facilities?	Moderate/Low
6.1.2 Do households have access to health services?	Moderate/Low
6.1.3 Are health services affordable for households?	Not at all
6.2 Housing	**Moderate/Low**
6.2.1 Do households have access to good quality accomodations?	Moderate/Low
6.2.2 Do households have access to good quality water and sanitation facilities?	Moderate/Low
6.3 Education and training	**Moderate/Low**
6.3.1 Is primary education accessible to households?	Substantial
6.3.2 Are secondary and/or vocational education accessible to households?	Moderate/Low
6.3.3 Existence and quality of in-service vocational training provided by the investors in the value chain?	Moderate/Low

Rating Scale used:	
Meaning	***Scale***
High likelihoods of this happening, no or little risks in the VC	**High**
Substantial likelihoods of this happening, low risks in the VC	**Substantial**
Moderate to low likelihoods of this happening, medium risks in the VC	**Moderate/Low**
Unlikely of this happening, high risks in the VC	**Not at all**
The parameter is not applicable for the VC	**n/a**

TABLE 31: SUMMARY OF SOCIAL ANALYSIS ON LIVING CONDITIONS IN THE CASHEW VALUE CHAIN IN SIERRA LEONE

Health services

Basic health infrastructure in rural areas in Sierra Leone is very limited. Primary health centers are available approximately 2-3 miles from a village. The secondary hospitals are further away from villages. The first line of treatment in most cases is village-level herbalist (a registered herbalist in some case). If that does not work, then people go to a nearby government health facility (PHC). While cost of local treatment is around 10,000 Le (~1.5 USD), the cost of treatment through a PHC is exorbitant at ~70,000 to 230,000 (~10 to 30 USD), depending on the disease. The health services are rudimentary and increasingly less affordable.

The main health problems, cashew family face is Malaria, ulcer, cough and stomach ache. The cashew farmers (spoken to) go to the Port Loko hospital for treatment which is about 4 miles away. The spend lot of money (transport, doctor's fee and medicine cost) for getting treated. As per Govt. policy medicines are free only for children less than 5 years of age. The female cashew farmer told us that is also not the case when her children needed treatment. Drugs are supplied by international agencies to main hospital but the drugs delivery from main hospital to health centers does not normally happen.

As per Comcashew baseline survey (2018), of the 231 surveyed households, 139 (43%) reported having at least one member with some chronic health problem while 212 (92%) reported having had some acute (sickness, accident, injury) problem. As per ProAct baseline survey (2017), insufficient access to health and WASH facilities largely contribute to the high malnutrition rates in Sierra Leone.

The state of health facilities and services can also be seen in the health outcomes. The secondary statistics (WFP-CFSVA, 2015) shows that Sierra Leone has the lowest life expectancy in the world (45 years), the highest maternal mortality rate (1,165 per 100,000 live births) and among the highest infant and child mortality rates at 92 per 1,000 births for infants and 70 per 1,000 children under five. HIV prevalence is estimated at 1.5 percent, with around 60,000 people living with HIV. Malaria poses a critical public health challenge and accounts for 17.0 percent of deaths. Only 1 percent of women and 3 percent of men have health insurance (DHS, 2013).

Housing

Many cashew producers and processors reside in dilapidated dwellings. Three main type of dwellings were seen in cashew districts:

- Type 1: Mud walls with thatched roof
- Type 2: Cemented wall with tin roof
- Type 3: Brick walls with tin roof

These dwelling have mud or cemented flooring and have one or two rooms. Generally, a family of 6-8 people reside in such houses.

As per ProAct baseline survey (2017), insufficient access to health and WASH facilities largely contributes to the high malnutrition rates in Sierra Leone. Just 4.3% of the households in rural area have access to improved sanitation facilities. Access to safe drinking water is poor especially in Kambia where 51.4 % of the households obtain their water from river, stream or pond. In the other cashew districts, this prevalence is as follows: Bombali 36.5 % and Port-Loko 43.5 %. The ProAct survey further report that lack of facilities and poor hygiene practices contribute to a high prevalence of diarrhoea and other diseases that negatively affect the nutritional status. Open defecation though is less serious problem in cashew districts (Bombali 13.7 %, Kambia 15.2 % and Port-Loko 13.7 %) than in other districts (such as Kailahun 48.1%).

Key messages on 'Living Conditions' in the VC:

Basic health infrastructure in rural areas in Sierra Leone is very limited. Primary health centres are available approximately 2-3 miles from a village. The secondary hospitals are further away from villages.

Unsafe drinking water and unhygienic sanitation practices could pose considerable strain on achieving health outcomes, while high cost of seeking treatment from primary or secondary health centres can continue to pose barriers for poor people in terms of health seeking behaviour.

Cashew production by smallholders is hampered, in terms of both quantity and quality, by limited education and training, as highlighted in earlier sections. The farmers need to improve their knowledge and skills related to cashew production and processing. COOPI, with MAFFs is providing extension services to about 4000 farmers and workers. This could possibly be scaled up to 10 to 20,000 farmers and workers in near future.

- Agrinatura Cashew VC study in Sierra Leone, 2018

Education and training

ComCashew survey (2018) report that 44% household head have either completed or have some primary school education and 4.4% have at least some secondary school education. DHS survey (2013) reported that the literacy rate for women is 36 percent, and the rate for men is 52 percent. Fifty-six percent of women have no education compared with 40 percent of men. The DHS data further show a decrease in the proportion of women and men with no education (51 percent for women and 41 percent for men) compared with the 2008 DHS survey (58 percent for women and 46 percent for men). 71 percent of children of primary school age are attending school—an improvement from 2008 when it was estimated at 62 percent at the primary school level.

The focus group discussions with cashew producers revealed that most educated men within a village is likely be a Junior Secondary School -JSS 3, which means 9 years of education while most educated women within a village is likely to be a JSS2, which means 7-8 years of education. The situation is changing for the current generation with most school-age boys and girls being in school, as the country is rebuilding schools (destroyed by the war) and increasing efforts on primary school enrolment. However, drop-out rates continue to be higher due to lack of schooling infrastructure and very high fees. The study team met a woman (who is mid-size cashew farm) headmaster of a primary school (her husband is headmaster in a secondary school). She shared that the teacher-student ratio is one of the main problems being faced. Sometime this ratio goes up to 70-80 pupils per teacher. Also, many of the teachers are not confirmed on govt rolls and are paid stipend based on community contributions, which are very small, and is not motivating enough for them. The govt teachers generally get 800,000-900,000 (102 to 119 USD) per month salary, which is just about the minimum wages in the country. They confirmed that dropout rates are very high for pupils moving to secondary schools (esp. from JSS to SSS). More drop out phenomenon seems to occur with girls than for boys as girls' numbers reduces considerably in

secondary schools. Teenage pregnancy was also cited as one of the reasons. The cost of education (as estimated during an FGD) for a child is around 400,000 to 500,000 Le; 51 to 64 USD per year, which is steep and unaffordable for majority of people and is one of cause of indebtedness.

The WFP survey (CFSVA, 2015) revealed that low levels of education attainment are an economic phenomenon, with 37.0 percent of children from the poorest quintile out of primary school compared to only 7.0 percent of the richest quintile. Household income status becomes an even more important factor which impacts enrolment at the secondary level, with 53.0 percent of children from the poorest wealth quintile out of school compared to just 15.0 percent from the richest wealth quintile.

Cashew production by smallholders is hampered, in terms of both quantity and quality, by limited education and training, as highlighted in earlier sections. The farmers need to improve their knowledge and skills related to cashew production and processing. COOPI, with MAFFs, is providing extension services to about 4000 farmers and workers. This could possibly be scaled up to 10 to 20,000 farmers and workers.

The labour force survey (2014) reported that only 5.5 percent of the working-age population has participated in vocational training. Considerably more men than women undertake vocational training (7.1 percent versus 4.2 percent).

4.4 Findings - Social Analysis (framing question 2)

Framing Question 2: Is this economic growth inclusive?

The study analysed the potential of cashew value chain development in Sierra Leone in addressing the dire situation of food and nutrition insecurity. The study results show that with a 2.5 ha cashew farm (median cashew holding of a cashew farmer as per Comcashew baseline survey, 2017), a farmer in Sierra Leone can, in many likelihoods, earn annual profits (after deducting cost of production) almost equivalent to the living wage (USD 800) in the country. Cashew can, therefore, be a poverty alleviation tool. This is achievable if high quality planting material is provided to the farmers along with the needed management inputs and easy finance. Comcashew survey (2018) stated access to finance as 'almost a precondition' to achieve the overall objective.

Further economic growth induced by the cashew value chain development is expected to be economically inclusive as most cashew processing enterprises are run single-handedly by women that contribute average of 30% to total family income in processing families. The cashew value chain offers many other economic opportunities (such as cashew apple processing, bee keeping, and nursery management) for women.

The study also uncovered areas where 'inclusivity' of the value chain can be improved:

- Majority of workers across different parts of the value chain are probably earning much less than the minimum wages (~800 USD per annum), as data from sample investigations in the four districts shows. The worse-off are farm workers involved in cashew production.
- The prevailing rate of annual compensation from land-lease is $12.5 /hectares. If large-scale land investments in cashew sector become a reality (which it may), then there is a need to rethink and revise the compensation for the land owners. More so, as alternative business model of block farming can provide much better returns (~100 to 240 USD per ha.[79]) to land owners.

[79] Computed by the study, based on assumptions and basic data collected on block farm model from Balmed

- Lower technical capacities (at MAFFS, SLARI etc.) in cashew, low access to finance and labour could constrain efforts to increase cashew yields in the country. Agriculture productivity can remain low in the absence of strong information and extension services to the farmers. Also, improper /unregulated marketing structures may continue to bring the sector down, in terms of its contribution to farmers' incomes and economic growth of the country. The marketing structure in the sector is evolving. A need has emerged for streamlining marketing structures.

Overall, the Cashew value chain is showing signs of exemplary pro-poor and inclusive value chain development. However, this is at present at small scale and many efforts are needed for inclusive and sustainable expansion of the sector, for which a very large potential[80] exists.

[80] A World Bank study analysed cashew sector export potential in Sierra Leone to be about 10000 t per annum

5. Environmental analysis

This chapter focuses on the environmental analysis of the cashew nut value chain in Sierra Leone. This analysis is based on Life Cycle Assessment (LCA) methodology, following the ISO standard 14044/2006 and the ILCD guidelines from the Joint Research Centre of the European Commission (EC-JRC, 2010; ISO, 2006).

5.1 Goal and scope of the study

5.1.1 Objectives and scope of the study

The generic framing question of the environmental LCA studies carried out under the VCA4D project is to determine whether the value chains under study are environmentally sustainable. According to the Terms of Reference (ToR) of the Cashew Value Chain Analysis in Sierra Leone, the specific objective of this study is to "highlight the most relevant strengths, risks and opportunities in the value chain, the points to be further analysed in depth, and the aspects that are difficult to inform". The intended application of the results of this work is to "help the European Commission structuring their policy dialogue around the strategic issues that might hinder the sustainable development and growth of the cashew value chain in Sierra Leone". More specifically, the target audience for this study is the DG DEVCO of the European Commission and the Delegation of the European Union in Sierra Leone.

Based on these generic and specific elements, four main objectives are formulated for the LCA study to be undertaken:

- To quantify the potential environmental impacts of the current cashew value chains in Sierra Leone, based on available knowledge, and to highlight the environmental hotspots;
- To determine, through sensitivity and uncertainty analyses, the main gaps in knowledge that can introduce biases in findings and comparisons and that would need to be filled by specific studies;
- To explore, through sensitivity analyses, key opportunities and risks for the development of the cashew value chains from an environmental perspective; and
- To provide elements for discussion on the sustainability of current cashew value chains in Sierra Leone.

From a methodological point of view, according to the ILCD handbook, the decision context of the study is classified as "micro-level decision support" since no structural consequence on other value chains is expected from the growth of the cashew value chains. The recommended approach for system description and Life Cycle Inventory (LCI) modelling is then attributional[81], and the recommendation to deal with multi-functionality is to use the system expansion approach[82], considering the market mix of the avoided process (EC-JRC, 2010).

[81] According to the ILCD handbook, "attributional life cycle inventory modelling [...] depicts the potential environmental impacts that can be attributed to a system (e.g. a product) over its life cycle, i.e. upstream along the supply-chain and downstream following the system's use and end-of-life value chain. Attributional modelling makes use of historical, fact-based, measureable data of known (or at least knowable) uncertainty, and includes all the processes that are identified to relevantly contribute to the system being studied." (EC-JRC, 2010, p. 71).

[82] According to the ILCD handbook, ""System expansion" and its variant "substitution" are [...] a combined concept for ensuring the equality of multifunctional systems with each other [...] by expanding the system boundaries and substituting the not required function supersedes ("substitution"). [...] Substitution means to subtract the inventory of another system from the analysed system. This often leads to negative inventory flows. It can even result in negative overall environmental impacts for the analysed system. This means that there is a net benefit of producing

Regarding the scope of the study, according to the ToR, the focus is set "on the cashew value chain that is developed in particular in the North of the country and where there is a limited availability of specific studies". Indeed, according to GIZ estimations[83], cashew plantations in Sierra Leone represented around 7000 ha in 2010, and around 55% of this area was located in three districts of the Northern Province: Kambia, Bombali, and Port Loko. Considering the recent efforts to develop the cashew value chain in these three specific districts, such as the Agriculture for Development (A4D) project and the ProAct action (A4D Project, 2016; Ballweg et al., 2017), this share is expected to have increased since 2010.

Therefore, the temporal and geographical coverages selected for this study are the current situation of the cashew value chain in the three main cashew-growing districts in the Northern Province of Sierra Leone: Kambia, Port Loko, and Bombali (see Figure 53). However, since one of the objectives of the study is to explore key opportunities and risks for the development of the cashew value chains in the country, potential future changes in the cashew value chain, regarding in particular cashew cultivation, are also integrated through sensitivity analyses. Furthermore, when available, data for the whole country is also considered.

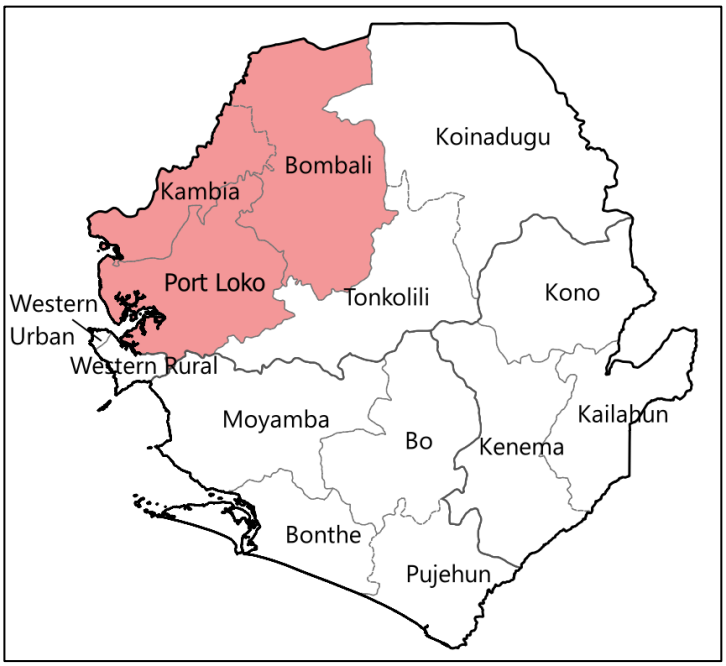


FIGURE 53: MAP OF SIERRA LEONE DISTRICTS, AND GEOGRAPHICAL SCOPE OF THE STUDY

Finally, it is worth noticing that no comparison of the LCA results obtained is intended, either between the different cashew value chains considered in this study or with other studies. Indeed, only two case studies on the environmental impacts of cashew production were found in the literature. The first one is an LCA case study focused on the farm stage in Brazil (Brito De Figueirêdo et al., 2016). The second one is a comparison of greenhouse gas balances of different cashew supply chains between West Africa and the United States, focused on transportation and processing (Agyemang et al., 2016).

the analysed system as the overall impact is more than compensated by the avoided impact the co-functions have elsewhere." (EC-JRC, 2010, pp. 77–78).

[83] Rita Weidinger, personal communication, February 23, 2018.

5.1.2 Main data sources used for the Life Cycle Inventory

The Life Cycle Inventory (LCI) of the environmental assessment was built on:

- Primary data and information from the VCA4D project, collected during a field mission which took place from January 28, 2018 to February 6, 2018, and during a field survey conducted by Sorie Bangura from May 9, 2018 to May 21, 2018;
- Secondary data, specific to scope of the study, and produced mainly from two European initiatives, namely the A4D project (A4D Project, 2016; Costa and Bocchi, 2017; University of Milan and Politecnico of Milan, 2016) and the ProAct action (Ballweg et al., 2017), and from a recent survey conducted by the Competitive Cashew initiative (ComCashew) and the German Society for International Cooperation (GIZ) (Weidinger et al., 2018); and
- Background data, from relevant literature and LCI databases, namely the ecoinvent database (version 3, recycled content, supplemented when needed by version 2) and the LCA-CIRAD database.

5.1.3 Description of the systems under study

5.1.3.1 Overview of the cashew value chains in Sierra Leone

The main steps of the full cashew value chain and their respective potential by-products are represented in Figure 54. Depending on situations, some of these steps may take place outside the country, e.g. processing or consumption.

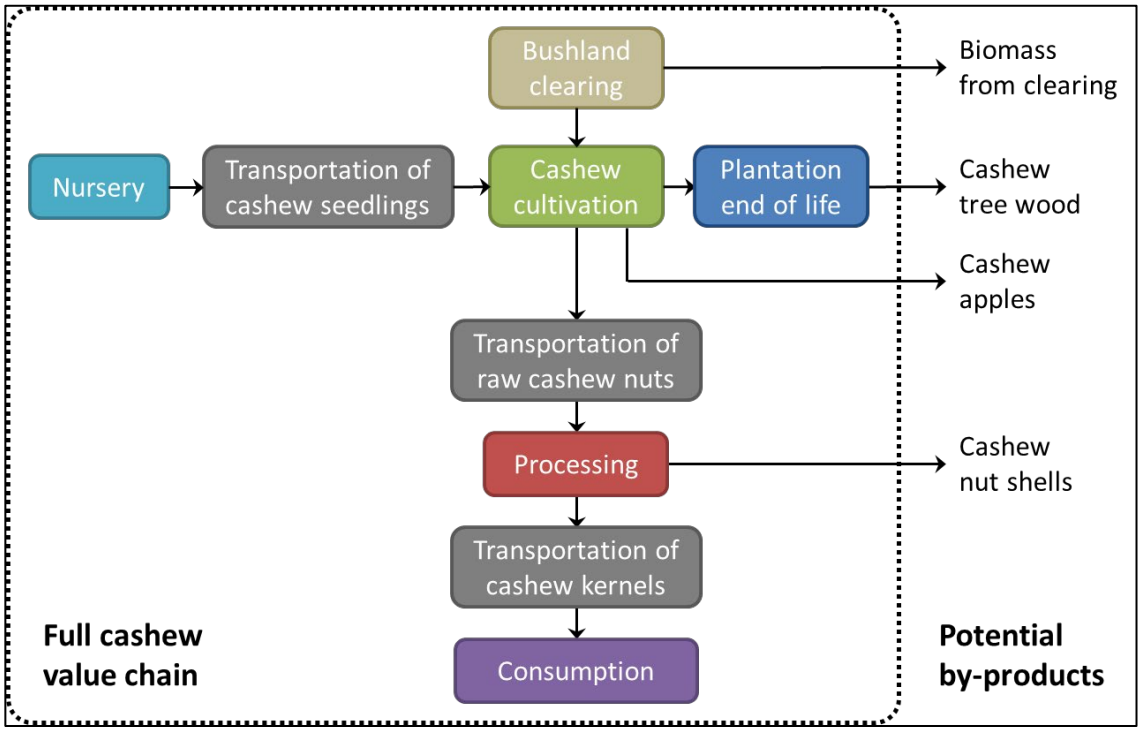


FIGURE 54: MAIN STEPS OF THE FULL CASHEW VALUE CHAIN AND THEIR POTENTIAL BY-PRODUCTS

The functional analysis carried out for the VCA4D project made it possible to identify the main types of actors involved in the cashew value chain in Sierra Leone and the main related cashew flows. These actors and flows are represented in Figure 55.

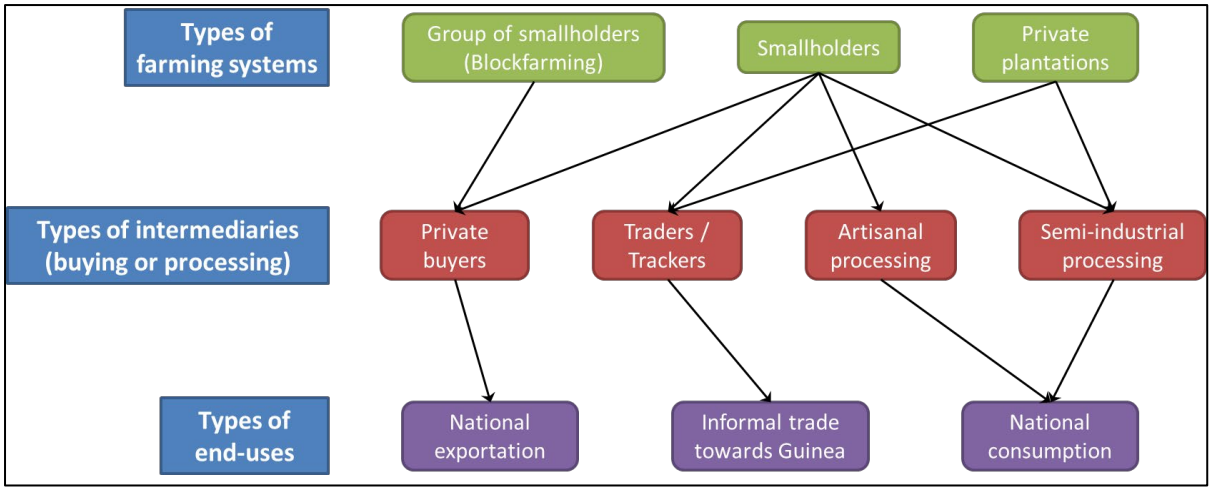


FIGURE 55: MAIN ACTORS AND FLOWS OF THE CASHEW VALUE CHAIN, BASED ON THE FUNCTIONAL ANALYSIS

Due to its particular nature and to a lack of available data, the informal trade towards Guinea will not be further considered in the environmental assessment, although it most likely represents the main market for the current production of Sierra Leone. Then, two main types of value chains can be defined from the functional analysis:

- A value chain dedicated to national exportation, promoted by companies such as Balmed, mostly based on groups of smallholders, also called blockfarming by Balmed, and inspired by their experience on cocoa value chain; and
- A value chain dedicated to national consumption, based on either smallholders or larger private plantations, and on either artisanal or semi-industrial processing.

According to the functional analysis (see Table 1 and section 2.3.2), the national exportation system might represent less than 2% of the national cashew production in 2017, which was the first year of official exportation. The rest of cashew production is shared out between informal trade and national consumption, but no reliable data is available regarding their respective proportions.

5.1.3.2 Functions of the value chains and choice of the Functional Units

The functions of the cashew value chains in Sierra Leone differ according to the type considered:

- In the case of national exportation, the main function is to produce raw cashew nut for exportation from Freetown port; and
- In the case of national consumption, cashew contributes to the national food security, and the main function is then to produce cashew kernels for Sierra Leonean markets.

Consequently, the Functional Units (FU) chosen for each of these two types of value chains are:
In the case of national exportation, one ton of RCN at Freetown port; and
In the case of national consumption, one ton of cashew kernels at Sierra Leonean markets.

5.1.3.3 Potential and actual multi-functionality of the value chains

According to Figure 54, cashew value chains can generate up to four potential by-products: biomass from bushland clearing, tree wood from the end of life of cashew plantations, cashew apples, and Cashew Nut Shells (CNS).

5.1.3.4 Biomass from bushland clearing

For the cashew plantation to be established, proper clearing and cleaning of the land plot are required. As explained, the land use prior to the establishment of cashew plantations is assumed to be bushland.

FIGURE 56: TYPICAL BUSHLAND (LEFT) AND BUSHLAND AFTER FIRE (RIGHT) IN THE NORTHERN PROVINCE OF SIERRA LEONE

As illustrated in Figure 56, vegetation of bushlands consists mainly of tall grass, shrubs and small trees. Bushland can be cleared either manually or by setting it on fire. In the second case, all biomass is burnt and then no longer available for other purposes. In the first case, is is assumed that only a limited amount of biomass can be recovered as fuelwood, and that most of it is left on the fields. In both cases, biomass from bushland clearing is either lost during fire or produced in small quantities and is therefore not considered as a by-product in this study.

5.1.3.5 Tree wood from the end of life of cashew plantations

Cashew is quite a recent tree crop in Sierra Leone. No information based on observation is available regarding the recovery of tree wood from the end of life of cashew plantations. In this study, this tree wood is assumed to be used as fuelwood and is then an actual by-product of the value chains.

In accordance with ILCD guidelines, system expansion is applied to deal with tree wood from cashew plantations, considering that this wood avoids traditional fuelwood production.

5.1.3.6 Cashew apples

Low use of cashew apples was reported in Sierra Leone in recent surveys and the A4D study (University of Milan and Politecnico of Milan, 2016; Weidinger et al., 2018). In some cases, apples are directly eaten or, in very rare cases, processed into wine and gin, but even in these cases, only a part of the fruit production is concerned. Most of the apple production is then left in the fields currently in Sierra Leone. Accordingly, cashew apples are not considered as by-products of the value chain in this study.

5.1.3.7 Cashew Nut Shells (CNS)

When RCN are directly exported, CNS are not produced in Sierra Leone, and are therefore not a by-product at the country level.

When RCN are processed in Sierra Leone, CNS are mostly used as fuel, on the basis of the information collected during the VCA4D study for both artisanal and semi-industrial processing. Only in some cases of artisanal processing, shells were reported to be disposed of instead of being used. These cases occurred in eastern Bombali, for processing capacities of more than 1250 t of RCN per year. In this study, this situation where CNS are disposed of is assumed particular and specific to places where fuel is quite available, and CNS are then assumed to be always used as fuel. However, based on the information collected, different uses are considered depending on the type of processing (see details in section 4.2.3.):

- In the case of artisanal processing, charcoal is used for RCN processing, and CNS are then an actual by-product of the value chain, used as fuel for other purposes; and
- In the case of semi-industrial processing, all CNS are used for RCN processing, and fuelwood is used in addition.

In accordance with ILCD guidelines, system expansion is applied to deal with CNS from artisanal processing, considering that CNS production avoids other fuel production, based on a market mix (see other sections for details).

5.1.3.8 *Description of the product systems and their system boundaries*

Based on previous sections, three product systems are considered in this study: a national exportation system, and two national consumption systems, based respectively on artisanal and semi-industrial processing.

No further differentiation on farming systems is introduced since despite the structural differences between smallholders, groups of smallholders or private plantations, no difference was reported in terms of agricultural practices (Ballweg et al., 2017; University of Milan and Politecnico of Milan, 2016; Weidinger et al., 2018). These current agricultural practices can be characterized as extensive. However, a possible evolution of practices, characterized here as semi-extensive, is considered as a sensitivity analysis.

These three product systems and their respective system boundaries are represented in Figure 57. For simplification purposes, production of the different inputs required in the different steps of the cashew value chains are not represented in the figure.

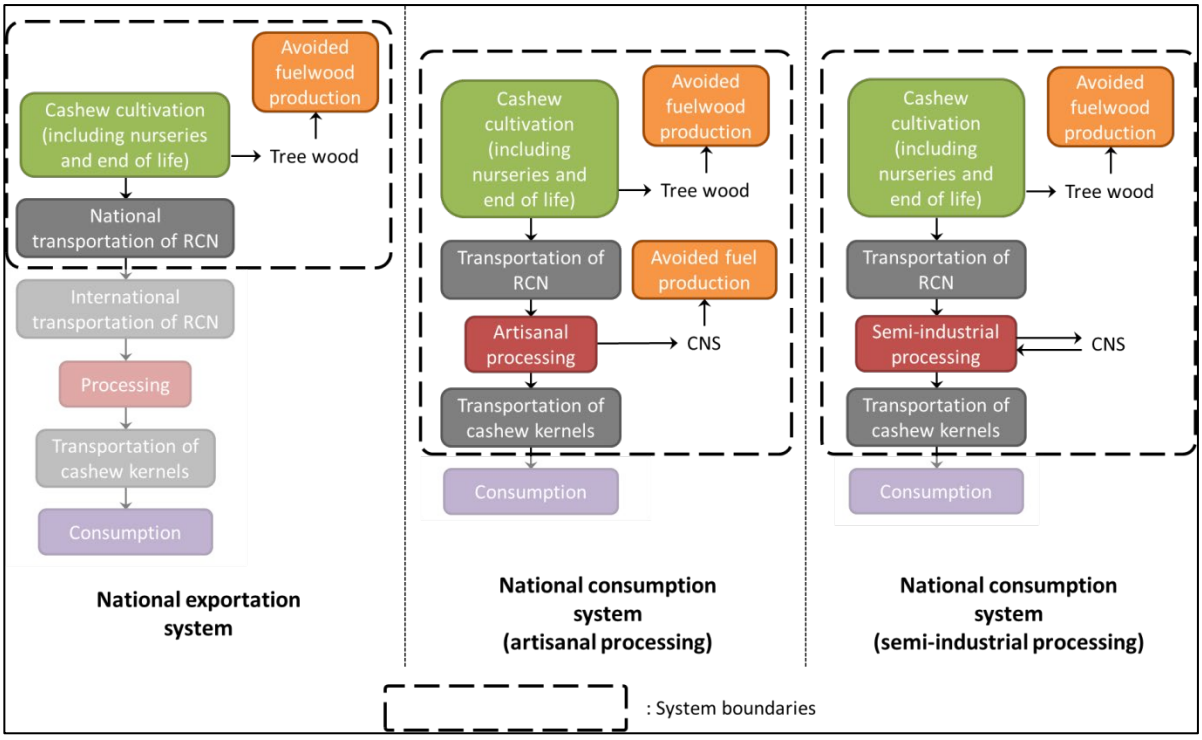


FIGURE 57: SIMPLIFIED SYSTEM BOUNDARIES OF THE THREE TYPES OF SYSTEMS CONSIDERED IN THIS STUDY

In compliance with the ToR of the study, all processes taking place outside of Sierra Leone in the national exportation system were excluded of the system, in order to focus on the potential environmental impacts or benefits at stake at the country level. Furthermore, in the national consumption systems, the consumption itself of the cashew kernels was also excluded, assuming that no specific environmental issue is associated with cashew consumption.

5.1.3.9 Choice of impact assessment method and indicators

As stated in the introduction of this section, the generic framing question of this environmental LCA study is to determine whether the cashew value chains in Sierra Leone are environmentally sustainable. To this end, three underlying core questions are defined, with the objective to determine the potential impacts of these value chains on the three Areas of Protection (AoP) classically used in LCA: resource depletion, ecosystem quality, and human health (EC-DG DEVCO, 2017). The Life Cycle Impact Assessment (LCIA) method to be applied must then provide endpoint indicators relative to these three AoP. To support the analysis and understanding of the LCA results, the LCIA method should also provide midpoints indicators.

Furthermore, regarding geographical coverage, no Life Cycle Impact Assessment (LCIA) method specific to West African conditions is available in the literature. The LCIA method to be applied in this study should thus also be global, as well as up-to-date with the most recent knowledge in environmental sciences.

ILCD recommendations for LCIA only partly meet these requirements since endpoint indicators are still quite incomplete (EC-JRC, 2011; PRé Consultants, 2018). The ReCiPe2016 LCIA method (hierarchist version) is then adopted for this LCA study since it is a global and recent LCIA method, providing both midpoint and endpoint indicators (Huijbregts et al., 2017, 2016). Table 32 summarizes the impact categories and the damage pathways on AoP considered in the ReCiPe2016 LCIA method.

Impact category	Considered damage pathways on AoP		
Climate change	✓	✓	
Stratospheric ozone depletion	✓		
Ionising radiation	✓		
Particulate matter formation	✓		
Photochemical ozone formation	✓	✓	
Terrestrial acidification		✓	
Freshwater eutrophication		✓	
Toxicity and ecotoxicity	✓	✓	
Water consumption	✓	✓	
Land use		✓	
Mineral resource scarcity			✓
Fossil resource scarcity			✓

TABLE 32: SUMMARY OF IMPACT CATEGORIES AND DAMAGE PATHWAYS CONSIDERED IN THE RECIPE2016 LCIA METHOD AND IN THIS LCA STUDY (HUIJBREGTS ET AL., 2017)

The following gives a quick overview of the environmental issues addressed by the different impact categories specified in Table 32.

Impact category	Description of the environmental issues addressed
Climate change	Greenhouse gas emissions causing disturbances on the global climate system
Stratospheric ozone depletion	Emissions of compounds such as chlorofluorocarbons or halons, which are responsible for the ozone hole phenomenon
Ionising radiation	Release of radioactive substances into the environment
Particulate matter formation	Emissions of particulate matter or particulate precursors, which contribute to respiratory disorders
Photochemical ozone formation	Emissions of ozone precursor pollutants such as nitrogen oxides or volatile organic compounds, causing human health problems (irritation, asthma) or damage to plants
Terrestrial acidification	Emissions of acidifying pollutants, causing phenomena such as acid rain, and damage to terrestrial ecosystems
Freshwater eutrophication	Emissions of nutrients into the natural environment, causing disequilibria in freshwater ecosystems (proliferation of plant or animal species at the expense of other species)
Toxicity and ecotoxicity	Emissions of pollutants toxic to human health and ecosystems
Water consumption	Effects for human population and ecosystems of freshwater consumption
Land use	Biodiversity changes due to land transformations and occupations
Mineral resource scarcity	Depletion of mineral ores
Fossil resource scarcity	Cumulated primary energy demand from fossil and nuclear sources

TABLE 33: BRIEF DESCRIPTION OF THE ENVIRONMENTAL ISSUES ADDRESSED BY THE DIFFERENT IMPACT CATEGORIES IN RECIPE2016

5.1.4 Interpretation of results

To meet the first objective formulated in the beginning of this environmental section, related to the identification of environmental hotspots, three types of contribution analyses were carried out:

- Identification of the main steps of the value chains contributing to endpoint indicators;
- Identification of the main impact categories contributing to endpoint indicators; and
- Identification of the main steps of the value chains contributing to the midpoint indicators of the main impact categories.

Full contribution analyses to midpoint indicators are provided in annex (page 184).

To determine the significance and the reliability of the conclusions reached on system comparisons, uncertainty analyses were undertaken for all comparisons in this LCA study. These uncertainty analyses were performed through Monte Carlo simulations, based on 10,000 runs.

Regarding the discussion on the environmental sustainability of the different value chains, an important limitation of the LCA method, and of most other environmental assessment approaches, is that they are more suitable for comparison purposes than for absolute assessments. An LCA study can then point out that one system is "more sustainable" than another one, but not that a system is environmentally sustainable in absolute terms.

Nonetheless, to provide insights on sustainability issues, endpoint impacts of cashew value chains were compared in this study to those of some benchmark systems. These benchmark systems were selected for their meaningfulness in the context of Sierra Leone:

- Regarding the AoP of human health and ecosystems, bushfires were used as a benchmark system, impacts being expressed per hectare of bushland burned; and
- Regarding the AoP of resources, a round trip air flight between Brussels and Freetown was used as a benchmark system, impacts being expressed per passenger.

5.2 Life Cycle Inventory

5.2.1 Detailed system description

This second section provides details on the technical data and assumptions used for the three systems considered in this LCA study. Detailed description of these systems is given in Figure 58, Figure 59 and Figure 60, for, respectively, the national exportation system, and the national consumption systems, based on artisanal or semi-industrial processing.

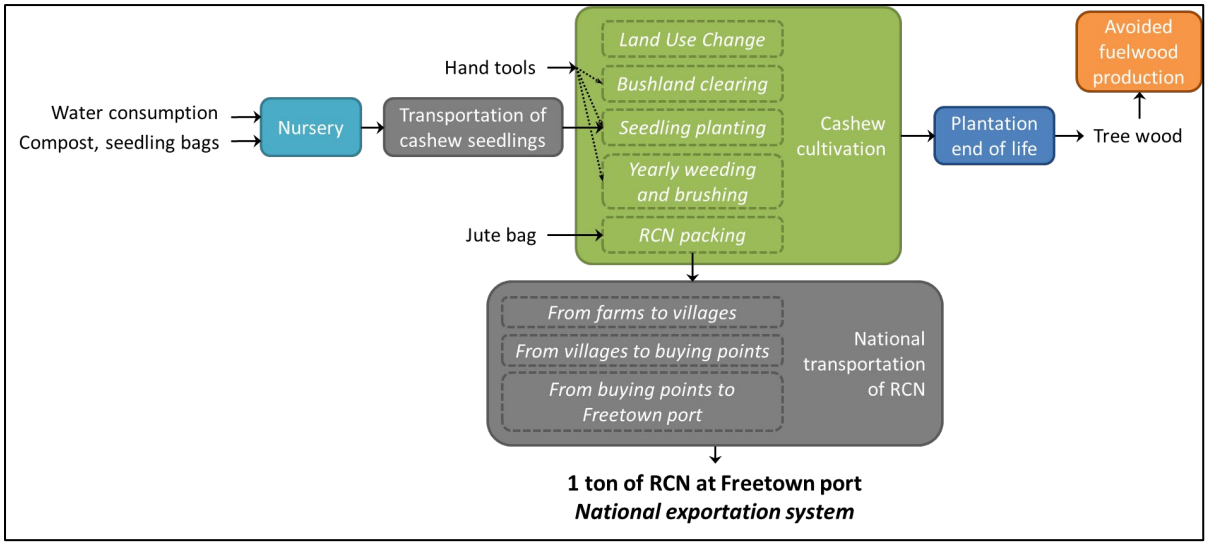


FIGURE 58: DETAILED DESCRIPTION OF THE NATIONAL EXPORTATION SYSTEM

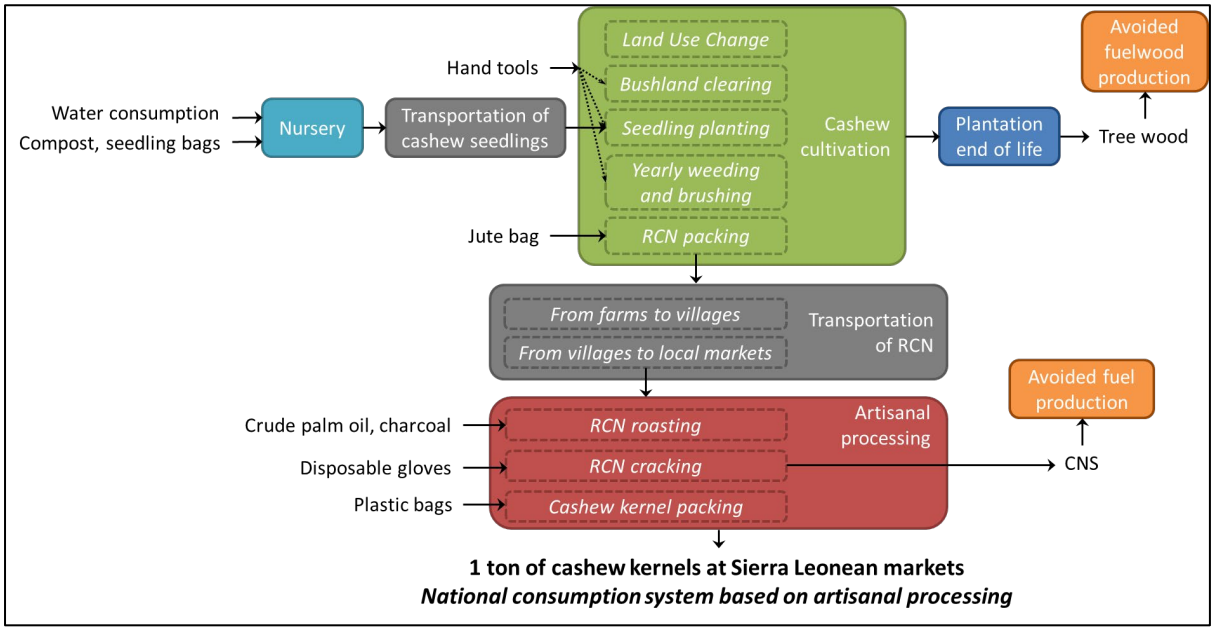


FIGURE 59: DETAILED DESCRIPTION OF THE NATIONAL CONSUMPTION SYSTEM BASED ON ARTISANAL PROCESSING

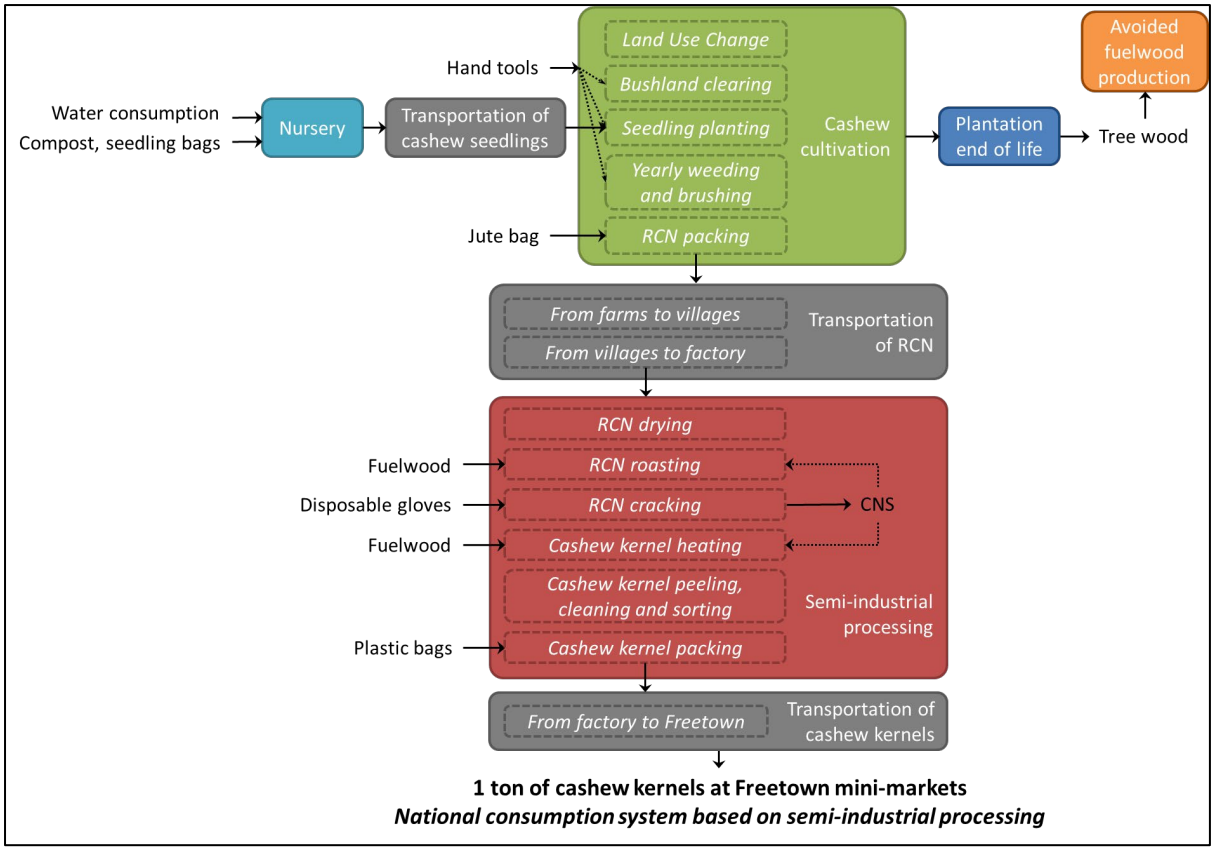


FIGURE 60: DETAILED DESCRIPTION OF THE NATIONAL CONSUMPTION SYSTEM BASED ON SEMI-INDUSTRIAL PROCESSING

Cashew nut cultivation, which is common to all systems, is first described in section 4.2.2. Then cashew nut transportation and processing are detailed in section 4.2.3. Finally, a description of benchmark systems is provided in section 4.2.4.

5.2.2 Cashew tree cultivation

Since cashew is a perennial crop, LCI modelling of its cultivation requires some specific considerations, which are described in the next section. Effects of Land Use Changes (LUC) associated with cashew cropping are considered afterwards. Current extensive agricultural practices and some prospective elements on cashew cultivation, based on existing recommendations for semi-extensive plantations, are then presented.

General modelling principles of cashew cultivation

Recent surveys showed that cashew is a recent tree crop in Sierra Leone: reported tree ages range from 0 to 20 or 40 years, with a mean tree age varying between 4 and 12 years depending on sources (A4D Project, 2016; Ballweg et al., 2017; Weidinger et al., 2018). This means that young cashew plantations are over-represented compared to older ones in the current situation, which can introduce a bias when using available average data.

LCI modelling of cashew cultivation is then based on existing specific recommendations for perennial crops (Bessou et al., 2013). As proposed by Bessou et al. (2013), a modular assessment is adopted in order to balance the different tree stages and to model cashew cropping in a way representative of the complete tree cycle. The representation of the cashew tree cycle adopted

for this study is given in Figure 61 and based on crop production guidelines for Sierra Leone (Momoh, 2005). In terms of RCN yield, the following assumptions were considered:

- No RCN production is considered during the unproductive years;
- RCN harvesting occurs from the first year of the transitory years (year 4) up to the end of the cashew tree cycle (year 30);
- During the transitory years, RCN yield is assumed to increase linearly from no production at year 3 to a maximum yield at year 10; and
- During the fully productive years, RCN yield is assumed constant and equal to a maximum yield value, which depends on the cultivation practices (see previous sections).

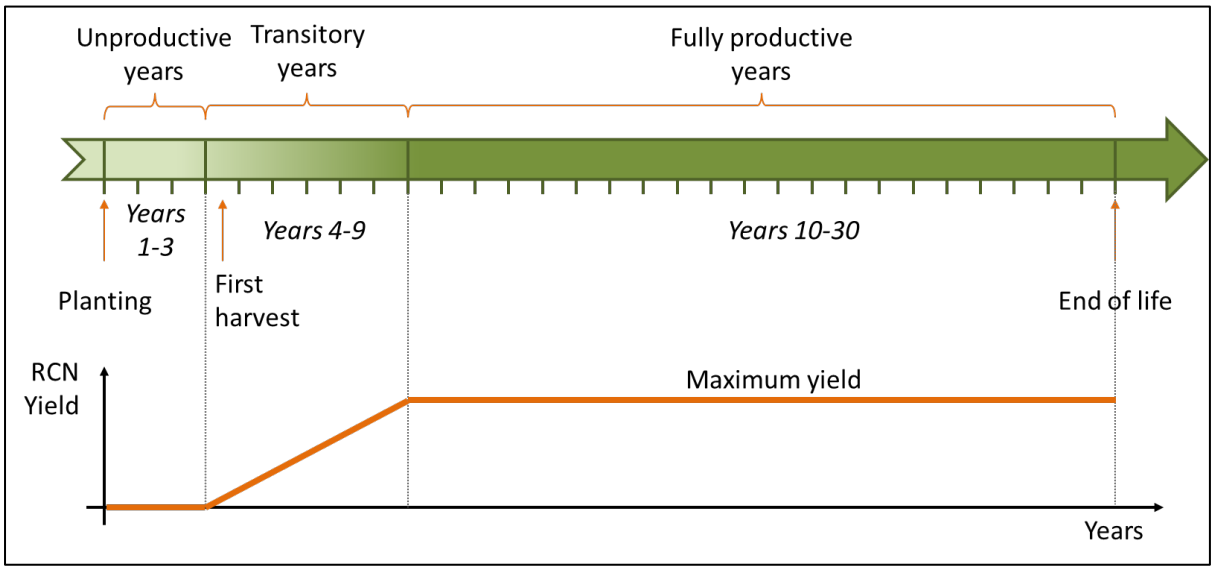


FIGURE 61: TEMPORAL MODELLING OF CASHEW TREE CYCLE

No bushfire is assumed to occur during the cashew tree cycle. Bushfires are nevertheless a major cause of concern for farmers and of losses in cashew plantations of the Northern Province of Sierra Leone (A4D Project, 2016). To assess the effect of these bushfires on the overall environmental impact of cashew value chains, a sensitivity analysis was performed considering a premature interruption in the cashew tree cycle. In this analysis, two cashew plantations with early interruptions were modelled: a plantation lost due to a bushfire at the beginning of the fully productive years (year 10), and one lost at the beginning of the transitory years (year 4).

5.2.2.1 Land Use Change associated to cashew cultivation

General considerations on Land Use Change (LUC)

Based on the ComCashew survey and the information collected during this VCA4D study, farmers' experience in cashew farming is quite recent, and current cashew plantations must be the first ones to be established (Weidinger et al., 2018). Thus, cashew plantations replaced another type of land use, and Land Use Change (LUC) must be taken into account in the cultivation modelling. Based on the information collected during the VCA4D study, it is assumed that current cashew plantations replaced bushland, either directly or by displacing food crops.

The ReCiPe2016 LCIA method includes an assessment of the potential impacts of LUC on biodiversity (Huijbregts et al., 2017). Based on the land use classification used in ReCiPe2016, bushland is characterized here as "grassland, natural (non-use)" and cashew plantation as

"permanent crop, fruit, extensive". In addition, changes in carbon storage due to this LUC are also considered based on IPCC and ILCD recommendations (EC-JRC, 2010; IPCC, 2006). According to these guidelines, carbon storage of each land use can be estimated from the climate region and soil type of the area under study, as well as land use, land management, and input level factors.

Estimation of LUC consequences on carbon storage

According to IPCC data and classification, Sierra Leone is located in the tropical wet climate region, which corresponds to a mean annual temperature above 18°C, a mean annual precipitation above 2000 mm, and an elevation under 1000 m (Bickel et al., 2006). According to the Harmonized World Soil Database (HWSD), dominant soils in the three districts under study are Fluvisols, Ferralsols, Leptosols, and Plinthosols (see Figure 62) (FAO / IIASA / ISRIC / ISSCAS / JRC, 2012). Under IPCC soil classification, Fluvisols, Ferralsols and Plinthsols are classified as low activity clay soils, and Leptosols as high activity clay soils (Bickel et al., 2006; European Commission, 2010).

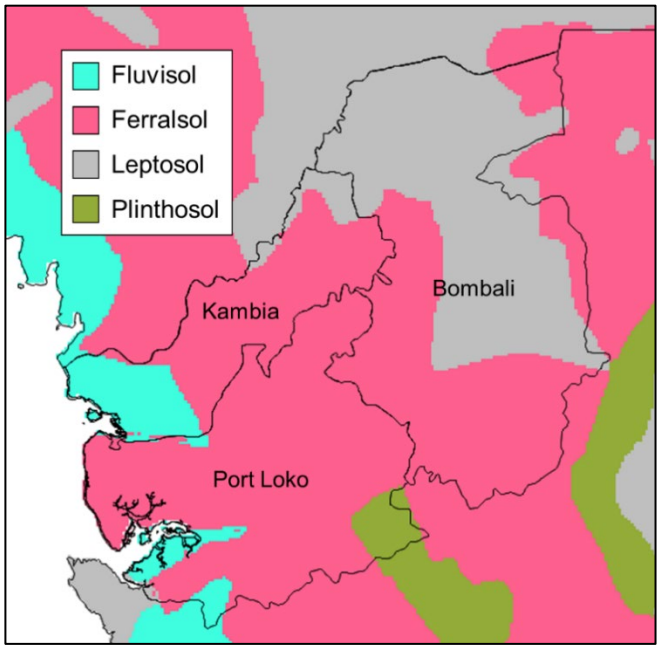


FIGURE 62: DOMINANT SOILS IN KAMBIA, BOMBALI, AND PORT LOKO DISTRICTS (SOURCE: HWSD)

According to IPCC methodology, the total carbon stock is the sum of the vegetation and Soil Organic Carbon (SOC) stocks. Vegetation carbon stocks are determined from the type of land use and the climate region. SOC stocks are obtained by multiplying a native SOC stock, determined from the climate region and the soil type, by three factors:

- A Land Use factor, determined from the type of land use;
- A Land Management factor, determined from the climate region, the type of land use and the type of management; and
- An Input Level factor, determined from the type of land use, the climate region, and a classification of input level.

Table 34 specifies the different factors used to determine Soil Organic Carbon (SOC) stock in the 0-30 cm soil horizon, and vegetation carbon stock, according to the IPCC methodology and data (Aalde et al., 2006; EC-JRC, 2010; European Commission, 2010). Before LUC, bushland is characterized as permanent grassland in IPCC land use classification, and assumed to be moderately degraded due to the frequent bushfires in this province. After LUC, cashew cultivation is characterized as a tree crop in IPCC classification, without tillage and with low input.

Soil type	Land use	Native SOC stock (tC/ha)	Land Use Factor	Land Management Factor	Input Level Factor	SOC stock (tC/ha)	Vegetation carbon stock (tC/ha)	Total carbon stock (tC/ha)
Low activity clay soils	Before LUC	60	1	0.97 ± 11%	1	58.2 ± 11%	8.1	66.3
	After LUC	60	1 ± 50%	1.22 ± 7%	0.92 ± 14%	67.3 ± 71%	34.3	101.6
High activity clay soils	Before LUC	44	1	0.97 ± 11%	1	42.7 ± 11%	8.1	50.8
	After LUC	44	1 ± 50%	1.22 ± 7%	0.92 ± 14%	49.4 ± 71%	34.3	83.7

TABLE 34: DETERMINATION OF ORGANIC CARBON STOCKS IN SOIL (0-30 CM HORIZON) AND VEGETATION, ACCORDING TO THE IPCC METHODOLOGY AND DATA

Results from Table 34 show that LUC from bushland to cashew plantations entails an increase of carbon stocks, both in soils and vegetation. Estimates of this carbon storage are 35.3 tC/ha for low activity clay soils, and 32.9 tC/ha for high activity clay soils. For this study, a weighted average value of 34.5 tC/ha is considered, assuming two thirds of low activity clay soils and one third of high activity clay soil in Kambia, Bombali and Port Loko districts (see Figure 62).

According to IPCC data, it can be assumed that this carbon storage takes place over 20 years (Aalde et al., 2006). This duration is shorter than the one considered for the life cycle of cashew plantations (see previous section). The carbon storage due to LUC is then fully allocated to the whole RCN production from one life cycle of cashew plantations.

5.2.2.2 *General considerations on current agricultural practices*

As already mentioned, little difference was reported between farming systems in recent surveys and during this VCA4D study, even between smallholders and private plantations (Ballweg et al., 2017; University of Milan and Politecnico of Milan, 2016; Weidinger et al., 2018). All recent surveys reported low use of chemical fertilizers or crop protection products in cashew plantations, regardless of their structure. In the A4D endline survey for instance, less than 10% of farmers were using chemical fertilizers in Port Loko, Kambia or Bombali, and less than 3% were using pest control (A4D Project, 2016). This is in line with the current promotion of organic farming which is done in these 3 districts by local actors such as the *COOPI* NGO or the *Balmed* company.

However, the survey from *ComCashew* reported a slightly higher use of chemical pest control products in the whole country, with 24% of cashew farmers using pesticides (Weidinger et al., 2018). This might be due to a higher access to this kind of products in other parts of the country. Accordingly, the chosen base modelling of current agricultural practices in cashew plantations is extensive cashew plantations, with no use of inputs. An alternate modelling involving organic inputs is considered as a sensitivity analysis, based on existing recommendations. Since no data is available regarding the use of chemical inputs or pest controls in cashew plantations in Sierra Leone and the resulting RCN yield, this scenario is not considered.

5.2.2.3 *Base case: extensive cashew plantations*

Production in nurseries and transportation of cashew seedlings

First, cashew seedlings are produced in nurseries, in propylene bags where compost and soil are mixed. Production of these bags was taken into account from the *ecoinvent* database. No bag transportation was considered due to a lack of data. Regarding compost, it was assumed that it is

produced mainly from available chicken manure. Only emissions during composting were then considered, from the *ecoinvent* database.

Groundwater consumption was also considered assuming one watering per day of 0.2 l per seedling during 3 months. The impact of initial seed production was neglected, due to a lack of information on seed origins.

Based on the information collected during the VCA4D study, transportation distance of seedlings from nurseries to cashew farms was estimated considering one nursery per chiefdom. GIS exploitation of *OpenStreetMap* data allowed determining that the average area of chiefdoms in Port Loko, Bombali and Kambia is 560 km², which was declined to an average distance of 10 km considering a theoretical circular shape of chiefdoms (OpenStreetMap Foundation, 2018). Transportation was assumed to be done by motorbikes or motor tricycles, which were assimilated to vans from the *ecoinvent* database on a t.km basis.

5.2.2.4 *Bushland clearing*

Before planting cashew seedlings, farmers must clear the bushland. This operation is traditionally done manually, with axes, cutlasses, hoes, and shovels. The quantification of the use of these tools were provided by the *KamCashew* company during the VCA4D study, and the impact of the production of these tools came from the LCA-CIRAD database. Human labour was not considered.

5.2.2.5 *Seedling planting*

Planting requires the use of hoes, which was considered based on the same assumptions used for bushland clearing. An average tree density of 115 trees/ha was assumed based on reported average values from recent surveys ranging from 85 to 145 trees/ha (A4D Project, 2016; Ballweg et al., 2017).

5.2.2.6 *Yearly operations: weeding and brushing*

In extensive cashew plantations, the only annual operations are weeding and brushing, which were considered to be done manually with cutlasses every year of the plantation life cycle. Based on the data provided by the *KamCashew* company, ten men equipped with ten cutlasses were considered for the weeding and brushing of one hectare of cashew plantation. As for bushland clearing, human labour was not included and only the production of these tools was considered, from the LCA-CIRAD database.

5.2.2.7 *RCN harvesting and packing*

Regarding RCN yields obtained in extensive plantations, reported values of current yields range from 110 kg/ha to 300 kg/ha depending on surveys (A4D Project, 2016; Ballweg et al., 2017; Weidinger et al., 2018). Since these values include young trees, which did not reach their maximum yield yet, the maximum average value of 300 kg/ha/yr, reported in the *ComCashew* survey for Port Loko district, was considered for the fully productive years (Weidinger et al., 2018). Along with the assumption of tree density, this value for RCN yield implies an average production of 2.6 kg of RCN per cashew tree per year.

Finally, harvested RCN are packed manually in jute bags of 50 kg. The impact of the production of these bags came from the LCA-CIRAD database. Regarding apple by-products, which can be eaten or left in the plantations, no associated environmental impact was considered, either positively or negatively.

5.2.3 Alternate case: semi-extensive cashew plantations

General considerations on semi-extensive plantations

Current agricultural practices are based on a very low use of inputs, except for human labour (see previous section). However, as many tree crops, cashew tree should benefit from the use of inputs to favour the establishment of young trees and to compensate for nutrient losses from harvesting. In this semi-extensive cashew plantation scenario, the use of organic fertilizers is considered based on recommendations from the A4D project (Costa and Bocchi, 2017; University of Milan and Politecnico of Milan, 2016).

In semi-extensive plantations, seedling production in nurseries, bushland clearing, tree density, annual weeding and clearing of the plantations, and RCN packing are the same as for extensive plantations (see base case in previous section).

A key assumption in this alternate case is that organic fertilizers are available. This availability is quite unlikely, which may be the primary reason why few fertilizers are used currently. However, this alternate case is meant to explore the potential interest of semi-extensive cashew plantations.

Effect on carbon storage

In the case of semi-extensive plantations, the application of organic fertilizers can increase the SOC stock under cashew plantation. *Table 36* presents the updated estimation of SOC stocks in this case; in this table, updated values compared to the ones in *Table 35* are written in red.

Soil type	Land use	Native SOC stock (tC/ha)	Land Use Factor	Land Management Factor	Input Level Factor	SOC stock (tC/ha)	Vegetation carbon stock (tC/ha)	Total carbon stock (tC/ha)
Low activity clay soils	Before LUC	60	1	0.97 ± 11%	1	58.2 ± 11%	8.1	66.3
	After LUC	60	1 ± 50%	1.22 ± 7%	1.44 ± 13%	105,4 ± 70%	34.3	139.7
High activity clay soils	Before LUC	44	1	0.97 ± 11%	1	42.7 ± 11%	8.1	50.8
	After LUC	44	1 ± 50%	1.22 ± 7%	1.44 ± 13%	77.3 ± 70%	34.3	111.6

TABLE 35: UPDATED DETERMINATION OF ORGANIC CARBON STOCKS IN SOIL (0-30 CM HORIZON) AND VEGETATION, ACCORDING TO THE IPCC METHODOLOGY AND DATA, IN THE CASE OF SEMI-EXTENSIVE PLANTATIONS

Results from *Table 35* show that LUC in the case of semi-extensive cashew plantations entails an increase of carbon stocks of 73.4 tC/ha for low activity clay soils, and 60.8 tC/ha for high activity clay soils. These potential carbon storages represent about twice those estimated for extensive cashew plantations.

Organic fertilizer application

Based on Costa and Bocchi (2017), the considered amount of organic fertilizers applied was:

- 10 kg per tree at planting;
- 1 kg per tree and per year during the first ten years;

- 1.5 kg per tree and per year from years 11 to 15;
- 2 kg per tree and per year from years 16 to 20; and
- 2.5 kg per tree and per year from years 21 to 30.

Organic fertilizer use was assumed to be composted chicken manure since chickens are the most widespread form of breeding. An average composition of chicken manure was then considered based on the *Phyllis2* database (Energy research Centre of the Netherlands, 2018): 4.21% of nitrogen N, 2.15% of phosphorus P, and 2.94% of potassium P, on a dry basis. Moisture content of poultry manure when applied was assumed to be 40% on a wet basis. Assumptions for the estimation of emissions associated with poultry manure application are summarized in *Table 36*.

Substance	Receiving medium	Emission rate	Unit	Source
Direct emissions				
NH_3	Air	0.04	kg N-NH_3 / kg N	(Nemecek and Kägi, 2007)
N_2O	Air	0.008	kg N-N_2O / kg N	(Bouwman et al., 2002)
NO	Air	0.005	kg N-NO / kg N	(Bouwman et al., 2002)
NO_3	Water	0.3	kg N-NO_3 / kg N	(de Klein et al., 2006)
P	Water	0.00038	kg P / kg P	(Nemecek and Kägi, 2007)
Indirect emissions				
N_2O (from volatilization)	Air	0.01	kg N-N_2O / (kg N-NH_3 + kg N-NO)	(de Klein et al., 2006)
N_2O (from leaching / runoff)	Air	0.0075	kg N-N_2O / kg N-NO_3	(de Klein et al., 2006)

TABLE 36: SUMMARY OF EMISSION RATE ASSUMPTIONS FROM POULTRY MANURE APPLICATION

5.2.3.1 Yield achieved in semi-extensive plantations

Finally, RCN yield in semi-extensive plantations was assumed to be 420 kg/ha (University of Milan and Politecnico of Milan, 2016), or 3.65 kg RCN per cashew tree. Compared to previous assumptions, that means that RCN yield is assumed to be 40% higher in semi-extensive plantations than in extensive plantations.

5.2.4 Cashew nut transportation and processing

Section 4.2.1. presented the three systems under study in this LCA study: national exportation, and national consumption, based on artisanal or semi-industrial processing. The following sections provide details on the transportation and processing steps of these three systems.

National exportation system

General considerations on the national exportation system

The national exportation system does not include any RCN processing. Only transportation from cashew plantations to Freetown port for international exportation was then modelled. The description of related logistics was based on data collected during the VCA4D study from farmers and the *Balmed* company, which is currently the only cashew exporter in Sierra Leone. Overall, RCN transportation from plantations to Freetown port takes place in three steps: from plantations to villages, from villages to buying points, and from buying points to Freetown port.
No RCN loss was considered during the different transportation steps.

RCN transportation from plantations to villages

The distance from plantations to villages is generally 1 to 3 km long and is covered on foot by farmers. No environmental impact was then associated to this first transportation step.

RCN transportation from villages to buying points

The exact location of *Balmed* buying points is not known, so these points are assumed to be close to local markets. Since these markets correspond to the places where cashew kernels from artisanal processing are sold (see next section), the same data was applied here. Based on a specific survey carried out during the VCA4D study, it was then assumed that RCN bags cover a distance of 3 to 72 km, with an average distance of 22 km, by motorbikes or motor tricycles. For the uncertainty analysis, a triangular distribution was considered using 22 km, 3 km and 72 km as, respectively, mode, and lower and upper limits.

RCN transportation from buying points to Freetown port

Finally, collected RCN bags are sent to Freetown by trucks. The modelling of these trucks was based on small trucks with the lowest emission standards available in the *ecoinvent* database (payload of 3.5-7.5 t, and EURO3 standard for emission). The largest city of each district under study was considered as a central point of this district and used to estimate the distance from buying points to Freetown port: 170 km from Kambia city (Kambia district), 117 km from Port Loko city (Port Loko district), and 183 km from Makeni (Bombali district). An average distance of 160 km was then considered in this LCA study.

At Freetown port, handling and loading operations were neglected due to a lack of specific data.

National consumption system based on artisanal processing

General considerations on the national consumption system based on artisanal processing

The national consumption system based on artisanal processing aims at representing current manual cashew kernel production. Based on the information collected during the VCA4D study, this type of production system generally takes place close to Sierra Leonean local markets where these kernels are sold. This system therefore includes RCN transportation from plantations to local markets, and artisanal processing. Due to the proximity between processors and markets, no kernel transportation is considered in this study.

RCN transportation from plantations to local markets

RCN transportation is the same as for the national exportation system between plantations and local markets (see previous section): a first transportation step from plantations to villages done by farmers on foot, and a second one from villages to local markets over 3 to 72 km, with an average distance of 22 km, done by motorbikes or motor tricycles.

Artisanal RCN processing

Artisanal processing consists of consecutive roasting and cracking of RCN to obtain cashew kernels. The main data sources to describe this process are the information collected during the VCA4D study, and information derived from a business plan prepared by the *COOPI* NGO to establish an artisanal cashew processing unit (al Sapatteh and Bangura, 2016).

Regarding RCN roasting, the two main inputs are vegetable oil and charcoal, even if the field survey carried out during this VCA4D study showed that many artisanal processors do not seem to use any vegetable oil. This input is nonetheless considered in the base modelling as a conservative assumption, but the effect of this assumption is studied in a dedicated sensitivity analysis.

Based on data from the *COOPI* NGO, 2.7 l of vegetable oil, in which RCN are heated, and 11.3 kg of charcoal are needed to process one RCN bag of 50 kg. The environmental impact related to charcoal use was provided by the LCA-CIRAD database for charcoal production (Benoist et al., 2011), and by an available literature review for combustion emissions (Andreae and Merlet, 2001). No impact from deforestation was considered for charcoal production. Due to a lack of data, no charcoal transportation was included.

Regarding vegetable oil, most of current vegetable oil consumption in Sierra Leone is based on national palm oil production, even in the Northern Province where oil palm is much less prevalent than in Eastern and Southern Provinces (FEWS NET, 2017). The environmental impact of palm oil production was then derived from another VCA4D study, related to palm oil production in Sierra Leone, assuming that palm oil used for cashew roasting comes from smallholder plantations and artisanal processing.

During RCN cracking, disposable latex gloves were assumed to be used due to the acidic nature of Cashew Nut Shells (CNS) (Lomonaco et al., 2017). A consumption of one pair of disposable latex gloves per RCN bag of 50 kg, based on the *ecoinvent* database, was then considered in this LCA study.

Finally, a production yield of 1 kg of kernel for 3 kg of RCN was considered for artisanal processing. After RCN cracking, cashew kernels are packed in small polyethylene bags, assumed to weigh 50 g each, to contain 100 g of kernels, and to be used 10 times before disposal. The impact from polyethylene production was provided by the *ecoinvent* database.

Avoided fuel production due to CNS by-product

As explained in previous section, CNS produced during artisanal RCN cracking are a by-product of the system, used as a domestic fuel. According to the Global Alliance for Clean Cookstoves, 85% of Sierra Leonean use fuelwood for domestic purposes, 14% use charcoal, and 1% use other non-biomass fuels (United Nations Foundation, 2018). Due to their small share, non-biomass fuels were not considered in the domestic fuel mix. Then, assuming an equivalence between CNS, fuelwood and charcoal based on an energy basis[84], it comes that 1 kg of CNS substitutes 1.2 kg of fuelwood and 0.12 kg of charcoal. Avoided impact from the production and use of fuelwood and charcoal were considered from the LCA-CIRAD database and literature (Andreae and Merlet, 2001).

No data on emissions from CNS combustion is currently available in the literature, even if different sources, including the field survey carried out during this VCA4D study, report "acrid" or "offensive" smell from CNS combustion smoke (Godjo et al., 2015). This specificity of CNS combustion is due to phenolic compounds contained in CNS, also known as CNS Liquid (CNSL), which represent from 25% to 35% of CNS weight (Ettien, 2010; Lomonaco et al., 2017). Emissions from CNS combustion were then estimated considering that 85% of CNS underwent combustion, and that the remaining 15% were compounds from CNSL directly emitted to the atmosphere due to their volatile nature.

Emissions from CNS which underwent combustion were assumed similar to those from charcoal combustion, due to their similar LHV. Since cardanol and cardol, which are the main constituents of CNSL, are not included in the ReCiPe2016 LCIA method, these compounds were assimilated to phenol (Lomonaco et al., 2017).

[84] The low heating values considered for the calculation of the substitution factors were, on a dry matter basis: 25 MJ/kg for CNS, 18 MJ/kg for fuelwood, and 30 MJ/kg for charcoal (Damien, 2008; Ettien, 2010; Rodrigues Colossi, 2011).

5.2.4.1 National consumption system based on semi-industrial processing

General considerations on the national consumption system based on semi-industrial processing

The national consumption system based on semi-industrial processing aims at representing current industrial cashew kernel production. The description of this system is mostly based on data collected during this VCA4D study from the *KamCashew* company, which is currently the only industrial cashew processor in Sierra Leone (University of Milan and Politecnico of Milan, 2016). The system modelling includes RCN transportation from plantations to a cashew factory, semi-industrial processing, and cashew kernel distribution.

According to the information from the A4D project (University of Milan and Politecnico of Milan, 2016), the main outlets for cashew kernels from processing companies are the mini-markets in Freetown. Hence, kernel transportation from processing factories to Freetown was considered for the distribution step. Due to a lack of data and an *a priori* limited impact due to short distances, kernel distribution within Freetown to retailers was neglected.

RCN transportation from plantations to factory

In this national consumption system based on semi-industrial processing, it was assumed that the processing factory was partly supplied by a private plantation next to the factory. In particular, this situation is true for the case of the *KamCashew* company. However, data collected during the VCA4D study was not sufficiently consistent to estimate the share of RCN coming from the *KamCashew* plantation in their RCN supply. Therefore, a theoretical share of 50% of the RCN supply coming from a private plantation associated to the cashew factory was assumed here. For half the RCN supply from this private plantation, no RCN transportation was then considered.

For the other half, RCN were assumed to come from surrounding plantations. According to *KamCashew* information, RCN which do not come from their private plantation come from Kambia district, where the *KamCashew* factory is located. According to *OpenStreetMap* data, Kambia district area is 6000 km², which leads to an theoretical average distance of 31 km if a circular shape for RCN supply is assumed, if cashew plantations are supposed to be homogeneously distributed over the district, and if no tortuosity is considered (OpenStreetMap Foundation, 2018). Since this distance of 31 km is similar to the one of 22 km between villages and buying points or local markets in previous systems, RCN transportation means were assumed to be the same as for previous systems, that is motorbikes or motor tricycles.

Semi-industrial RCN processing

Semi-industrial cashew kernel production at the *KamCashew* factory includes six main steps: RCN drying, RCN roasting, RCN cracking, cashew kernel heating, cashew kernel peeling, cleaning and sorting, and cashew kernel packing. Among these steps, RCN drying and cashew kernel peeling, cleaning and sorting do not require any particular input and therefore do not have any specific environmental impact. Indeed, RCN drying is achieved by manually spreading RCN out on open platforms and letting them dry naturally during 1 or 2 days, and cashew kernel peeling, cleaning and sorting are carried out manually.

Conversely, RCN roasting and cashew kernel heating require important energy inputs. All CNS produced during the process were assumed to be used as fuel in boilers in order to provide energy for these two steps. The same assumptions regarding emissions from CNS combustion as for artisanal processing were considered.

In addition, fuelwood is used as a fuel supplement. According to data collected during the VCA4D study, 5 to 6 bassoons of fuelwood, which represent 50 kg of dry fuelwood, are needed to roast 350 kg of RCN, and another 5 to 6 bassoons to heat 350 kg of cashew kernels. No impact was

considered for fuelwood production since wood is generally harvested from natural forests or from isolated trees in bushlands, but related combustion emissions were taken from Andreae and Merlet (2001).

Finally, RCN cracking and cashew kernel packing are carried out manually and require few inputs. Assumptions made regarding those inputs were then similar to those from artisanal processing: disposable latex gloves for RCN cracking, and polyethylene bags for kernel packing.

Cashew kernel distribution from factory to Freetown mini-markets

After being processed and packed, cashew kernels are sent to mini-markets in Freetown. The same trucks as for the national exportation system were considered. Transportation distance was estimated from the *KamCashew* factory location in Magbema in Kambia district, which is 170 km from Freetown.

5.2.5 Benchmark systems

As explained earlier, benchmark systems were considered to provide insights and a comparison basis to discuss the sustainability of the cashew value chains. Benchmark systems used in this study are bushfires in Sierra Leone, and a round trip air flight between Brussels and Freetown.

The bushfire system only includes emissions from biomass burning during a bushfire. The amount of biomass in bush vegetation was estimated from the carbon stock provided by IPCC for tropical savannah, which is 8.1 tC/ha) Based on the data from Andreae and Merlet (2001), carbon content of grassland vegetation was assumed to be 44% on a dry basis, leading to an amount of 18.4 t/ha of dry matter for bush vegetation. Emissions from savannah and grassland burning were then considered based on the literature review from Andreae and Merlet (2001).

The air flight system includes inventory data for airplane production and use, based on the *ecoinvent* database for intercontinental flights, considering a number of 320 effective passengers per plane. The distance assumed for a round trip flight between Brussels and Freetown was 9950 km (Fubra, 2018).

5.3 Life Cycle Impact Assessment results and interpretation

5.3.1 Analyses of environmental hotspots

National exportation system

Endpoint indicator results of the national exportation system are presented in Figure 63 and Figure 64 with the contribution of, respectively, life cycle stages and impact categories.

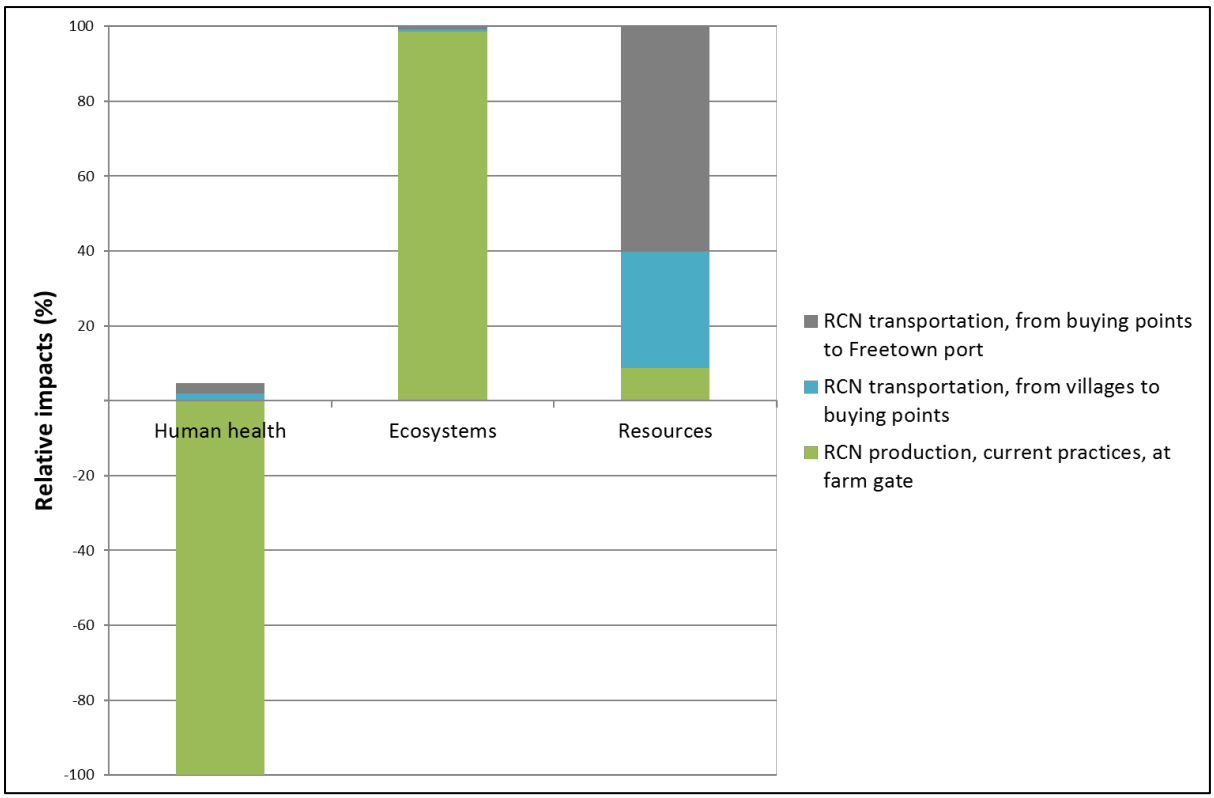


FIGURE 63: ENDPOINT IMPACTS OF THE NATIONAL EXPORTATION SYSTEM, WITH THE CONTRIBUTION OF LIFE CYCLE STAGES (RECIPE2016 LCIA METHOD)

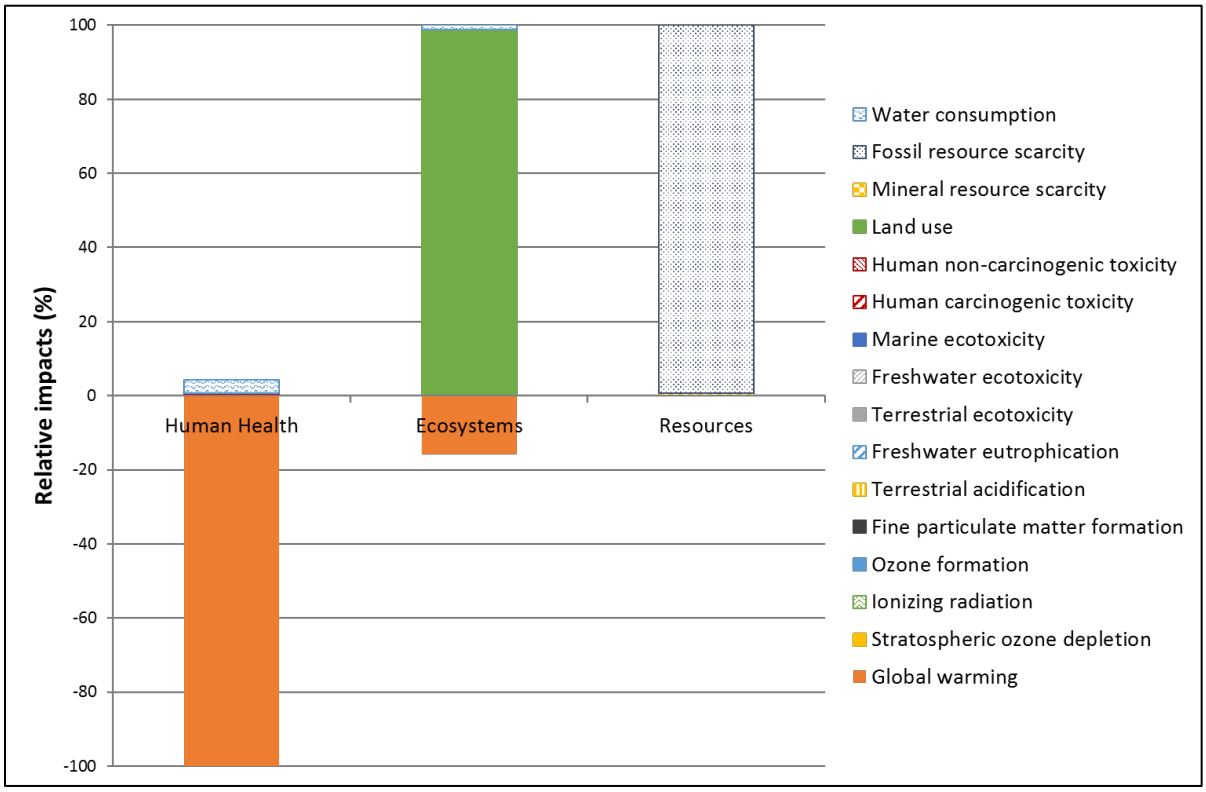


FIGURE 64: ENDPOINT IMPACTS OF THE NATIONAL EXPORTATION SYSTEM, WITH THE CONTRIBUTION OF IMPACT CATEGORIES (RECIPE2016 LCIA METHOD)

Among the three Areas of Protection (AoP), results on human health are particular since the final impact is negative, meaning that the value chain actually has a benefit for human health. This benefit is due to the global warming effect of cashew cultivation, and more specifically the LUC

from bushland to cashew plantations, which involves a carbon storage. However, due to high uncertainties in the estimation of carbon stocks (see previous section and *Table 35*), the uncertainty analysis, performed through Monte Carlo simulations, indicates that there is an 83% chance that the indicator result is actually negative.

Conversely, cashew cultivation is also responsible for the potential biodiversity losses arising from land use. Among these potential losses, 85% come from land occupation, due to a lower species richness in cashew plantations than in a non-anthropogenic use of land, and 15% from bushland conversion, due to habitat losses.

Finally, regarding the AoP on resource scarcity, RCN transportation contributes for 90% of the indicator result, with 60% for the transportation step from buying points to Freetown port. More generally, impacts on resource scarcity are entirely due to fossil resource consumption, among which crude oil represents 89%.

A full analysis of midpoint indicator results of the national exportation system is available in annex.

National consumption system based on artisanal processing

Endpoint indicator results of the national consumption system based on artisanal processing are presented in Figure 65 and Figure 66 with the contribution of, respectively, life cycle stages and impact categories.

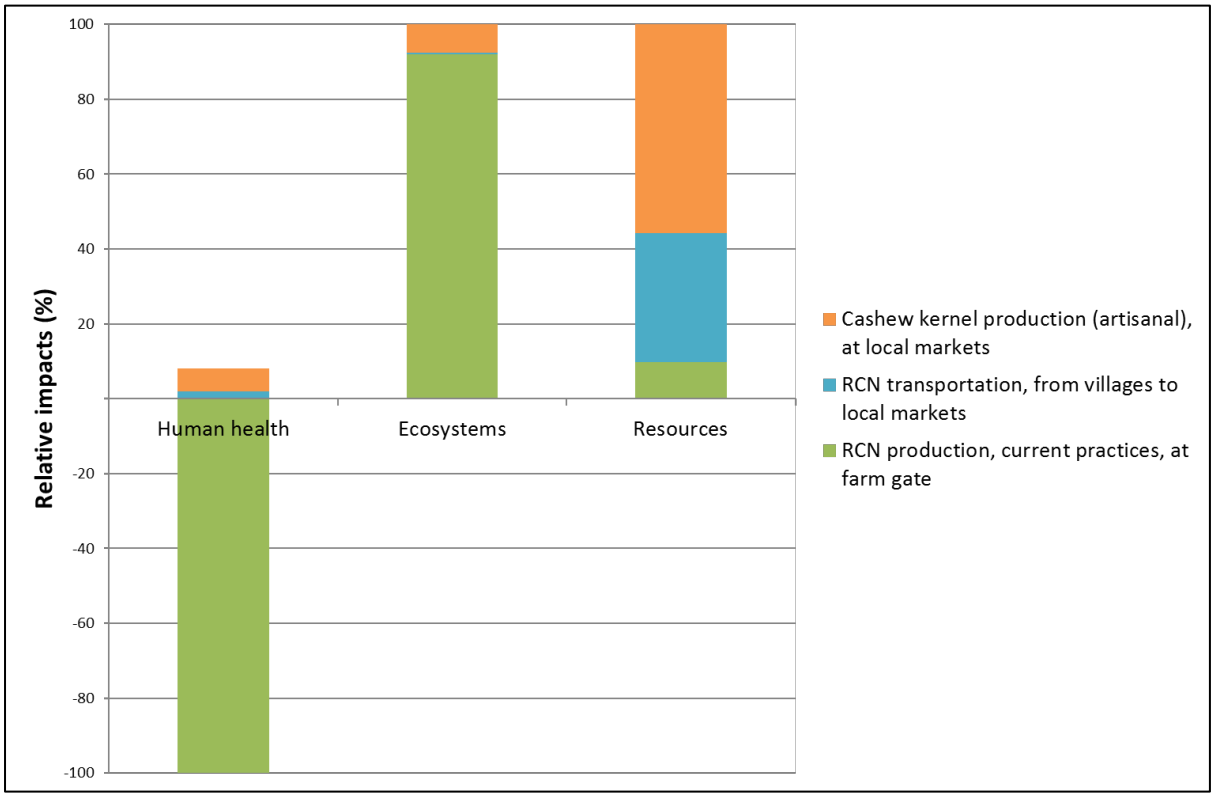


FIGURE 65: ENDPOINT IMPACTS OF THE NATIONAL CONSUMPTION SYSTEM BASED ON ARTISANAL PROCESSING, WITH THE CONTRIBUTION OF LIFE CYCLE STAGES (RECIPE2016 LCIA METHOD)

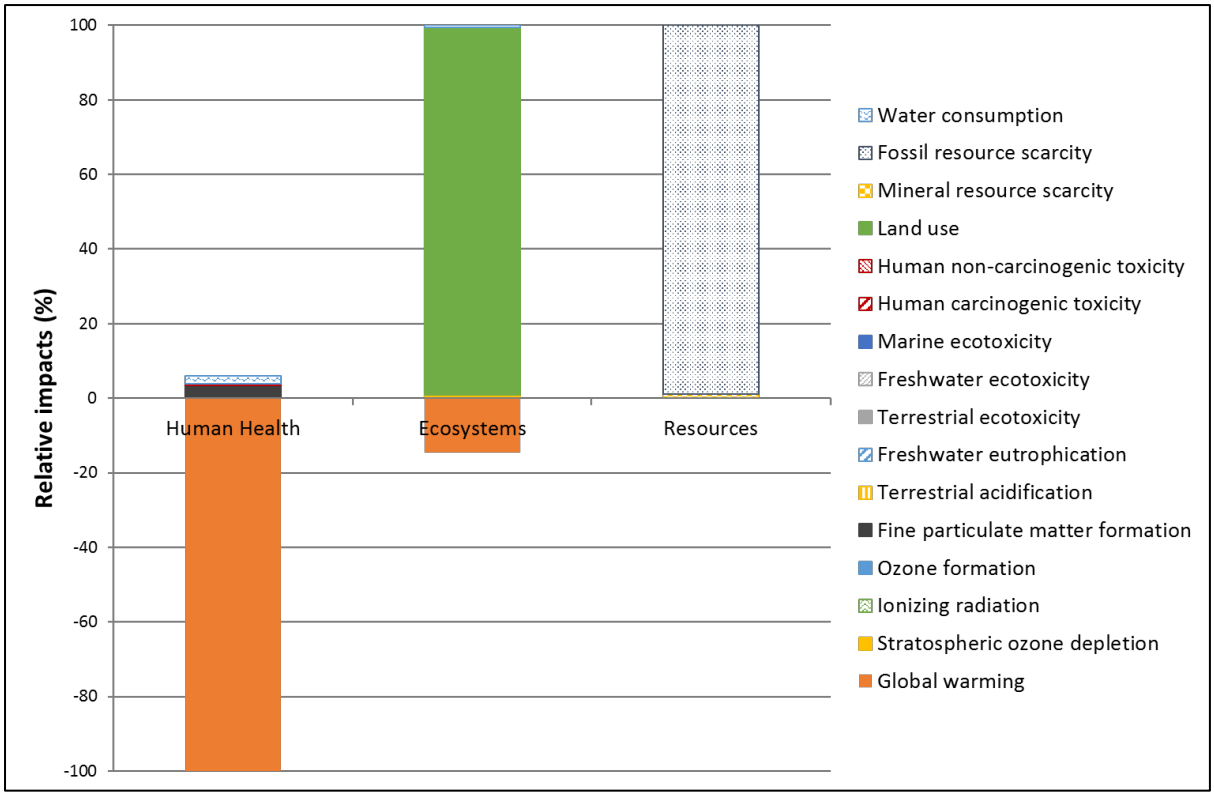


FIGURE 66: ENDPOINT IMPACTS OF THE NATIONAL CONSUMPTION SYSTEM BASED ON ARTISANAL PROCESSING, WITH THE CONTRIBUTION OF IMPACT CATEGORIES (RECIPE2016 LCIA METHOD)

As for the national exportation system, the cashew cultivation stage dominates the endpoint indicator results for human health and ecosystems due to, respectively, carbon storage and land use effects on biodiversity. Nonetheless, cashew kernel production has a non-negligible contribution to impacts on human health and ecosystems, of 6% and 7% respectively. Concerning human health, this contribution is mostly due to emissions from charcoal combustion and production. Concerning ecosystems, the contribution of cashew kernel production also arises from land occupation, through palm oil and charcoal consumption.

Regarding resources, the production stage of cashew kernels contributes for 56% of the indicator result, due mainly to resource consumption during the crude palm oil production, then the RCN transportation stage contributes for 34%. As for the national exportation system, impacts on resource scarcity entirely come from fossil resource consumption.

A full analysis of midpoint indicator results of the national consumption system based on artisanal processing is available in annex.

National consumption system based on semi-industrial processing

Endpoint indicator results of the national consumption system based on semi-industrial processing are presented in Figure 67 and Figure 68 with the contribution of, respectively, life cycle stages and impact categories.

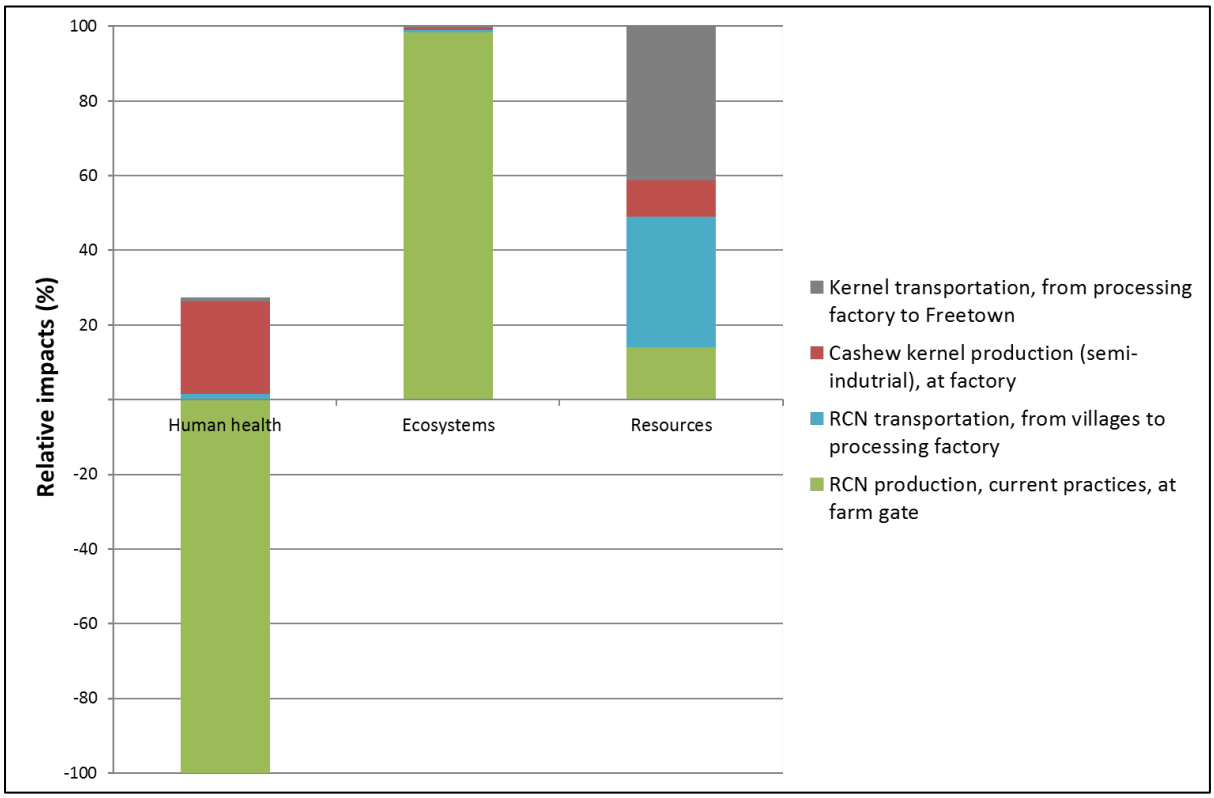


FIGURE 67: ENDPOINT IMPACTS OF THE NATIONAL CONSUMPTION SYSTEM BASED ON SEMI-INDUSTRIAL PROCESSING, WITH THE CONTRIBUTION OF LIFE CYCLE STAGES (RECIPE2016 LCIA METHOD)

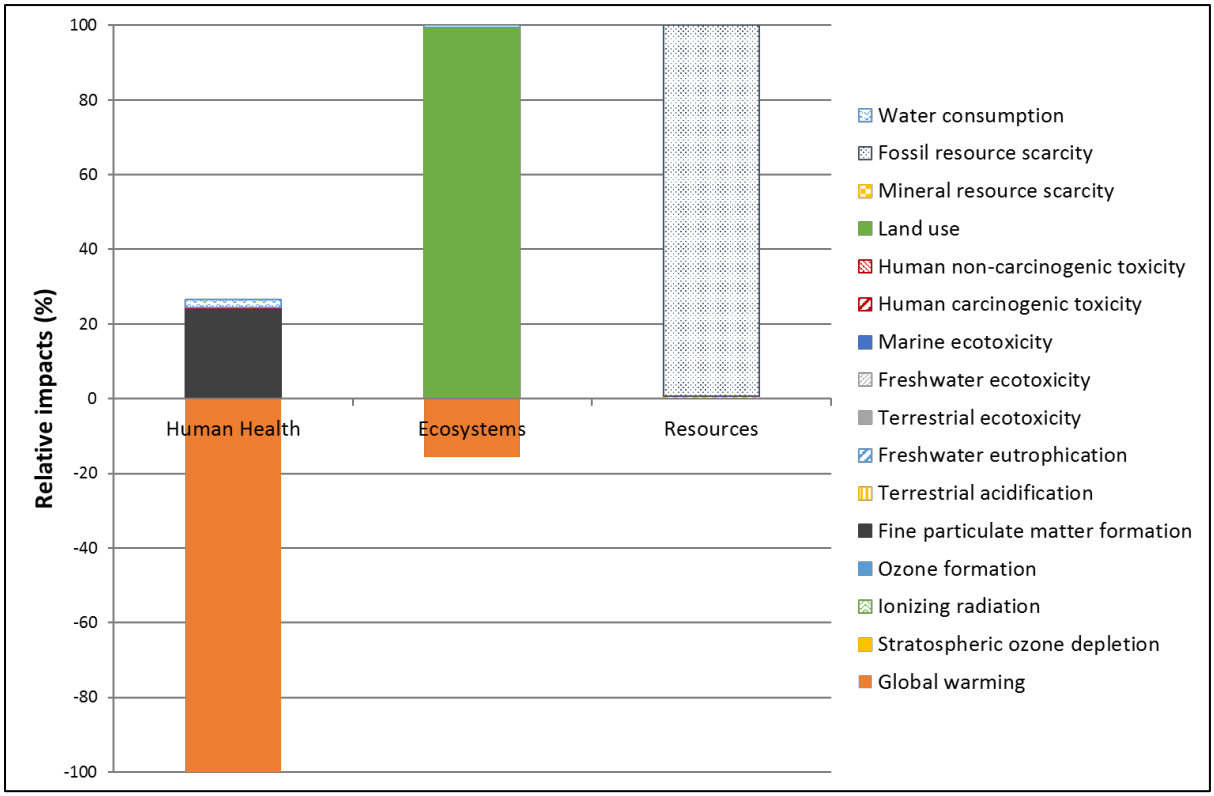


FIGURE 68: ENDPOINT IMPACTS OF THE NATIONAL CONSUMPTION SYSTEM BASED ON SEMI-INDUSTRIAL PROCESSING, WITH THE CONTRIBUTION OF IMPACT CATEGORIES (RECIPE2016 LCIA METHOD)

As for previous systems, cashew cultivation dominates endpoint results for human health and ecosystems. Nonetheless, in the case of human health, impacts arising from RCN processing represent 25% of the benefit due to carbon storage during cashew cultivation. These potential impacts on human health are caused by fine particulate matter emissions from CNS and fuelwood combustion. Still, the uncertainty analysis performed through Monte Carlo simulations indicates that there is a 76% chance that the indicator result is actually negative.

Regarding resource scarcity, transportation is the main contributor to resource consumption with a quite evenly distributed contribution from RCN transportation and cashew kernel distribution which represent respectively 35% and 41% of the total impact. The remaining impact mostly comes from the production of bags used for seedlings in cashew tree nurseries and for cashew kernel packing. As for previous systems, impacts on resource scarcity entirely arise from fossil resource consumption.

A full analysis of midpoint indicator results of the national consumption system based on semi-industrial processing is available in annex.

5.3.2 Sensitivity analyses

Comparison between extensive and semi-extensive plantations

As explained before, according to existing cashew cultivation guidelines, organic fertilizers should be used to favour plantation establishment and to compensate for nutrient losses from harvesting. The corresponding agricultural practices have been referred to as semi-extensive plantations, in comparison with current extensive plantations. Comparison of endpoint impacts

of extensive and semi-extensive plantations are presented in Figure 69, and related uncertainty analysis in Figure 70.
The results in Figure 69 show that for all endpoint results, semi-extensive plantations have lower impacts and greater benefits than extensive plantations. These conclusions are attributable to the higher carbon storage under semi-extensive plantations for human health, and to the higher RCN yield for ecosystems and resource scarcity.

Results from the uncertainty analysis, presented in Figure 70, show that these conclusions are reliable for resources and ecosystems, with respectively 100% and 93% confidence that the endpoint impacts for extensive plantations are actually higher than the ones for semi-extensive plantations. However, regarding human health, the conclusion is more debatable, with 61% confidence that the endpoint impact for extensive plantations is actually higher than the one for semi-extensive plantation. This precaution to be taken is mainly due to the significant uncertainties in SOC stock estimations (see *Table 34* and *Table 35*).

Finally, an additional potential benefit of semi-extensive plantations compared to extensive plantations is to limit nutrient losses from harvesting, and then to limit reduction of soil fertility. This type of environmental considerations regarding soil quality is not accounted for in the ReCiPe2016 LCIA method but if so, it would be an additional advantage of semi-extensive over extensive plantations.

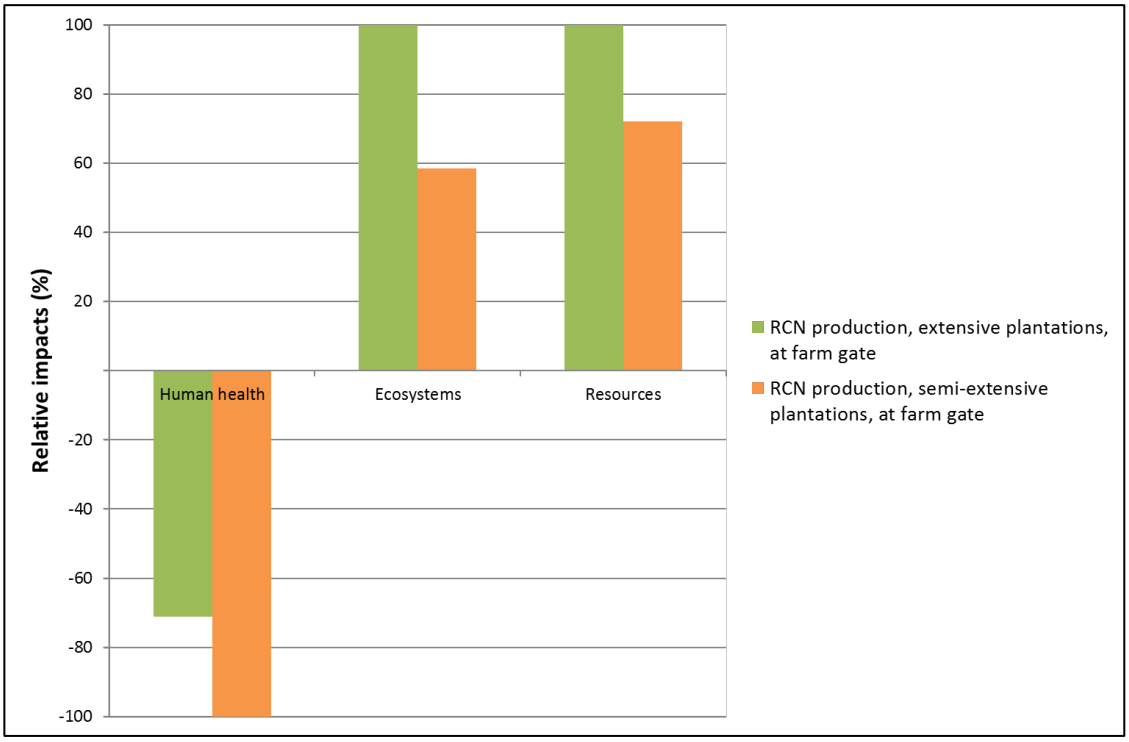


FIGURE 69: COMPARISON OF ENDPOINT IMPACTS OF EXTENSIVE AND SEMI-EXTENSIVE CASHEW PLANTATIONS (RECIPE2016 LCIA METHOD)

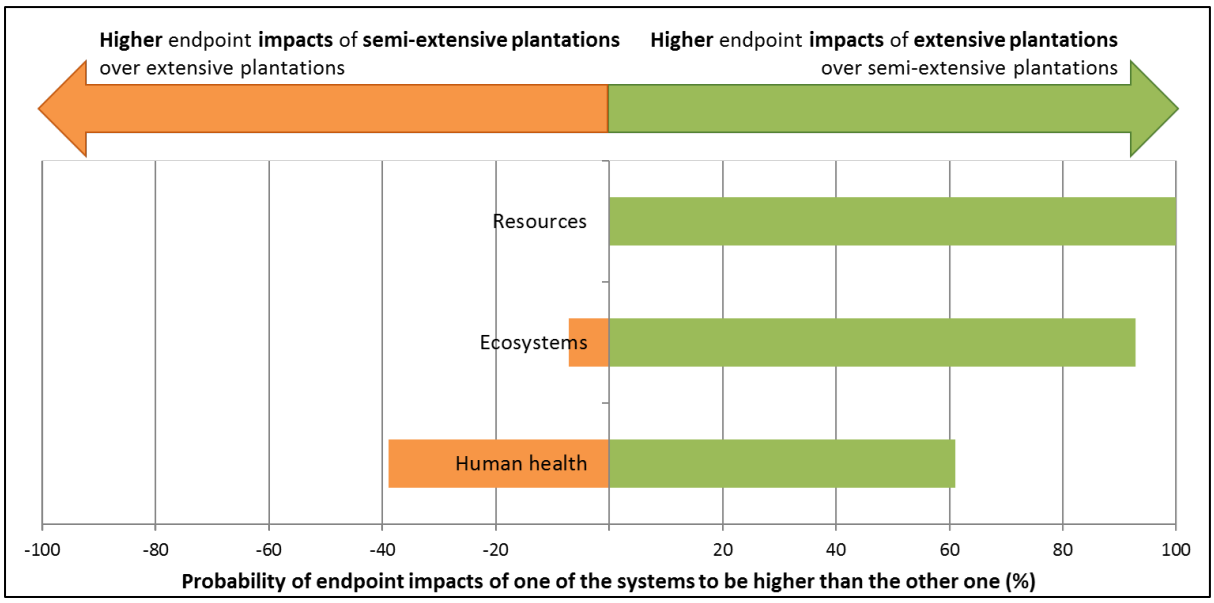


FIGURE 70: UNCERTAINTY ANALYSIS OF THE COMPARISON OF ENDPOINT IMPACTS OF EXTENSIVE AND SEMI-EXTENSIVE CASHEW PLANTATIONS (RECIPE2016 LCIA METHOD)

Effect of bushfires on the impacts of cashew cultivation

As mentioned earlier, bushfires are an important issue in the Northern Province of Sierra Leone, and a potential threat to cashew plantations. In order to investigate the consequences of early losses of cashew plantations due to bushfires, two cashew plantations with early interruptions were modelled: a plantation lost due to a bushfire at the beginning of fully productive years (year 10), and one lost at the beginning of transitory years (year 4). The comparison of endpoint results for RCN production from a full extensive plantation, an extensive plantation interrupted at year 10, and one at year 4 is given in Figure 71. Related uncertainty analysis for the extreme scenarios is given in Figure 72.

Results show that in extensive plantations, early interruptions due to bushfires multiply the endpoint impacts of RCN production up to a factor 2 for ecosystems and a factor 6 for resources, when the bushfire occur at year 10. These factors increase to 22 for ecosystems and 163 for resources when the bushfire occur at year 4.

Regarding human health, results were not presented because of a bias due to a lack of data. Indeed, these bushfires are a major disturbance of the carbon storage process, especially for soil organic carbon, which can hardly be properly modelled with available knowledge.

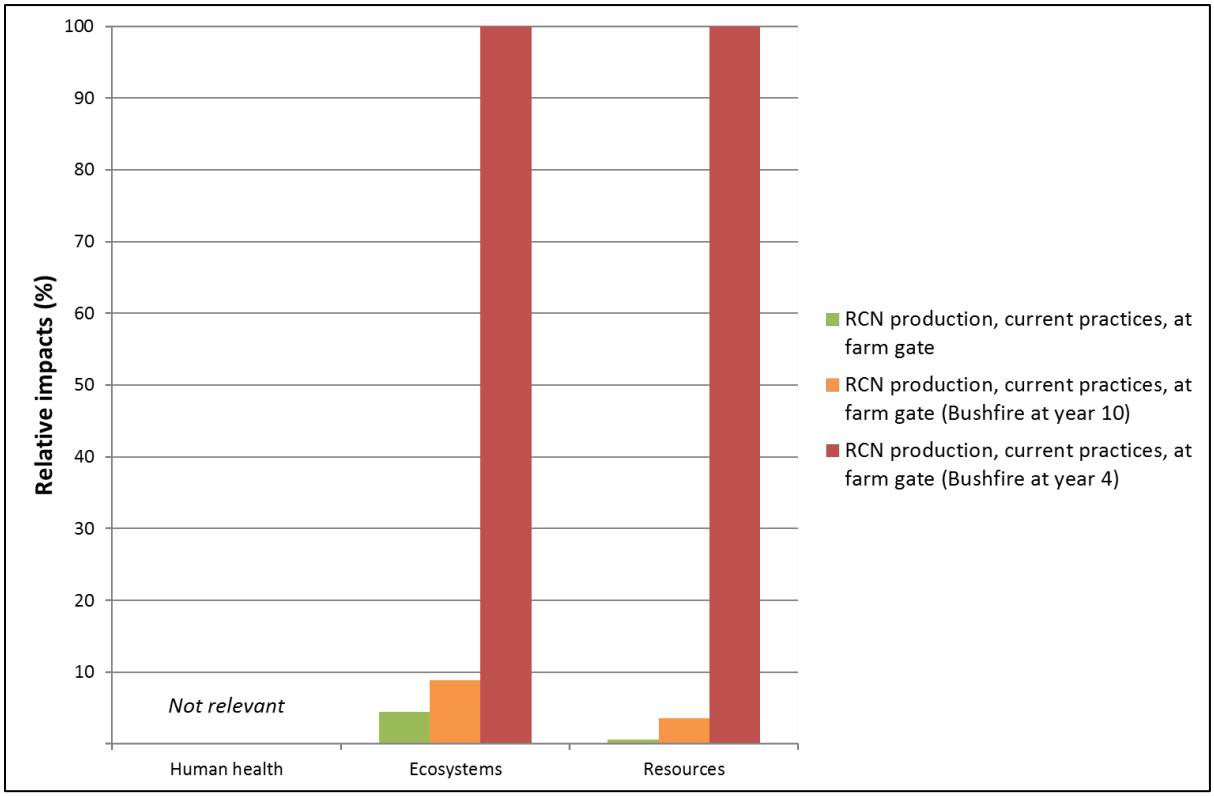


FIGURE 71: COMPARISON OF ENDPOINT IMPACTS OF EXTENSIVE CASHEW PLANTATIONS OVER A FULL TREE CYCLE AND OVER INTERRUPTED CYCLES AT YEARS 10 AND 4, DUE TO BUSHFIRES (RECIPE2016 LCIA METHOD)

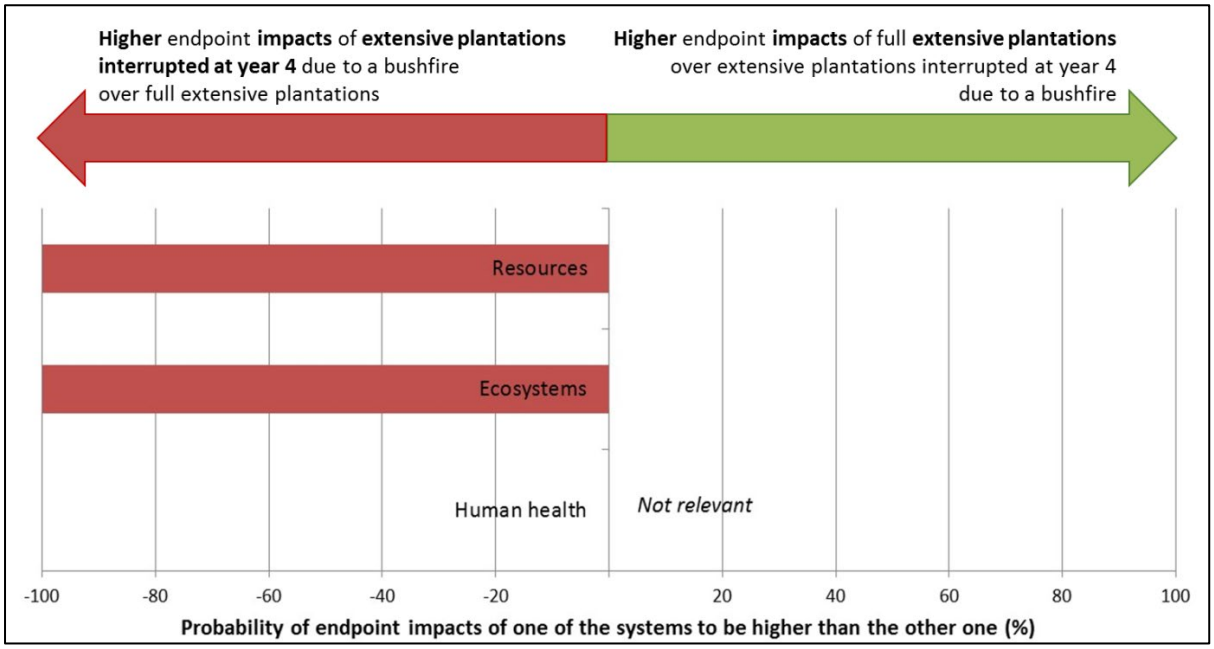


FIGURE 72: UNCERTAINTY ANALYSIS OF THE COMPARISON OF ENDPOINT IMPACTS OF EXTENSIVE CASHEW PLANTATIONS OVER A FULL TREE CYCLE AND OVER INTERRUPTED CYCLE AT YEAR 4, DUE TO A BUSHFIRE (RECIPE2016 LCIA METHOD)

Palm oil use in artisanal processing

The first section showed that for the national consumption system based on artisanal processing, the use of palm oil for RCN roasting is an important contributor to midpoint and endpoint impact indicators. However, as explained in previous section, the field survey carried out during this VCA4D study showed that many artisanal processors do not seem to use any vegetable oil during

RCN roasting. Figure 73 shows the effect of not using any palm oil for RCN roasting on the endpoint impacts of the national consumption system based on artisanal processing. Results then show that not using palm oil during RCN roasting has a limited effect on impacts on human health and ecosystems, but decreases significantly, by about 50%, the impact on resources.

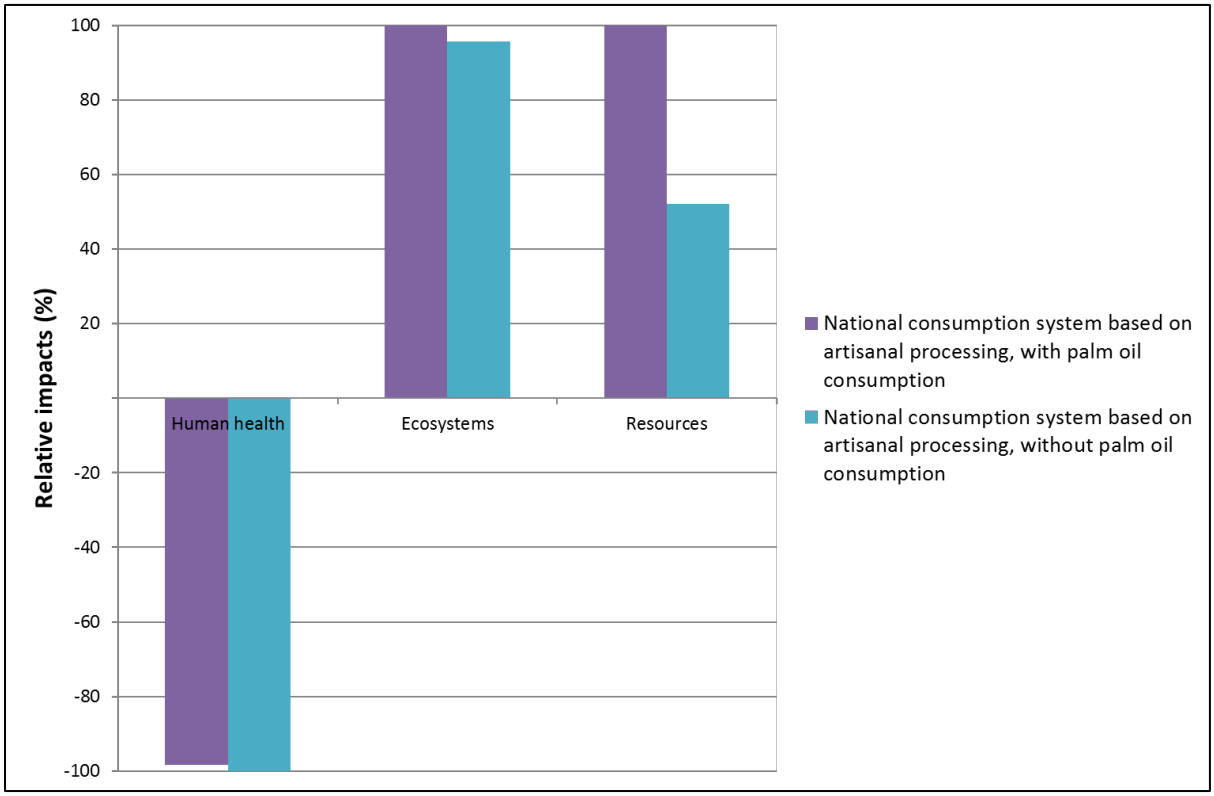


FIGURE 73: COMPARISON OF ENDPOINT IMPACTS OF THE NATIONAL CONSUMPTION SYSTEM BASED ON ARTISANAL PROCESSING, WITH AND WITHOUT PALM OIL CONSUMPTION DURING RCN ROASTING (RECIPE2016 LCIA METHOD)

In this case of the national consumption system based on artisanal processing where no palm oil is used during RCN cracking, Figure 74 presents the endpoint indicator results with the contribution of life cycle stages. Cashew kernel production then contributes only 15% of the endpoint impact on resource scarcity.

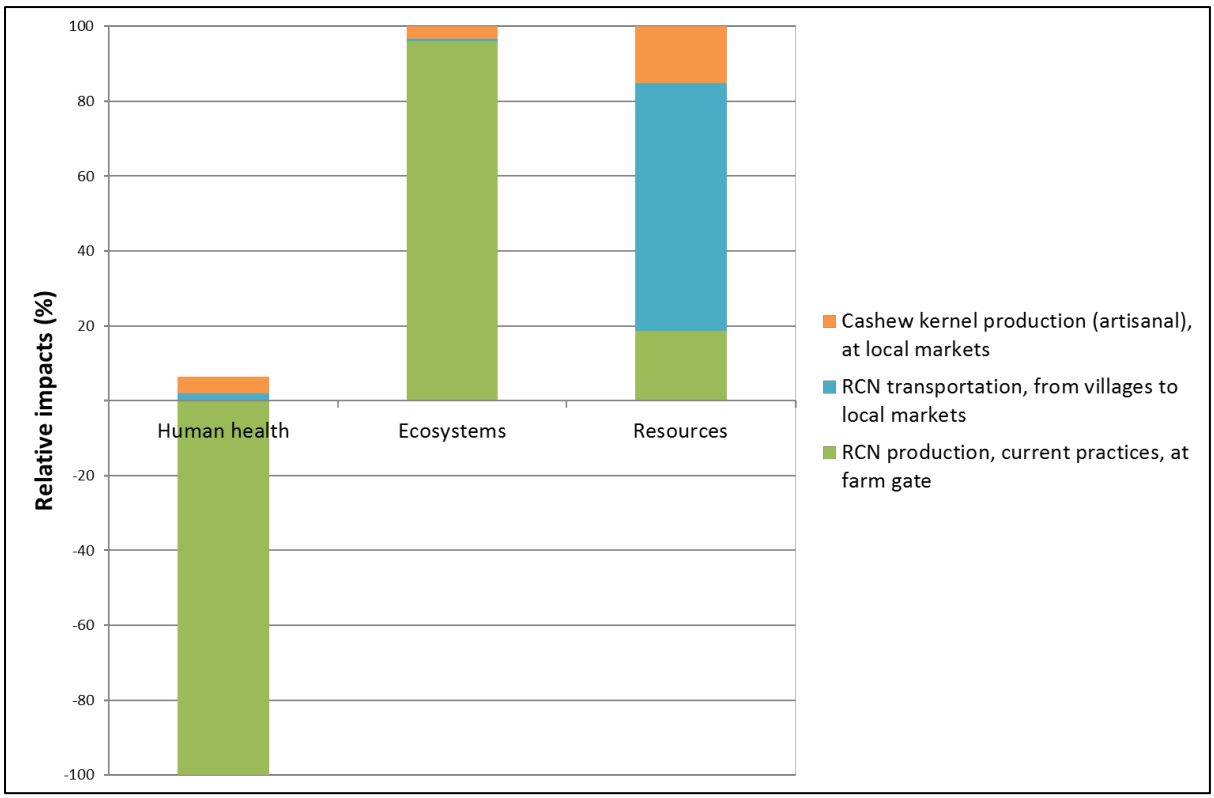


FIGURE 74: ENDPOINT IMPACTS OF THE NATIONAL CONSUMPTION SYSTEM BASED ON ARTISANAL PROCESSING, WITHOUT PALM OIL CONSUMPTION, WITH THE CONTRIBUTION OF LIFE CYCLE STAGES (RECIPE2016 LCIA METHOD)

For this sensitivity analysis, no result from the uncertainty analysis is presented since these conclusions do not suffer from any known and quantified uncertainty. However, a limitation of this analysis is that no effect of not using any vegetable oil during RCN roasting was modelled, due to a lack of data. Especially, one should assume that using vegetable oil might mitigate the risks of burning cashew nuts and then reduce losses of cashew kernels.

5.3.3 Discussion on the environmental sustainability of cashew value chains in Sierra Leone

The comparison of endpoint impacts from the different cashew value chains and from benchmark systems aims at expressing the impacts of the cashew value chains relative to more meaningful environmental issues in the context of Sierra Leone. *Table 37* provides the resulting equivalence factors: these results mean that, for instance, one ton of cashew kernels produced from artisanal processing in Sierra Leone has a potential impact on ecosystems equivalent to the one from the burning of 2.21 hectares of bushland.

Areas of Protection:	Human Health	Ecosystems	Resources
Benchmark system:	Bushfire		Brussels-Freetown round trip air flight
Unit:	Hectare-equivalent of burned bushland		Passenger-equivalent
National exportation system, per ton of RCN at Freetown port	- 0.23	0.69	0.11
National consumption system based on artisanal processing, per ton of cashew kernels at Sierra Leonean markets	- 0.68	2.21	0.30
National consumption system based on semi-industrial processing, per ton of cashew kernels at Freetown markets	- 0.44	1.72	0.17

TABLE 37: EQUIVALENCE BETWEEN THE CASHEW VALUE CHAIN SYSTEMS AND THE BENCHMARK SYSTEMS

Based on *ComCashew* data from the functional analysis of this VCA4D project, Sierra Leonean cashew production was estimated at 4300 t of RCN in 2017, or 1430 t of cashew kernels assuming 3 kg of RCN for 1 kg of cashew kernels (see previous section). Based on these estimations, *Table 38* gives equivalence factors between cashew value chains and benchmark systems for the full Sierra Leonean cashew production in 2017.

Areas of Protection:	Human Health	Ecosystems	Resources
Benchmark system:	Bushfire		Brussels-Freetown round trip air flight
Unit:	Hectare-equivalent of burned bushland		Passenger-equivalent
National exportation system, for the full Sierra Leonean cashew production in 2017	- 1000	3000	480
National consumption system based on artisanal processing, for the full Sierra Leonean cashew production in 2017	- 970	3200	430
National consumption system based on semi-industrial processing, for the full Sierra Leonean cashew production in 2017	- 640	2500	250

TABLE 38: EQUIVALENCE BETWEEN THE CASHEW VALUE CHAIN SYSTEMS AND THE BENCHMARK SYSTEMS, BASED ON THE ESTIMATED CASHEW PRODUCTION IN SIERRA LEONE IN 2017

Regarding human health, all cashew value chains have a potential beneficial effect due to carbon storage from the establishment of cashew plantations on bushlands. Therefore, all value chains can be considered sustainable in this regard.

Regarding resources, *Table 38* shows that all cashew value chains, even applied to the full Sierra Leonean cashew production in 2017, have a potential impact on resources lower than the potential impact of two round trips between Brussels and Freetown of an airplane of 320 effective passengers. Sierra Leonean cashew value chains have then a negligible impact on resources at a national or global scale, and can then be considered sustainable in this regard. However, it must be reminded that the national exportation system only includes transportation steps within Sierra Leone. This system then excludes international trading routes of cashew, which generally entail RCN transportation from Africa to India or Vietnam, RCN processing in these countries, and cashew kernel transportation to Europe or the United States where most of cashew consumption takes place (see functional analysis of this VCA4D study). Hence for the national exportation system, this conclusion on sustainability regarding resources only applies to production and transportations steps which take place within Sierra Leone, and not to the full value chain.

Regarding ecosystems, *Table 38* shows that depending on the type of value chains, the impact on ecosystems from the full cashew production in 2017 is equivalent to the impact arising from the burning from 2500 to 3200 hectares of bushland. As a comparison, from 1997 to 2015, an average of 400000 hectares of bushland burned each year in Bombali, Kambia and Port Loko districts (see Figure 75), based on data from the *Global Fire Emissions Database* (Giglio et al., 2018). The impact on ecosystems from the full cashew production in Sierra Leone in 2017 is then equivalent to the impacts on ecosystems of 0.6% to 0.8% of the average burned area in these three districts. At a local scale, the impact from cashew value chains on ecosystems can then be considered negligible compared to the environmental issues arising from bushfires. Cashew value chains can thus be considered sustainable in this regard.

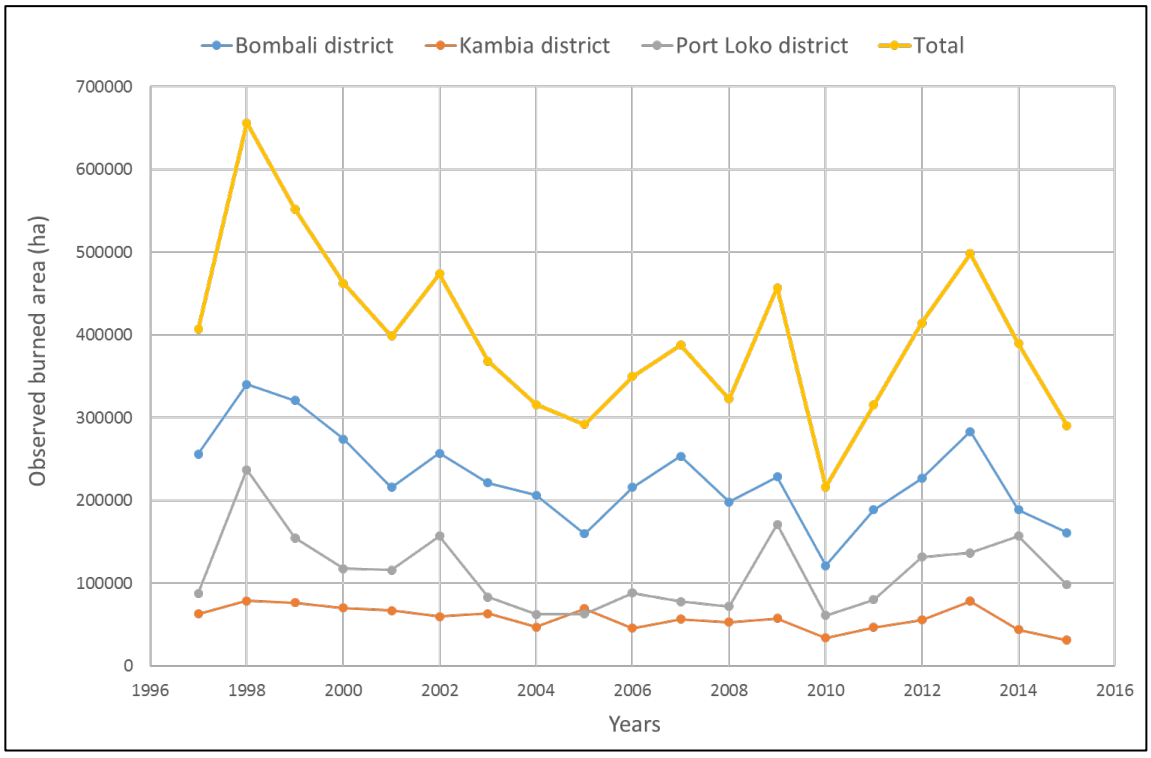


FIGURE 75: OBSERVED BURNED AREA PER YEAR IN BOMBALI, KAMBIA AND PORT LOKO DISTRICTS FROM 1997 TO 2015 (GIGLIO ET AL., 2018)

6. Conclusions and recommendations

The objective of the study consists of describing and analysing the Cashew Value Chain in Sierra Leone using the tools and methods included in the DEVCO1/C1 Methodological Brief – Frame and Tools. Key features of the experts' work (20p). The expected output is a robust diagnosis system to describe the state of affairs for the functioning of the chain (VC system, technical diagnosis and governance) and the three dimensions of sustainability (economic, environmental, and social).

Analyses are conducted for replying to four leading questions: 1) what is the contribution of the VC to economic growth? 2) Is this economic growth inclusive? 3) Is this VC socially sustainable? 4) Is the VC environmentally sustainable?

This diagnosis of the functioning of the VC will help the EC in structuring their policy dialogue around the strategic issues that might hinder the sustainable development and growth of the cashew value chain in Sierra Leone. Throughout the functional, economic, social and environmental analyses, the four distinct but complementary analyses must highlight the most relevant strengths, risks and opportunities in the value chain, the points to be further analysed in depth, and the aspects that are difficult to inform.

The first stage of the analyses was a first rough analysis of the cashew value chain in Sierra Leone. Indeed, this first study was done in Sierra Leone by the team of experts. Since the VC is very underdeveloped in Sierra Leone, it has been difficult to find reliable and relevant information about its functioning. Especially since it is strongly invested by informal exchanges and a clear lack of transparency between the various links and actors. In an attempt to bridge this gap, experts developed survey questionnaires that were submitted to the main types of actors: producers, processors and traders. The data collected in the field from these actors were encoded and put at the service of each analysis. They were supplemented with secondary data obtained from local contacts and organizations such as ComCashew, Balmed, etc.

The functional analysis gives the "big picture" of the functioning of the VC. The cashew VC in Sierra Leone is embryonic. The main actors involved in the VC, producers, processors and traders get profits through their activities in the VC. Producers costs and profits are not easy to measure because smallholders are the main producers, but they are in a self-consumption system and they are mainly self-employed in agricultural activities. Cashew yields are not good in Sierra Leone and the quality of the RCN is not high. Informal traders buy them at farm or village gates and they generate the highest profits. But informal trade is very common and traders are not very transparent on prices. A few international retailers are in place. Processors don't get significant profits because this activity is integrated in farms or villages and mainly artisanal. There is a clear technical challenge concerning processing.

Results of the financial and economic analyses of main actors and the VC allow concluding that the VC contribute to growth in Sierra Leone. Growth increase could be achieved with technical and transparent improvement in the VC. There is a lack of technical knowledge and equipment for cashew yields and processing. The country structure is not business friendly and favourable for RCN and kernels exports.

Moreover, in terms of the economic sustainability of the VC, it can be concluded that:

- The contribution of the VC in the overall GDP is not significant but in Sierra Leone, the Agricultural sector contributes around 60% to the GDP and food crops are increasing. Indeed,

climate and topographic conditions are very good in Sierra Leone, as well as in West Africa, for tree crop cultivation such as cashew.

- The VC does not contribute concretely to the public finance because are not levied on many agricultural products and incomes because the government has adopted a policy of encouraging agricultural production to fight against poverty and to guarantee a better food security.
- The cashew VC does not have significant impact on the balance of trade. Indeed, this VC involves almost no imported goods and services. Moreover, cashew products official exports are 63 MT for 2017. The goal is to increase this level, but the quality and the yields must follow.
- In terms of international economy, the cashew VC in Sierra Leone has a comparative advantage. Indeed, factors of production such as wages, agricultural inputs, etc. are comparatively good according to other countries.

The economic analysis demonstrates that there is a concrete potential for growth through the development of the cashew VC in Sierra Leone. Growth inclusiveness has been analysed through the social analysis.

The social study analysed the potential of the cashew value chain development in Sierra Leone in addressing the dire situation of food and nutrition insecurity. The study results show that with a 2.5 ha cashew farm (median cashew holding of a cashew farmer as per Comcashew baseline survey, 2017), a farmer in Sierra Leone can, in many likelihoods, earn annual profits (after deducting cost of production) almost equivalent to the living wage (USD 800) in the country. Cashew can, therefore, be a poverty alleviation tool. This is achievable if high quality planting material is provided to the farmers along with the needed management inputs and easy finance. Comcashew survey (2018) stated access to finance as 'almost a precondition' to achieve the overall objective.

Further economic growth induced by development of the cashew value chain is expected to be economically inclusive as most cashew processing enterprises are run single-handedly by women that contribute an average of 30% to total family income in processing families. Overall contribution is about 200 to 800 USD per year. Women have direct control of incomes earned. The cashew value chain offers many other economic opportunities (such as cashew apple processing, bee keeping, nursery management) for women to increase their independent incomes and consequently economic standing and decision-making role within the family /community.

The study also uncovered areas where 'inclusivity' of the value chain can be improved:

- Except workers at a 'block farm', most other workers in the value chain are 'informal' workers meaning that they neither have a contract nor any benefits (health, insurance, pension etc.). Majority of workers across different part of the value chain are probably earning much less than the minimum wages (~800 USD per annum), as data from sample investigations in the four districts shows. The worse-off are farm workers involved in cashew production. The study estimates that the farm level workers (both men and women) are probably earning between 1.8 million to 2.4 million SLL (240 to 320 USD) per annum.
- The prevailing rate of annual compensation from land-lease is $12.5 /hectares. If large-scale land investments in cashew sector become a reality (which it may), then there is a need to rethink and revise the compensation for the land owners. More so, as an alternative business model of block farming can provide much better returns (~100 to 240 USD per ha.[85]) to land owners.

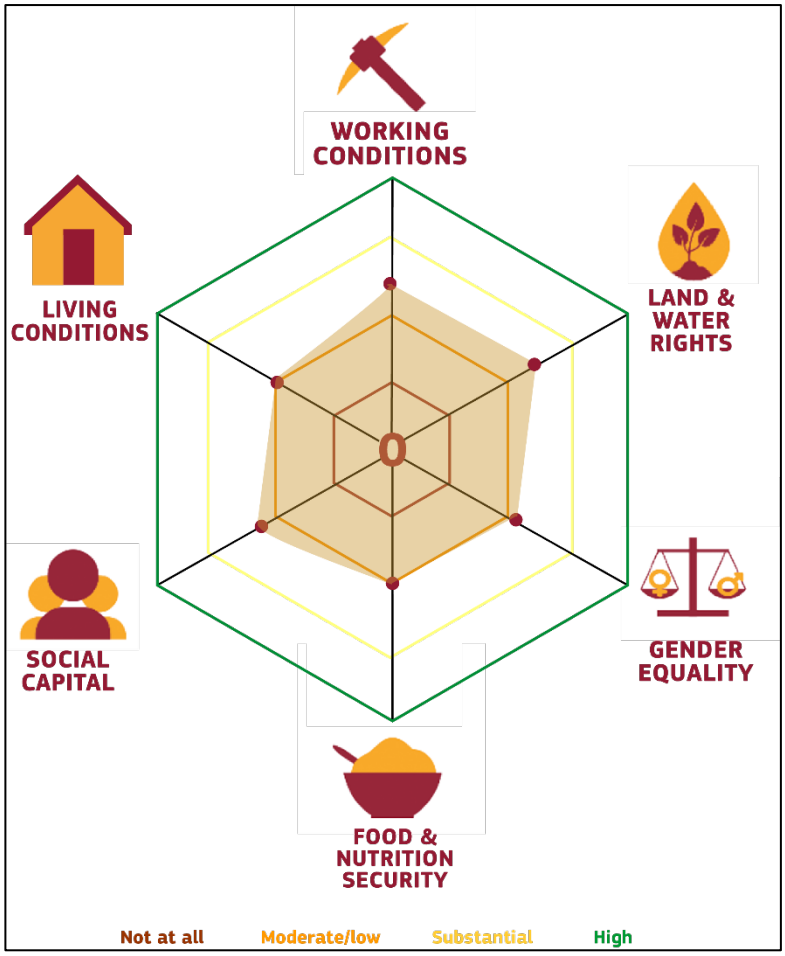
[85] Computed by the study, based on assumptions and basic data collected on block farm model from Balmed

- Lower technical capacities (at MAFFS, SLARI etc.) in cashew, low access to finance and labour could constrain efforts to increase cashew yields in the country. Agriculture productivity can remain low in the absence of strong information and extension services to the farmers. Also, improper /unregulated marketing structures may continue to bring the sector down, in terms of its contribution to farmers' incomes and economic growth of the country. The marketing structure in the sector is evolving. A need has emerged for streamlining marketing structures.

Overall, the Cashew value chain is showing signs of exemplary pro-poor and inclusive value chain development. However, this is at present at small scale and needs many efforts for inclusive and sustainable expansion of the sector, for which a very large potential[86] exist.

In terms of social sustainability, the social analysis conducted in 2018 shows that the cashew value chain, at the present juncture, carries low social risks and offers vast opportunities for pro-poor and inclusive economic development in the country. The main findings from the social analysis of the cashew value chain are presented below.

[86] A World Bank study analysed cashew sector export potential in Sierra Leone to be about 10000 t per annum



Working condition:

- The workers in the cashew VC are found at production, processing and trading levels, the majority being at the 'production' level. The processing of RCN is currently very limited in the country. The processing is mostly artisanal with about 50 to 100 women entrepreneurs involved in it across four main cashew districts - Kambia, Port Loko, Bombali, Tonkalli. Industrial scale processing is not significant with only two main players involved - KamCashew[87] and National Agriculture Development Export Co (NaDeCo) - and their processing operations are running haltingly.
- Among the four cashew production systems (small holder, mid & large size plantations, block farm), respect of labour rights is observably better in the block farming model[88] initiated in cashew by the Balmed company. The workers in the cashew plantation (either 40.48 ha or 20.24 ha) established as a 'block farm' are the youth group of 25-50 persons.
- Two clear risks are present in the value chain: a) The wages of farm level workers, working on farms and mid-size /large size cashew plantations are very low - much less than minimum wages (~800 USD per annum) prescribed, b) Overall, 'informal' nature of wage employment in cashew value chain makes it difficult to implement or monitor compliances to labour standards. The workers' associations or collective bargaining possibilities cannot be expected to exist in this set up.

[87] Kamcashew factory has good infrastructure and could be readied for attracting potential investors who can modernise it and run efficiently (source: factory observations and discussions with key informants)

[88] Balmed first introduced block farming model in Cocoa and coffee in the eastern province. Learning from experience, Balmed have now adapted and replicated the model in cashew in the northern province of Sierra Leone

Land and Water Rights:

- The examples of large-scale land leases in other commodities in the country suggest history of violations and non-compliances with the principles of VGGT. This is not the case in cashew value chain. This presents a clean slate to begin cashew VC development – learning from experiences in other crops (e.g. oil palm, sugarcane in Sierra Leone) and from other countries (in cashew).
- Large-scale land investments in cashew is a distinct possibility in next few years. Conditions are favourable for investments. In addition, promising models are being developed by Balmed and COOPI, which could provide an alternative to large-scale land acquisition by 'non-natives'. However, it is to be seen, whether past mistakes would not be repeated.
- Balmed model is demonstrating a transparent approach. Nonetheless, compromises on transparency, participation and consultation can happen in the cashew sector as well (instances seen). In the prevailing context, the process of transparency, participation and consultation in land acquisition can easily be compromised if companies do not follow self-regulation and /or rigorous land governance framework is not applied.
- The iniquitious and inadequate compensation for land-leases, if not reformed, can potentially generate conflicts and confrontations in cashew sector as well. If large-scale land acquisitions or agri-business investments materialise (high likelihood) in the cashew sector, then the socio-economic benefits realised by communities could be low, leading to dissatisfaction.
- The new land policy (NLP) will have high relevance for the cashew value chain as it can help cashew sector avoid the pitfalls already experienced by other commodity sectors. New agri-business investments in land acquisitions for cashew plantations and for setting up cashew processing plants could be guided by an enabling NLP.

Gender equality:

- The women are economically very active in cashew value chain and play significant roles throughout the VC. Women play main role in harvesting and play subsidiary roles in other activities as part of family farming; Women are also part of the farm management group in block farming model; Men mostly control incomes from cashew farming. Women have direct control of incomes earned from processing and trading engagements.
- Barriers to greater decision-making role of women in the VC are related to prevailing economic (limited opportunities for earning independent incomes), social (polygamous relationships, lack of education) and policy (lack of land ownership) constructs /risks.
- Women ownership of assets (such as housing) are very low, which is partly explained by historical context, socio-cultural norms and patrilineal systems of the Sierra Leonean society. The new National Land Policy provide specific provisions for "joint spousal consent to land disposals". The implementation of the policy is yet to be promulgated.
- The forums like CPUs/FBO/ABC provide voice and public profile to women. The challenge, however, remains of promoting increased women's participation and leadership roles in these groups as currently it is very limited.

Food and Nutrition Security:

- Cashew communities have experienced hungry season and have adopted various coping strategies. food consumption scores are much below the national average in cashew growing districts (Kambia, Port Loko, Bombali). Close to two-third households in these districts are either poor or on the borderline of food consumption scores (CFSVA, 2015)
- The diet of cashew producers and processors generally lack proteins and vitamins. About 60 to 70 % of cashew farmers are suffering from dietary deficiency, which have deteriorated over last five years. Cashew and its products have potential to address some

of these nutritional deficiencies as cashew kernel is very rich in fat (46 per cent) and protein (18 per cent) and a good source of calcium, phosphorus, and iron.

- Food price variations are increasing over last 5 years, putting additional pressures on household economy. Cashew value chain development, in this context, have potential to increase stability of incomes and food security for cashew producers and processors. Many field observations and interactions suggest that strategy of nutritional integration in cashew value chain development (as is done by COOPI) is worth scaling up.

Social capital:

- Comcashew baseline survey (2018) found that 57% of the surveyed households member are part of a formal, registered farmers' association or cooperative. More participation for cashew producers and processors in existing FBOs /ABCs can be encouraged as these organisations can provide various services to their members, including easy source of finance for cashew producers and processors.
- CPUs are starting to play a role in input and output markets. However, this require strengthening CPUs capacities. The CPU will need infusion of both technology and finance to make headway on the business plan as otherwise grant-based initiative will fail to become a profitable social venture.
- The study found out that there is not defined market place for cashew in the district, no organisation of the farmers to get fair price. So, farmers get discouraged and this could be one of the factors why farmers generally do not take care of their farm. The value chain may need some institutional interventions such as cashew commodity association at district level and cashew development board at national level to steer and coordinate all cashew value chain upgradation activities at respective levels.
- At the same time, PMB could play a hugely important role in organising and governing the value chain (in areas such as transparent price discovery, cashew quality standards setting and regulation, regional trade regulation, producer support programme etc.). Realisation of cashew's full potential demand such structural improvement actions.
- The farmers in the value chain have very low access to information and agriculture extension services. In the cashew sector, ComCashew baseline survey (2018) found that only 21% of the 231 responding households have had some training on cashew within the last 5 years. Cashew farmers are facing constraints related to capital and labour availability. Technical support capacity at MAFFS and SLARI needs to be upgraded as well. These are constraining to farmers for achieving higher agricultural productivity.
- Cashew value chain have seen many novel experiments such as Balmed's block farm model, COOPI's semi block farming concept, COOPI's CPUs, women-centric ABC working on cashew trading and processing (Ladeka ABC) are some examples of on-going value chain experiments of social involvement at small-scale. Further development and strengthening of these initiatives is important for achieving country's export potential of cashew (~10,000 t).

Living conditions:

- Basic health infrastructure in rural areas in Sierra Leone is very limited. Primary health centres are available approximately 2-3 miles from a village. The secondary hospitals are further away from villages.
- Unsafe drinking water and unhygienic sanitation practices could pose considerable strain on achieving health outcomes, while high cost of seeking treatment from primary or secondary health centres can continue to pose barriers for poor people in terms of health seeking behaviour
- Cashew production by smallholders is hampered, in terms of both quantity and quality, by limited education and training, as highlighted in earlier sections. The farmers need to

improve their knowledge and skills related to cashew production and processing. COOPI, with MAFFs is providing extension services to about 4000 farmers and workers. This could possibly be scaled up to 10 to 20,000 farmers and workers.

For the environmental analysis of this VCA4D study, an attributional LCA for micro-level decision support was undertaken, with the following specific objectives:

- To quantify the potential environmental impacts of the cashew value chains in Sierra Leone, based on available knowledge, and to highlight the environmental hotspots;
- To determine, through sensitivity and uncertainty analyses, the main gaps in knowledge that can introduce biases in findings and comparisons and that would need to be filled by specific studies;
- To explore, through sensitivity analyses, key opportunities and risks for the development of the cashew value chains from an environmental perspective; and
- To provide elements for discussion on the sustainability of current cashew value chains in Sierra Leone.

Three systems related to different purposes for cashew production were considered in this analysis: national exportation, and national consumption based on artisanal processing for Sierra Leonean markets, or based on semi-industrial processing for Freetown mini-markets. The description of these systems was built on primary data collected during this VCA4D study from a field mission and a field survey, secondary data from recent surveys and studies by the European Commission (A4D project, ProAct action), ComCashew and the GIZ, and background data from literature and available databases.

The main conclusions of the environmental analysis can be summarised as follows:

- Regarding the potential environmental impacts of current cashew value chains in Sierra Leone:
  - All systems considered show a benefit for human health, due to the carbon storage potential related to the establishment of cashew plantations on bushlands, in the Northern Province of Sierra Leone. Even if this benefit is subject to high uncertainties, it prevails on other potential impacts on human health, and the uncertainty analysis determined that the probability for this overall benefit to be confirmed varies between 76% for the national consumption system based on semi-industrial processing, and 83% for the national exportation system.
    For national consumption systems, this benefit on human health from carbon storage is reduced by 6% for artisanal processing and 25% for semi-industrial processing. This reduction is explained by the fine particulate matter formation from the production and combustion of fuels, either fuelwood, charcoal, or CNS.
  - Cashew cultivation is also the main contributor to the potential damages on ecosystems and biodiversity, due mostly to land occupation for cashew plantations and to habitat losses from bushland conversion. In the case of the national consumption system based on artisanal processing, the land occupation impact is higher than for other systems due to palm oil and charcoal consumptions during RCN processing.
  - Finally, the potential impacts on resource scarcity from the three systems considered come from fossil fuel consumption. However, consumption sources differ slightly depending on the system: RCN transportation for the national exportation system, RCN processing due to palm oil consumption for the national consumption system based on artisanal processing, and RCN transportation and cashew kernel distribution for the national consumption system based on semi-industrial processing.

- Three main gaps in current knowledge were identified during the study, and should be filled by specific studies for a more accurate environmental assessment:
  - Even if the uncertainty analysis helped to manage the high uncertainties associated to the potential carbon storage under cashew plantations, specific studies on this issue should be carried out in order to validate this potential and to enable a better discrimination between agricultural practices.
  - Since recent studies mainly focused on cashew cultivation, little information and data was available on artisanal production of cashew kernels for local consumption, whereas this type of processing can be a non negligible source of environmental damages. Specific studies should then be carried out in order to have a better understanding of current processing practices and to be able to propose improvements.
  - Most of the current Sierra Leonean cashew production is located in the Northern Province, especially Kambia, Bombali, and Port Loko districts. Most of the recent available data then refers to these three districts. However, the recent survey by ComCashew and the GIZ suggests that agricultural practices in cashew plantations might be different in other parts of the country, which might be due to a higher access to pest controls and chemical inputs. A survey should then be carried out to have a better picture of agriculture practices in cashew plantations in the whole country.
- Along with these gaps in knowledge, one major threat and one opportunity were identified for a sound development of cashew value chains in Sierra Leone:
  - Bushfires are both an important environmental issue in the Northern Province of Sierra Leone and a key threat for cashew plantations, which can dramatically increase the potential environmental damages of cashew value chains. Actions to reduce the number of bushfires should then be taken. Potential positive or negative effects on bushfires of cashew development in the Northern Province of Sierra Leone may also be investigated.
  - A specific sensitivity analysis on semi-extensive plantations has shown that there is room and opportunities to reduce impacts and to increase environmental benefits from cashew cultivation. In this regard, the use of organic fertilizers should be promoted to favour the establishment of young cashew trees, to increase yields and to avoid losses in soil fertility.
- Finally, comparisons with benchmark systems were performed to discuss the sustainability of cashew value chains in Sierra Leone. These comparisons have shown that the current potential impacts of cashew value chains are marginal compared to other environmental issues relevant in the context of this study: impacts of bushfires on human health and ecosystems, and resource consumption of air flights between Brussels and Freetown. From this perspective, current cashew value chains can be considered as environmentally sustainable.

  However, in the case of the national exportation system, it is important to keep in mind that steps taking place outside of Sierra Leone were out of the scope of this study. This conclusion cannot then be generalized to the international cashew market.

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8. Annexes

8.1 Cashew VC Analysis in Sierra Leone – PART A - Quantitative Surveys with Cashew Producers operating at different scales

The survey targets cashew farmers or producers operating at different scale. The guidance to the survey team is that they should sample 3 to 5 Households /Groups each from following category:

- *Small holder cashew production (<2 ha)*
- *Mid-size private plantations (up to 10 ha)*
- *Large size private plantations (more than 10 ha)*
- *Large nucleus plantations by investors (any size)*
- *Block farming model /Semi-block farming production*

The survey question are:

Province:	District:
Chiefdom:	Village:
Date of Survey:	Interviewer name:
Production System (state one among the above five production system specified) :	

A.1 Profile of the Cashew Producer and Farm

A.1.1 Household Respondent's name:
A.1.2 Age:
A.1.3 Sex (Male /Female):
A.1.4 Are you the head of your household (Yes /No)
A.1.5 What is the household head's relationship to you (Self/ Husband /Wife /Children/Other):
A.1.6 How many children people in your household (people to feed)?
A.1.7 Do you own the land or rent it?
A.1.8 Do you own land that is used by other households (Yes/No):
A.1.9 Does your land have a title (certificate or any other documentation) (Yes/No):
A.1.10. Area of Farm: _____ hectares
A.1.11. Area of farm under cropping:_____ hectares
A.1.12 **Main crops cultivated:**

Crop Name	Area under cultivation (ha)	Variety	Number of trees or plants	Age of plantation (for tree crops)	Source of seedling

A.2 Production and Productivity of Main crops

A.2.1 Agricultural products in previous season

Main Crop Name	Harvest/ year	Local measurement (if any)	Harvest	For consumption	For seed	For sale	Sales		
		Name=....kg	Amount	%	%	%	In kg	Price/ kg	Total Sales Value (SLL)

A.2.2 Agricultural input used for Cashew in last season

Size of Cashew plots (if diffèrent plantations maintained)	Seed	Fertilizer	Herbicide	Insecticide	Fungicide
	Kg (cost incurred in SLL)	Kg (cost incurred in SLL)	Kg (cost incurred in SLL)	Kg (cost incurred in SLL)	Kg (cost incurred in SLL)
1.					
2.					
3.					
4.					
5.					

A.2.3 Agriculture labour for cashew

A.2.3.1 Do you employ labour outside your family (Yes/No)?

A.2.3.2 Cost of labour: Cashew (previous season)

Size of cashew plots (if diffèrent plantations maintained)	Labour cost (in SLL)					
	Land preparation/ ploughing	Planting	Maintenance/ weeding	Harvesting	Post-harvest	Marketing (including transport)
1.						
2.						
3.						
4.						
5.						

A.3 Source of finance for cashew production

A.3.1. What is the main source of finance for farm level investments?

A.3.2. Do you borrow money to cover the cost of cultivating cashew (Yes/No):

A.3.2.1 If yes, How much?

A.3.2.2 What is the interest rate /month?

A.4. Involvement in Development programmes and organisations

A.4.1 Have you ever received assistance or participated in a rural development programme undertaken by an external organisation (government, NGO, etc.) (Yes/No):

A.4.2 What development assistance in the past 5 years

Year	Name of programme	Organisation focal point	Description of activities	Level of success

A.4.3. Are you a member of any organisations (Yes/No):
A.4.3.1. If yes, please provide more details about Organisation membership

Name of organisation	Organisation status	Membershiop since ?	Description of activities

A.5. Market channel for selling RCN

A.5.1 What is the market channel, where RCN is sold? How far is it from the farm and how RCN are sent there?

Market channel, where cashew is sold recently	Volume of RCN	Average price realisation per Kg.

A.6. Family incomes and expenditures

A.6.1. What are main sources of family income and their proportions?

Source of income	Estimated amount per year (SLL)	Proportion of total income
Cashew production		
Cashew processing /kernel trading		
Other crops production		
Other crops processing/trading		
Livestock		
Trading		
Service /jobs		
Wage labour (farm or non-farm)		
Other (specify)		
Other (specify)		
Other (specify)		

A.6.2. What are the main area of expenditures for the family and their proportions?

Household expenditure	Monthly (SLL)	Annually (SLL)	Total (in last one year)
Routine expenditure			
Food and drink			
Energy (electricity, fuelwood, cooking gas, kerosene)			
Transport (including gasoline) and Sanitation (soap, detergent)			
Clothes, shoes			
Education			
Health			
Loan repayment			
Other			
Irregular expenditure (investment, etc.)			
House			
Transport			
Land			
Cattle			
Tools /machines			

Household expenditure	Monthly (SLL)	Annually (SLL)	Total (in last one year)
Other			

A.6.3. Does the family face any **deficit situation** in terms of inflows and outflows last year (Yes/No):
A.6.3.1 If yes, does it create food insecurity /food deficit for the family (Yes/No):
A.6.4. What is the approximate size of current outstanding loan (in SLL) with the family?

8.2 Cashew VC Analysis in Sierra Leone – PART B - Quantitative Surveys with Cashew Processors /kernel traders

The survey targets cashew processors (artisanal) /kernel traders. The guidance to the survey team is that they should sample 3 cashew processors /kernel traders in each district:
The survey question are:

Province:	District:
Chiefdom:	Village:
Date of Survey:	Interviewer name:
Whether RCN processor or kernal trader or both:	

B.1 Profile of the Cashew Processor

B.1.1 Household Respondent's name:
B.1.2 Age:
B.1.3 Sex (Male /Female):
B.1.4 Are you the head of your household (Yes /No):
B.1.5 What is the household head's relationship to you (Self/ Husband /Wife /Children/Other):
B.1.6 How many children people in your household (people to feed)?
B.1.7 Do you own the land or rent it?
B.1.8 Do you own land that is used by other households (Yes/No):
B.1.9 Does your land have a title (certificate or any other documentation) (Yes/No):
B.1.10. Area of Farm: _____ hectares
B.1.11. Area of farm under cropping:_____ hectares
B.1.12. When the cashew processing business was started (year):
B.1.13. Who started and is running the main business (men/women/youth):
B.1.14. Who is mainly involved in cashew processing:

Person in the family involved in cashew processing	Whether part of the family (yes/no)	Main months of involvement in cashew processing	What is the main role	Rough estimate of days involved per month in cashew processing
Men				
Women				
Youth (>18 years)				
Boys (15-18 years)				
Girls (15-18 years)				
Boys (<15 years)				
Girls (<15 years)				

B.2. Source and processing of RCN, last season of processing

Source of RCN	Distance from	Total procured (kg)	Method of procurement (farmgate/ delivery at	Price /cost	Conversion ratio (how much kernel	Total kernal	Empty or low quality nuts –

	processing site		processing site/ through intermediary traders)	per Kg (SLL)	produced per kg)	produced (Kg)	approximate proportion

B.2.1. What do you do with emptied nuts (used as fuel / disposed / other)? If they are used as fuel, do you have specific issues with them compared to charcoal?

B.3. Inputs used in processing of RCN, last season of processing

Inputs	Cost per unit	Total costs in the last season
Charcoal		
Labour		
Other (specify)		
Other (specify)		
Other (specify)		

B.4 Source of finance for cashew processing

B.4.1. What is the main source of finance for cashew processing?

B.4.2. Do you borrow money to cover the cost of processing (Yes/No):

B.4.2.1 If yes, How much?

B.4.2.2 What is the interest rate /month?

B.5. Marketing of kernels producers in the last season of processing

Marketing channel	Volume sold	Unit price (per kg)

B.6. Involvement in Development programmes and organisations

B.6.1 Have you ever received assistance or participated in a rural development programme undertaken by an external organisation (government, NGO, etc.) (Yes/No):

B.6.2 What development assistance in the past 5 years

Year	Name of programme	Organisation focal point	Description of activities	Level of success

B.6.3. Are you a member of any organisations (Yes/No):

B.6.3.1. If yes, please provide more details about Organisation membership

Name of organisation	Organisation status	Membershiop since ?	Description of activities

B.7. Family incomes and expenditures

B.7.1. What are main sources of family income and their proportions?

Source of income	Estimated amount per year (SLL)	Proportion of total income
Cashew production		
Cashew processing /kernel trading		
Other crops production		
Other crops processing/trading		
Livestock		
Trading		
Service /jobs		
Wage labour (farm or non-farm)		
Other (specify)		
Other (specify)		
Other (specify)		

B.7.2. What are the main area of expenditures for the family and their proportions?

Household expenditure	Monthly (SLL)	Annually (SLL)	Total (in last one year)
Routine expenditure			
Food and drink			
Energy (electricity, fuelwood, cooking gas, kerosene)			
Transport (including gasoline) and Sanitation (soap, detergent)			
Clothes, shoes			
Education			
Health			
Loan repayment			
Other			
Irregular expenditure (investment, etc.)			
House			
Transport			
Land			
Cattle			
Tools /machines			
Other			

B.7.3. Does the family face any **deficit situation** in terms of inflows and outflows last year (Yes/No):

B.7.3.1 If yes, does it create food insecurity /food deficit for the family (Yes/No):

B.7.4. What is the approximate size of current outstanding loan (in SLL) with the family?

8.3 Cashew VC Analysis in Sierra Leone – PART C - Qualitative interviews with key actors in the value chain

Checklists to be used during the interviews, with detailed notes taken – INTERVIEW AT LEAST 3 PEOPLE ON EACH OF THE 5 ISSUES

C.1 Trading flows, trade dynamics:

Through key informant interviews with traders, producers, private companies and other actors in the cashew supply chain

C.1.1 What are the informal /illegal trading routes and destinations for RCN?

C1.2 Who are the main actors involved in these trading routes?

C1.3 What is the approximate volumes (in Kgs) of transactions of RCN through these routes?

C1.4 How much influence these traders have on farmers/ producers and on the government machinery?

C1.5 What are the margins (% profits) these traders may be earning?

C1.6 Where the RCN supplied through these routes ultimately ends up and get processed there? Where does it get sold then?

C.2 Working condition:

Through key informant interviews and focus group discussions with youth and other workers involved in cashew production, processing and trading

C.2.1 What is the role of youth (aged 13-18) in production, processing and trading of cashew?

C2.2 What are the wages of youth (aged 13-18) - monthly or daily wages?

C2.3 How safe and secure the working conditions for the youth (aged 13-18)?

C2.4 What is the role of youth (aged 19-35) in production, processing and trading of cashew?

C2.5 What are the wages of youth (aged 19-35) - monthly or daily wages?

C2.6 How safe and secure the working conditions for the youth (aged 19-35)?

C2.7 Do the workers have any contract?

C2.8 Do the workers get any other benefit apart from the wages such as health insurance, pension, allowances, leave etc.

C.3 Food and nutrition:

Through key informant interviews and focus group discussions with cashew producers, merchants and shop keepers selling food items

C.3.1 What is the trend of pricing of main food items over last five years?

C3.2 What is the trend of household food expenditure (proportion of total income allocated to food) over the last five years?

C3.3 What proportion of cashew farmers or processors face food shortages every year?

C3.4 What is the trend of dietary diversity over the last five years?

C.4 Farmer organisations:

Through key informant interviews and focus group discussions with farmer organisations

C.4.1 What are the strengths and weaknesses of the farmer-based organisations, supporting cashew farmers?

C.4.2 What are the strengths and weaknesses of the ABCs supporting cashew farmers?

C.4.3 What are the opportunities available for these organisations to support cashew farmers?

C.5 Fire:

Through key informant interviews with producers and agriculture experts

C.5.1 What are the main causes of fires?

C.5.2 What are the key consequences of fires?

C.5.3 How often is the farm affected by fires? Are these fires happening more or less than in the past?

C.5.4 What could be the mitigation options for fires?

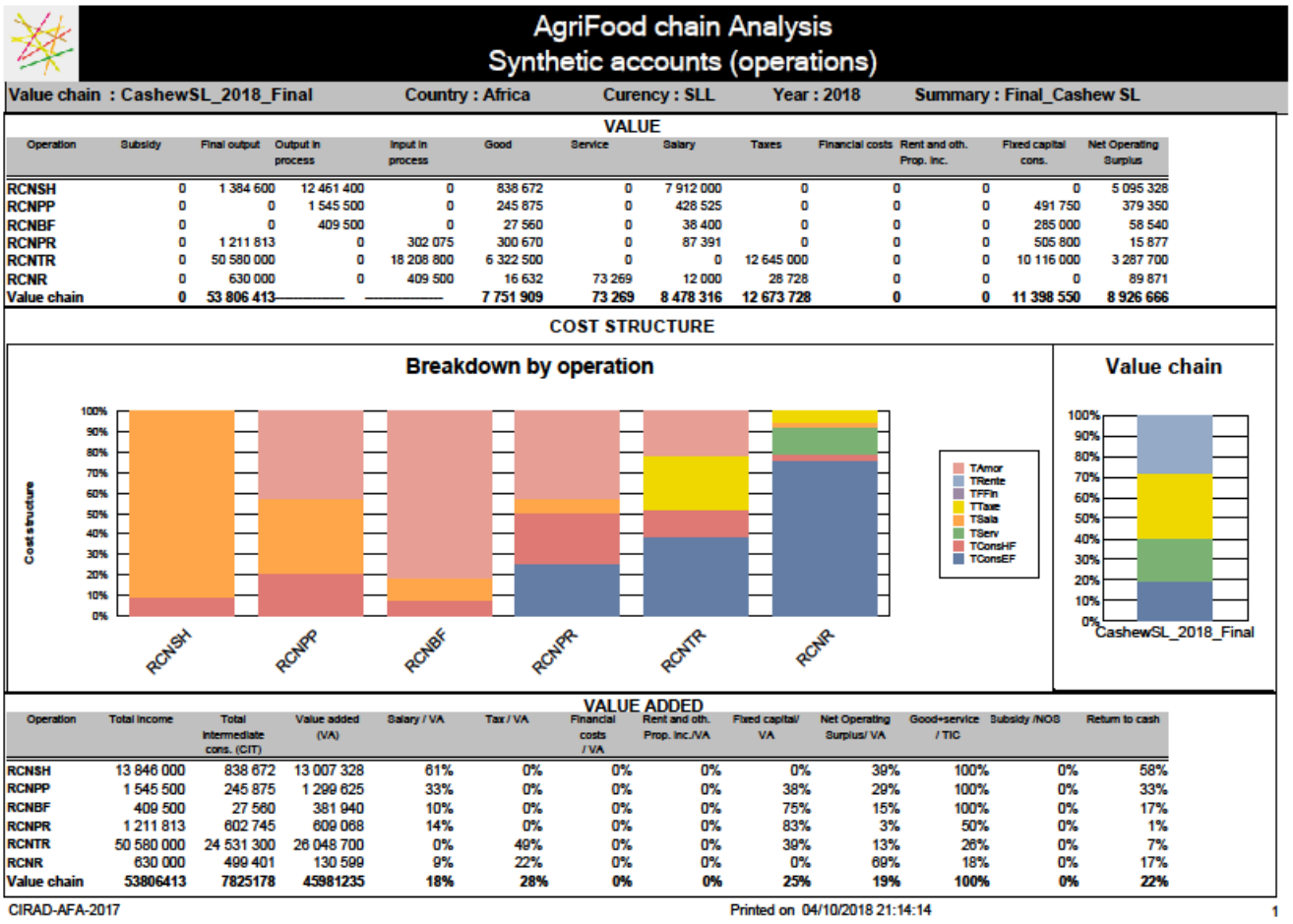
8.4 Cashew VC Analysis in Sierra Leone – Quantitative Surveys – Results

https://www.dropbox.com/s/rxdmqrjo67mk5rq/CashewSL_SurveyData_Final.xlsx?dl=0

8.5 Dropbox link to the detailed Social profile of the Cashew VC in Sierra Leone (Excel file)

https://www.dropbox.com/s/muggi3yt4bqjd5c/SOCIAL%20Profile%20VC%202017%20V00%20Cashew%20Sierra%20Leone%20260918.xlsx?dl=0

8.6 AFA Reports for the financial and economic analysis of the VC



AgriFood chain Analysis
Synthetic accounts (operations)

Value chain : CashewSL_2018_Final | Country : Africa | Curency : SLL | Year : 2018 | Summary : Final_Cashew SL

VALUE

Operation	Subsidy	Final output	Output in process	Input in process	Good	Service	Salary	Taxes	Financial costs	Rent and oth. Prop. Inc.	Fixed capital cons.	Net Operating Surplus
RCNSH	0	1 384 600	12 461 400	0	838 672	0	7 912 000	0	0	0	0	5 095 328
RCNPP	0	0	1 545 500	0	245 875	0	428 525	0	0	0	491 750	379 350
RCNBF	0	0	409 500	0	27 560	0	38 400	0	0	0	285 000	58 540
RCNPR	0	1 211 813	0	302 075	300 670	0	87 391	0	0	0	505 800	15 877
RCNTR	0	50 580 000	0	18 208 800	6 322 500	0	0	12 645 000	0	0	10 116 000	3 287 700
RCNR	0	630 000	0	409 500	16 632	73 269	12 000	28 728	0	0	0	89 871
Value chain	**0**	**53 806 413**			**7 751 909**	**73 269**	**8 478 316**	**12 673 728**	**0**	**0**	**11 398 550**	**8 926 666**

COST STRUCTURE

VALUE ADDED

Operation	Total income	Total intermediate cons. (CIT)	Value added (VA)	Salary / VA	Tax / VA	Financial costs / VA	Rent and oth. Prop. Inc./VA	Fixed capital/ VA	Net Operating Surplus/ VA	Good+service / TIC	Subsidy /NOG	Return to cash
RCNSH	13 846 000	838 672	13 007 328	61%	0%	0%	0%	0%	39%	100%	0%	58%
RCNPP	1 545 500	245 875	1 299 625	33%	0%	0%	0%	38%	29%	100%	0%	33%
RCNBF	409 500	27 560	381 940	10%	0%	0%	0%	75%	15%	100%	0%	17%
RCNPR	1 211 813	602 745	609 068	14%	0%	0%	0%	83%	3%	50%	0%	1%
RCNTR	50 580 000	24 531 300	26 048 700	0%	49%	0%	0%	39%	13%	26%	0%	7%
RCNR	630 000	499 401	130 599	9%	22%	0%	0%	0%	69%	18%	0%	17%
Value chain	**53806413**	**7825178**	**45981235**	**18%**	**28%**	**0%**	**0%**	**25%**	**19%**	**100%**	**0%**	**22%**

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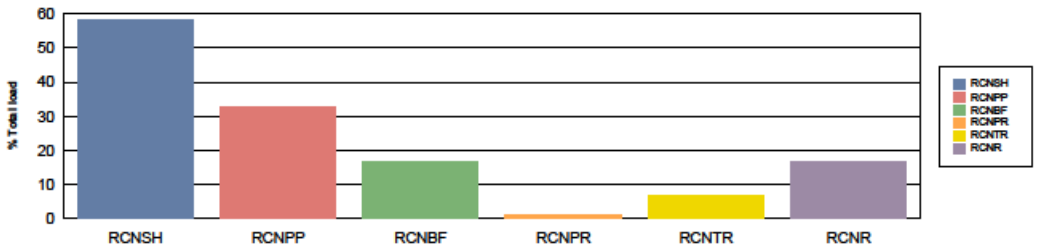
AgriFood chain Analysis
Synthetic accounts (operations)

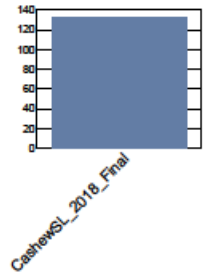
Value chain : CashewSL_2018_Final | Country : Africa | Curency : SLL | Year : 2018 | Summary : Final_Cashew SL

RETURN TO CASH

Breakdown by operation



Value Chain



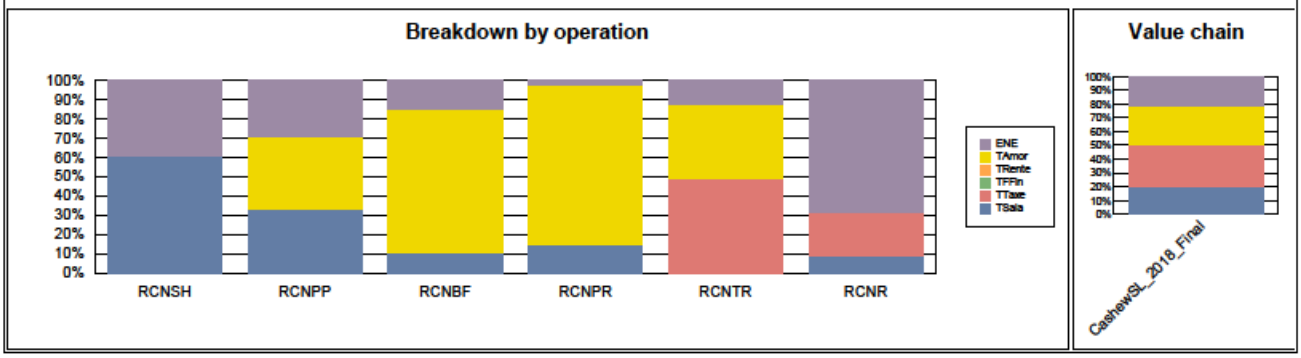
DISTRIBUTION

Opération	VA	Good	Service	Salary	Taxes	Financial costs	Rent and oth. Prop. inc.	Fixed capital cons.	Net Operating Surplus
RCNSH	31%	11%	0%	93%	0%	0%	0.00	0%	57%
RCNPP	3%	3%	0%	5%	0%	0%	0.00	4%	4%
RCNBF	1%	0%	0%	0%	0%	0%	0.00	3%	1%
RCNPR	1%	4%	0%	1%	0%	0%	0.00	4%	0%
RCNTR	63%	82%	0%	0%	100%	0%	0.00	89%	37%
RCNR	0%	0%	100%	0%	0%	0%	0.00	0%	1%
Value Chain	**100%**	**100%**	**100%**	**100%**	**100%**	**0%**	**0%**	**100%**	**100%**

AgriFood chain Analysis
Synthetic accounts (operations)

Value chain : CashewSL_2018_Final | Country : Africa | Curency : SLL | Year : 2018 | Summary : Final_Cashew SL

VALUE ADDED DISTRIBUTION



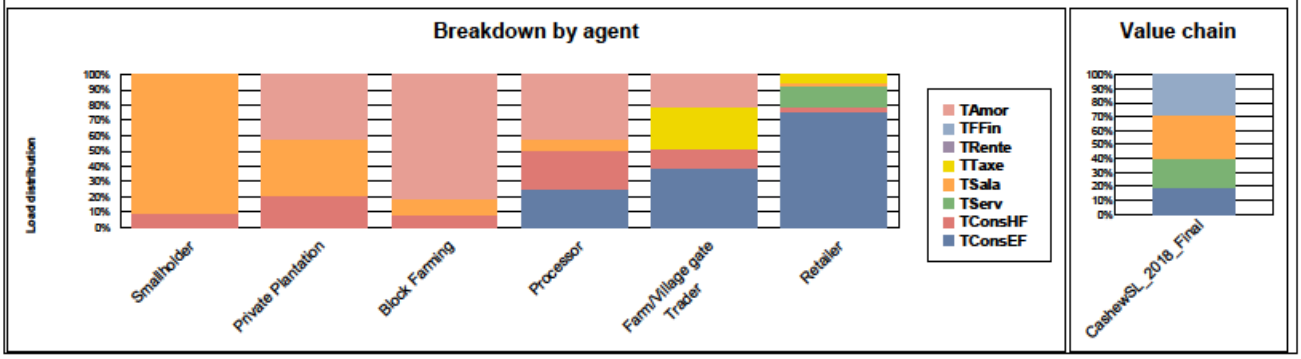
AgriFood chain Analysis
Synthetic accounts (agents)

Value chain : CashewSL_2018_Final | **Country : Africa** | **Curency : SLL** | **Year : 2018** | **Summary : Final_Cashew SL**

VALUES

Agent	Subsidy	Final output	Output in process	Input in process	Good	Service	Salary	Taxes	Financial costs	Rent and oth. Prop. Inc.	Fixed capital cons.	Net Operating Surplus	Volume output /input	Annual cap. per agent	Nbr of Agents
Smallholder	0	1384600	12461400	0	838672	0	7912000	0	0	0	0	5095328	3956001	300	13187
Private Plantation	0	0	1545500	0	245875	0	428525	0	0	0	491750	379350	281000	2 000	141
Block Farming	0	0	409500	0	27560	0	38400	0	0	0	285000	58540	63000	63 000	1
Processor	0	1211813	0	302075	300670	0	87391	0	0	0	505800	15877	395600	1 000	396
Farm/Village gate Trader	0	50580000	0	18208800	6322500	0	0	12645000	0	0	10116000	3287700	5058000	1 000	5058
Retailer	0	630000	0	409500	16632	73269	12000	28728	0	0	0	89871	63000	63 000	1
Value chain	**0**	**53806413**			**7751909**	**73269**	**8478316**	**12673728**	**0**	**0**	**11398550**	**8926666**			**18 783**

COST STRUCTURE



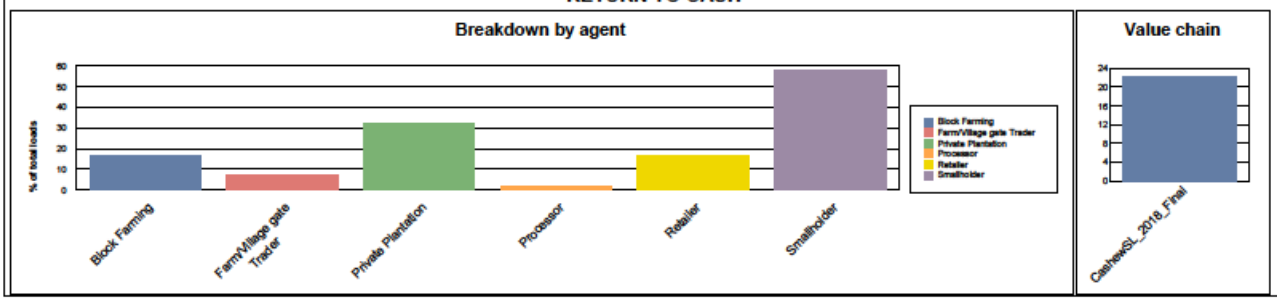
AgriFood chain Analysis
Synthetic accounts (agents)

Value chain : CashewSL_2018_Final | **Country : Africa** | **Curency : SLL** | **Year : 2018** | **Summary : Final_Cashew SL**

VALUE ADDED

Agent	Total income	Total intermediate consumption (TIC)	Value added (VA)	Salary / VA	Tax / VA	Financial cost / VA	Rent and oth. Prop. Inc./VA	Fixed capital/ VA	Net Operating Surplus / VA	Good+ Service / TIC	Subsidy/NOS	Return to cash	NOS per agent	NOS per Agent on VC average
Smallholder	13846000	838672	13007328	61%	0%	0%	0%	0%	39%	100%	0%	58%	386	0.81
Private Plantation	1545500	245875	1299625	33%	0%	0%	0%	38%	29%	100%	0%	33%	2 700	5.68
Block Farming	409500	27560	381940	10%	0%	0%	0%	75%	15%	100%	0%	17%	58 540	123.18
Processor	1211813	602745	609068	14%	0%	0%	0%	83%	3%	50%	0%	1%	40	0.08
Farm/Village gate Trader	50580000	24531300	26048700	0%	49%	0%	0%	39%	13%	26%	0%	7%	650	1.37
Retailer	630000	499401	130599	9%	22%	0%	0%	0%	69%	18%	0%	17%	89 871	189.11
Value chain	53 806 413	7 825 178	45 981 235	18%	28%	0%	0%	25%	19%	100%	0%	22%	475	1.00

RETURN TO CASH



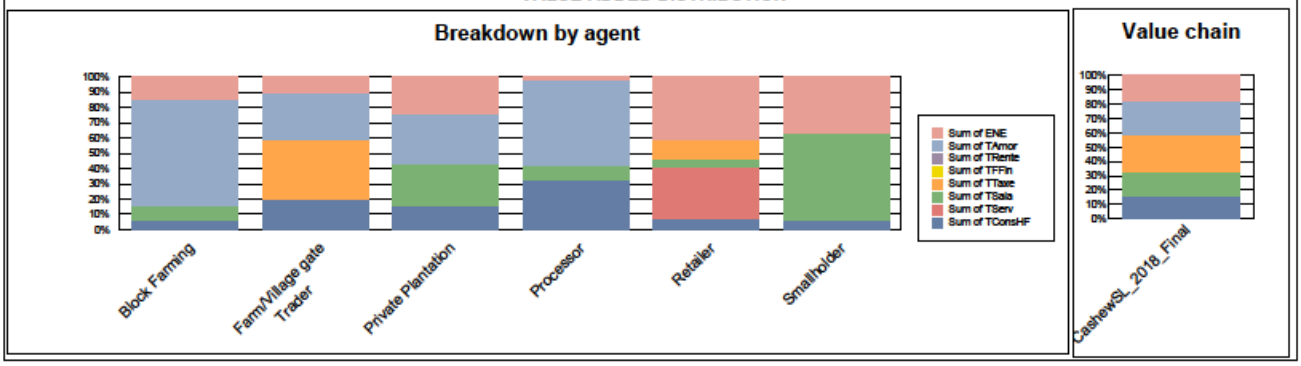
AgriFood chain Analysis
Synthetic accounts (agents)

Value chain : CashewSL_2018_Final | **Country : Africa** | **Curency : SLL** | **Year : 2018** | **Summary : Final_Cashew SL**

DISTRIBUTION

Agents	VA	Good	Service	Salary	Taxes	Financial cost	Rent and oth. Prop. Inc.	Fixed capital cons.	Net Operating Surplus
Private Plantation	3%	3%	0%	5%	0%	0%	0%	4%	4%
Smallholder	31%	11%	0%	93%	0%	0%	0%	0%	57%
Block Farming	1%	0%	0%	0%	0%	0%	0%	3%	1%
Processor	1%	4%	0%	1%	0%	0%	0%	4%	0%
Farm/Village gate Trader	63%	82%	0%	0%	100%	0%	0%	89%	37%
Retailer	0%	0%	100%	0%	0%	0%	0%	0%	1%
Chain	**100%**	**100%**	**100%**	**100%**	**100%**	**0%**	**0%**	**100%**	**100%**

VALUE ADDED DISTRIBUTION



AgriFood chain Analysis
Budget

Value chain : CashewSL_2018_Final **Country :Africa** **Curency :SLL** **Year : 2,018**

Agent : Smallholder

Operation : RCNSmallholders | Practice : Production | Location : Sierra Leone | Descriptive 2 :

Short name : RCNSH | Function : Primary production | Reference Space : Rural | Descriptive 1 :

Category	Wording	Quantities in units	Price in curency unit	VAT	Lifetime	Value	Use Ratio	Source	Observation
Production	RCNQ3	300.00 Kilogram	4 1000 S		0	10501000 S			
Subsidy									
Consumable	Agric Inputs	300.00 Kilogram	01000 S			641000 S	1.00		
Service									
Salary	Seasonal work	40.00 Day	151000 S			6001000 S	1.00		
Financial Cost									
Annuity									
Amortization									
Taxes									

AGGREGATES AND INDICATORS OF THE OPERATION

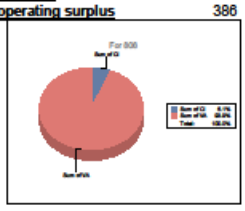
Resources

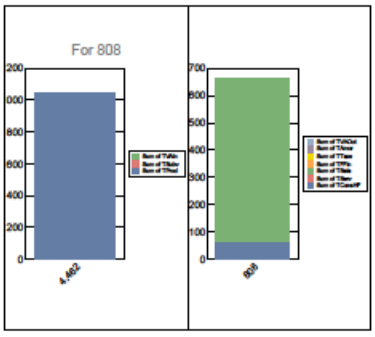
Production	1050
Subsidy	0
Annuity	0

Total Resource	1050
Total Uses	664
Total Intermediate Consumption	64
Value added	986
Net operating surplus	386

Uses

Consumable	64
Service	0
Salary	600
Financial Cost	0
Taxe	0
VAT to be repaid	0
VAT to be collected	0
Amortization	0





Indicators

Subsidy / TR =0.00
VA / TR =0.94
Salary / VA =0.61
Frais Financiers / VA =0.00

Taxe / VA =0.00
Amortization / VA =0.00
Ene / VA =0.39

ENE/Total expenses =0.64
Consumable/TR =0.06
Service/TR =0.00

Salary/TR =0.57
Frais Financier/TR=0.00

Amortization/TR=0.00
ENE/TR =0.37

AgriFood chain Analysis
Budget

Value chain : CashewSL_2018_Final **Country :Africa** **Curency :SLL** **Year : 2,018**

Agent : Private Plantation

Operation : RCNPP | Practice : Production | Location : Sierra Leone | Descriptive 2 :
Short name : RCNPP | Function : Primary production | Reference Space : Rural | Descriptive 1 :

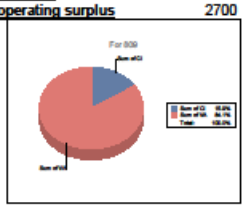
Category	Wording	Quantities in units	Price in curency unit	VAT	Lifetime	Value	Use Ratio	Source	Observation
Production	RCNQ2	2,000.00 Kilogram	61000 S	0		110001000 S			
Subsidy									
Consumable	Agric Inputs	2,000.00 Kilogram	01000 S			5001000 S	1.00		
	Fuel	500.00 Liter	31000 S			12501000 S	1.00		
Service									
Salary	Mandays	30.00 Day	151000 S			4501000 S	1.00		
	Nursery attendant	20.00 Day	301000 S			6001000 S	1.00		
	Supervisor	20.00 Day	501000 S			10001000 S	1.00		
	Attendants	2.00 Unitairy	5001000 S			10001000 S	1.00		
Financial Cost									
Annuity									
Amortization	Tractor		15,000.001000 S			3,000.001000 S			
	Machinery		500.001000 S			500.001000 S			
Taxes									

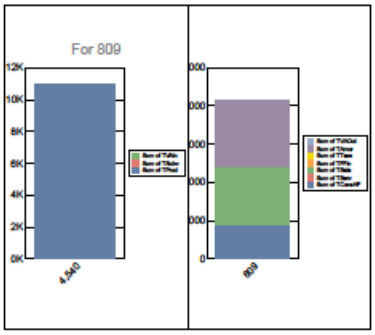
AgriFood chain Analysis
Budget

Value chain : CashewSL_2018_Final **Country :Africa** **Curency :SLL** **Year : 2,018**

AGGREGATES AND INDICATORS OF THE OPERATION

Resources			
Production	11000	**Total Resource**	11000
Subsidy	0	**Total Uses**	8300
Annuity	0		
		Total Intermediate Consumption	1750
		Value added	9250
Uses		**Net operating surplus**	2700
Consumable	1750		
Service	0		
Salary	3050		
Financial Cost	0		
Taxe	0		
VAT to be repaid	0		
VAT to be collected	0		
Amortization	3500		





Indicators

Subsidy / TR =0.00
VA / TR =0.84
Salary / VA =0.33
Frais Financiers / VA =0.00

Taxe / VA =0.00
Amortization / VA =0.38
Ene / VA =0.29

ENE/Total expenses =0.41
Consumable/TR =0.16
Service/TR =0.00

Salary/TR =0.28
Frais Financier/TR=0.00

Amortization/TR=0.32
ENE/TR =0.25

AgriFood chain Analysis
Budget

Value chain : CashewSL_2018_Final **Country :Africa** **Curency :SLL** **Year : 2,018**

Agent : Block Farming

Operation : RCNBF | Practice : Production | Location : Sierra Leone | Descriptive 2 :
Short name : RCNBF | Function : Primary production | Reference Space : Rural | Descriptive 1 :

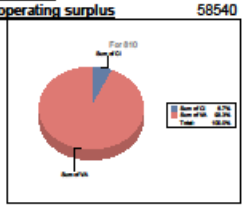
Category	Wording	Quantities in units	Price in curency unit	VAT	Lifetime	Value	Use Ratio	Source	Observation
Production	RCNQ1	63,000.00 Kilogra	7 1000 S		0	4095001000 S			
Subsidy									
Consumable	Agric Inputs	63,000.00 Kilogra	01000 S			189001000 S	1.00		
	Fuel	2,000.00 Liter	41000 S			86601000 S	1.00		
Service									
Salary	Mandays	240.00 Day	151000 S			36001000 S	1.00		
	Nursery Supervisor	60.00 Day	301000 S			18001000 S	1.00		
	Supervisor	60.00 Day	501000 S			30001000 S	1.00		
	Attendants	60.00 Unitairy	5001000 S			300001000 S	1.00		
Financial Cost									
Annuity	Land		0.001000 SL			0.001000 SLI			
Amortization	Tractors		30,000.001000 S			180,000.001000 S			
	Machinery		500.001000 S			5,000.001000 S			
	Land		10,000.001000 S			100,000.001000 S			
Taxes									

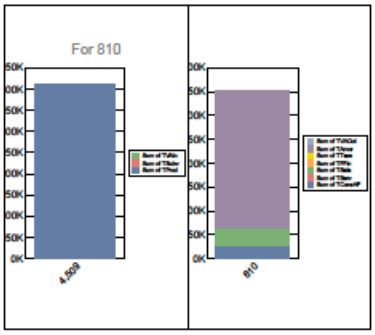
AgriFood chain Analysis
Budget

Value chain : CashewSL_2018_Final **Country :Africa** **Curency :SLL** **Year : 2,018**

AGGREGATES AND INDICATORS OF THE OPERATION

Resources			
Production	409500	**Total Resource**	409500
Subsidy	0	**Total Uses**	350960
Annuity	0		
		Total Intermediate Consumption	27560
		Value added	381940
Uses		**Net operating surplus**	58540
Consumable	27560		
Service	0		
Salary	38400		
Financial Cost	0		
Taxe	0		
VAT to be repaid	0		
VAT to be collected	0		
Amortization	285000		





Indicators

Subsidy / TR =0.00
VA / TR =0.93
Salary / VA =0.10
Frais Financiers / VA =0.00

Taxe / VA =0.00
Amortization / VA =0.75
Ene / VA =0.15

ENE/Total expenses =0.18
Consumable/TR =0.07
Service/TR =0.00

Salary/TR =0.09
Frais Financier/TR=0.00

Amortization/TR=0.70
ENE/TR =0.14

AgriFood chain Analysis
Budget

Value chain : CashewSL_2018_Final **Country :Africa** **Curency :SLL** **Year : 2,018**

Agent : Processor

Operation : RCNPro | Practice : Processing | Location : Sierra Leone | Descriptive 2 :
Short name : RCNPR | Function : Transformation | Reference Space : Rural | Descriptive 1 :

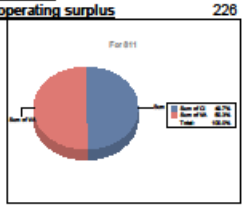
Category	Wording	Quantities in units	Price in curency unit	VAT	Lifetime	Value	Use Ratio	Source	Observation
Production	Kernels	750.00 Kilogram	231000 S		0	172501000 S			
Subsidy									
Consumable	Packaging material	750.00 Unitairy	11000 S			7501000 S	1.00		
	Pot	300.00 Unitairy	01000 S			301000 S	1.00		
	RCNQ2	400.00 Kilogram	61000 S			22001000 S	1.00		
	RCNQ3	600.00 Kilogram	41000 S			21001000 S	1.00		
	Sealing machine	3.00 Unitairy	5001000 S			15001000 S	1.00		
	Trays	20.00 Unitairy	451000 S			9001000 S	1.00		
	Vegetable oil	134.00 Liter	51000 S			6701000 S	1.00		
	Wheat Flower	100.00 Kilogram	41000 S			4301000 S	1.00		
Service									
Salary	Wage	1,000.00 Kilogram	21000 S			12441000 S	1.00		
Financial Cost									
Annuity									
Amortization	Computer		1,500.001000 S			1,000.001000 S			
	Trycicle		15,000.001000 S			6,000.001000 S			
	Colman		500.001000 S			200.001000 S			
Taxes									

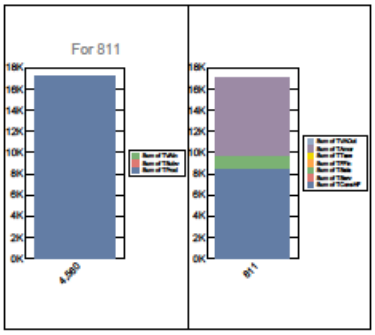
AgriFood chain Analysis
Budget

Value chain : CashewSL_2018_Final **Country :Africa** **Curency :SLL** **Year : 2,018**

AGGREGATES AND INDICATORS OF THE OPERATION

Resources			
Production	17250	**Total Resource**	17250
Subsidy	0	**Total Uses**	17024
Annuity	0		
		Total Intermediate Consumption	8580
		Value added	8670
Uses		**Net operating surplus**	226
Consumable	8580		
Service	0		
Salary	1244		
Financial Cost	0		
Taxe	0		
VAT to be repaid	0		
VAT to be collected	0		
Amortization	7200		





Indicators

Subsidy / TR =0.00
VA / TR =0.50
Salary / VA =0.14
Frais Financiers / VA =0.00

Taxe / VA =0.00
Amortization / VA =0.83
Ene / VA =0.03

ENE/Total expenses =0.03
Consumable/TR =0.50
Service/TR =0.00

Salary/TR =0.07
Frais Financier/TR=0.00

Amortization/TR=0.42
ENE/TR =0.01

AgriFood chain Analysis
Budget

Value chain : CashewSL_2018_Final | **Country :Africa** | **Curency :SLL** | **Year : 2,018**

Agent : Farm/Village gate Trader

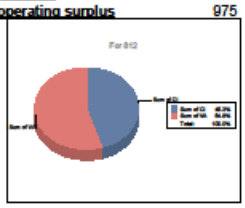
Operation : RCNFVTrade | Practice : Trade | Location : Sierra Leone | Descriptive 2 :
Short name : RCNTR | Function : Trade | Reference Space : Rural | Descriptive 1 :

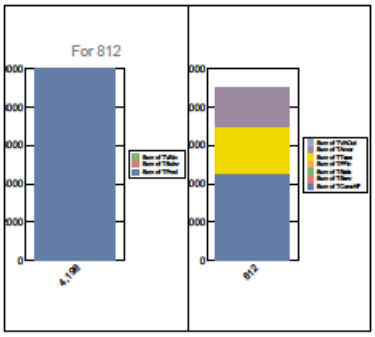
Category	Wording	Quantities in units	Price in curency unit	VAT	Lifetime	Value	Use Ratio	Source	Observation
Production	RCN	1,000.00 Kilogram	10 1000 S	0		100001000 S			
Subsidy									
Consumable	Fuel	500.00 Liter	31000 S			12501000 S	1.00		
	RCNQ2	50.00 Kilogram	61000 S			2751000 S	1.00		
	RCNQ3	950.00 Kilogram	41000 S			33251000 S	1.00		
Service									
Salary									
Financial Cost									
Annuity									
Amortization	Motorcycle		10,000.001000 S			2,000.001000 S			
Taxes	Informal Taxes		1000 S			25001000 S	1.00		

AGGREGATES AND INDICATORS OF THE OPERATION

Resources

Production	10000	**Total Resource**	10000
Subsidy	0	**Total Uses**	9025
Annuity	0		
		Total Intermediate Consumption	4525
		Value added	5475
Uses		**Net operating surplus**	975
Consumable	4525		
Service	0		
Salary	0		
Financial Cost	0		
Taxe	2500		
VAT to be repaid	0		
VAT to be collected	0		
Amortization	2000		





Indicators

Subsidy / TR =0.00
VA / TR =0.55
Salary / VA =0.00
Frais Financiers / VA =0.00

Taxe / VA =0.46
Amortization / VA =0.37
Ene / VA =0.18

ENE/Total expenses =0.22
Consumable/TR =0.45
Service/TR =0.00

Salary/TR =0.00
Frais Financier/TR=0.00

Amortization/TR=0.20
ENE/TR =0.10

AgriFood chain Analysis
Budget

Value chain : CashewSL_2018_Final **Country :Africa** **Curency :SLL** **Year : 2,018**

Agent : Retailer

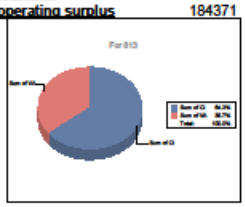
Operation : RCNR Practice : Trade Location : Sierra Leone Descriptive 2 :
Short name : RCNR Function : Trade Reference Space : Rural Descriptive 1 :

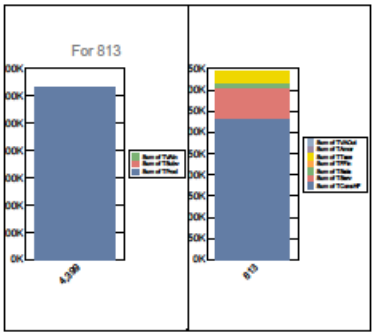
Category	Wording	Quantities in units	Price in curency unit	VAT	Lifetime	Value	Use Ratio	Source	Observation
Production	RCN	63,000.00 Kilogra	10 1000 S	0		6300001000 S			
Subsidy									
Consumable	Bags	63,000.00 Unitairy	01000 S			166321000 S	1.00		
	RCNQ1	63,000.00 Kilogra	71000 S			4095001000 S	1.00		
Service	Transportation	63,000.00 Kilogra	11000 S			732691000 S	1.00		
Salary	Supervisor	20.00 Unitairy	6001000 S			120001000 S	1.00		
Financial Cost									
Annuity									
Amortization									
Taxes	District Evacuation Fe		1000 S			24571000 S	1.00		
	Buying Officer Fees		1000 S			166321000 S	1.00		
	Tax		1000 S			96391000 S	1.00		

AGGREGATES AND INDICATORS OF THE OPERATION

Resources

Production	630000	**Total Resource**	630000
Subsidy	0	**Total Uses**	445629
Annuity	0		
		Total Intermediate Consumption	404901
		Value added	225099
Uses		**Net operating surplus**	184371
Consumable	331632		
Service	73269		
Salary	12000		
Financial Cost	0		
Taxe	28728		
VAT to be repaid	0		
VAT to be collected	0		
Amortization	0		





Indicators

Subsidy / TR =0.00
VA / TR =0.36
Salary / VA =0.05
Frais Financiers / VA =0.00

Taxe / VA =0.13
Amortization / VA =0.00
Ene / VA =0.82

ENE/Total expenses =4.53
Consumable/TR =0.53
Service/TR =0.12

Salary/TR =0.02
Frais Financier/TR=0.00

Amortization/TR=0.00
ENE/TR =0.29

AgriFood chain Analysis
Budget

Value chain : CashewSL_2018_Final **Country :Africa** **Curency :SLL** **Year : 2,018**

Agent : Official exporter

Operation : OfExporter | Practice : Exports | Location : | Descriptive 2 :
Short name : RCNEx | Function : End Use | Reference Space : Secondary center | Descriptive 1 :

Category	Wording	Quantities in units	Price in curency unit	VAT	Lifetime	Value	Use Ratio	Source	Observation
Production	RCN	63,000.00 Kilogra	14 1000 S		0	9032941000 S			
Subsidy									
Consumable	RCN	63,000.00 Kilogra	101000 S			6300001000 S	1.00		
Service									
Salary									
Financial Cost									
Annuity									
Amortization									
Taxes	Export Charges		1000 S			976501000 S	1.00		

AGGREGATES AND INDICATORS OF THE OPERATION

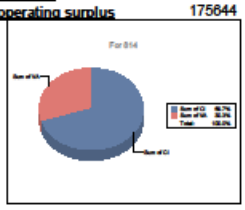
Resources

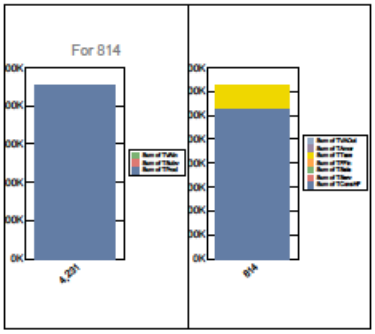
Production	903294
Subsidy	0
Annuity	0

Total Resource	903294
Total Uses	727650
Total Intermediate Consumption	630000
Value added	273294
Net operating surplus	175644

Uses

Consumable	630000
Service	0
Salary	0
Financial Cost	0
Taxe	97650
VAT to be repaid	0
VAT to be collected	0
Amortization	0





Indicators

Subsidy / TR =0.00
VA / TR =0.30
Salary / VA =0.00
Frais Financiers / VA =0.00

Taxe / VA =0.36
Amortization / VA =0.00
Ene / VA =0.64

ENE/Total expenses =1.80
Consumable/TR =0.70
Service/TR =0.00

Salary/TR =0.00
Frais Financier/TR=0.00

Amortization/TR=0.00
ENE/TR =0.19

AgriFood chain Analysis
Budget

Value chain : CashewSL_2018_Final **Country :Africa** **Curency :SLL** **Year : 2,018**

Agent : RCN Selfcons

Operation : RCNSelfCons Practice : Location : Descriptive 2 :
Short name : RCNSF Function : End Use Reference Space : Descriptive 1 :

Category	Wording	Quantities in units	Price in curency unit	VAT	Lifetime	Value	Use Ratio	Source	Observation
Production	RCN	30.00 Kilogram	41000 S	0		1051000 S			
Subsidy									
Consumable	RCNQ3	30.00 Kilogram	41000 S			1051000 S	1.00		
Service									
Salary									
Financial Cost									
Annuity									
Amortization									
Taxes									

AGGREGATES AND INDICATORS OF THE OPERATION

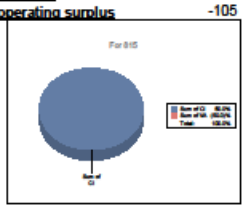
Resources
Production 0
Subsidy 0
Annuity 0

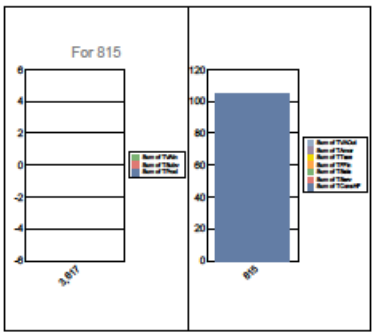
Total Resource 0
Total Uses 105

Total Intermediate Consumption 105
Value added -105
Net operating surplus -105

Uses
Consumable 105
Service 0
Salary 0
Financial Cost 0
Taxe 0
VAT to be repaid 0
VAT to be collected 0

Amortization 0





Indicators
Subsidy / TR =0.00
VA / TR =0.00
Salary / VA =0.00
Frais Financiers / VA =0.00

Taxe / VA =0.00
Amortization / VA =0.00
Ene / VA =1.00

ENE/Total expenses =0.00
Consumable/TR =0.00
Service/TR =0.00

Salary/TR =0.00
Frais Financier/TR=0.00

Amortization/TR=0.00
ENE/TR =0.00

F

AgriFood chain Analysis
Budget

Value chain : CashewSL_2018_Final **Country :Africa** **Curency :SLL** **Year : 2,018**

Agent : Kernels Selfcons

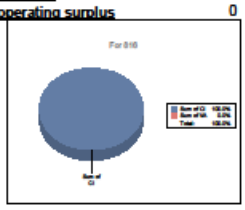
Operation : KernelsSF | Practice : | Location : | Descriptive 2 :
Short name : KSF | Function : End Use | Reference Space : | Descriptive 1 :

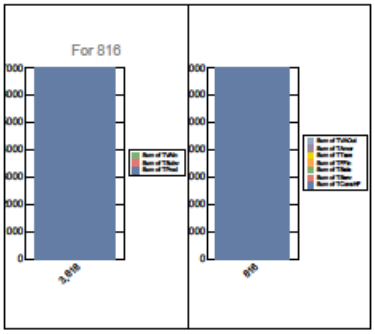
Category	Wording	Quantities in units	Price in curency unit	VAT	Lifetime	Value	Use Ratio	Source	Observation
Production	KSF	750.00 Kilogram	231000 S		0	172501000 S			
Subsidy									
Consumable	Kernels	750.00 Kilogram	231000 S			172501000 S	1.00		
Service									
Salary									
Financial Cost									
Annuity									
Amortization									
Taxes									

AGGREGATES AND INDICATORS OF THE OPERATION

Resources

Production	7000	**Total Resource**	7000
Subsidy	0	**Total Uses**	7000
Annuity	0		
		Total Intermediate Consumption	7000
		Value added	0
Uses		**Net operating surplus**	0
Consumable	7000		
Service	0		
Salary	0		
Financial Cost	0		
Taxe	0		
VAT to be repaid	0		
VAT to be collected	0		
Amortization	0		





Indicators

Subsidy / TR =0.00
VA / TR =0.00
Salary / VA =0.00
Frais Financiers / VA =0.00

Taxe / VA =0.00
Amortization / VA =0.00
Ene / VA =0.00

ENE/Total expenses =0.00
Consumable/TR =1.00
Service/TR =0.00

Salary/TR =0.00
Frais Financier/TR=0.00

Amortization/TR=0.00
ENE/TR =0.00

AgriFood chain Analysis
Budget

Value chain : CashewSL_2018_Final **Country :Africa** **Curency :SLL** **Year : 2,018**

Agent : Unofficial Transbordary Trader

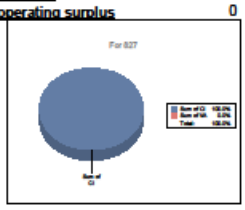
Operation : RCNUnOTr Practice : Location : Descriptive 2 :
Short name : RCNUO Function : End Use Reference Space : Rural Descriptive 1 :

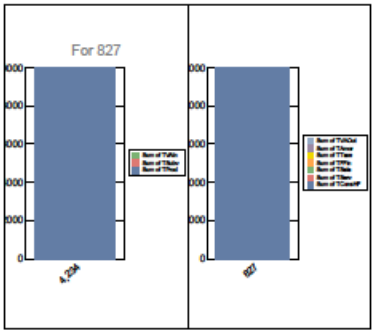
Category	Wording	Quantities in units	Price in curency unit	VAT	Lifetime	Value	Use Ratio	Source	Observation
Production	RCN	1,000.00 Kilogram	10 1000 S		0	100001000 S			
Subsidy									
Consumable	RCN	1,000.00 Kilogram	101000 S			100001000 S	1.00		
Service									
Salary									
Financial Cost									
Annuity									
Amortization									
Taxes									

AGGREGATES AND INDICATORS OF THE OPERATION

Resources

Production	10000	**Total Resource**	10000
Subsidy	0	**Total Uses**	10000
Annuity	0		
		Total Intermediate Consumption	10000
		Value added	0
Uses		**Net operating surplus**	0
Consumable	10000		
Service	0		
Salary	0		
Financial Cost	0		
Taxe	0		
VAT to be repaid	0		
VAT to be collected	0		
Amortization	0		





Indicators

Subsidy / TR =0.00
VA / TR =0.00
Salary / VA =0.00
Frais Financiers / VA =0.00

Taxe / VA =0.00
Amortization / VA =0.00
Ene / VA =0.00

ENE/Total expenses =0.00
Consumable/TR =1.00
Service/TR =0.00

Salary/TR =0.00
Frais Financier/TR=0.00

Amortization/TR=0.00
ENE/TR =0.00

AgriFood chain Analysis
Comparative advantages

Value chain : CashewSL_2018_Final **Country : Africa** **Curency : SLL** **Year : 2018**

Category	Item	Life time	Balance	Exchangeable	Labor	Capital	Control	Txv	Term	Prm	Cim	Trm	Cam	Prs	Cls	Trs	Cas
1-Fixed cost	Computer	3	70250	0.80	0.10	0.10	Ok	0.00	0.00		56200	7025	8435		65357	7427	8917
1-Fixed cost	Land	30	100000	0.01	0.00	0.00	Error	0.00	0.00		1000	0	115244		141	0	2085
1-Fixed cost	Machinery	2	75250	0.80	0.10	0.10	Ok	0.00	0.00		60200	7525	8656		70382	7998	9200
1-Fixed cost	Motorcycle	5	10116000	0.80	0.10	0.10	Ok	0.00	0.00		8092800	1011600	1317093		9312153	1058199	1377765
1-Fixed cost	Tractor	5	421500	0.80	0.10	0.10	Ok	0.00	0.00		337200	42150	54879		388006	44092	57407
1-Fixed cost	Tractors	5	180000	0.80	0.10	0.10	Ok	0.00	0.00		144000	18000	23436		165697	18829	24515
1-Fixed cost	Trycicle	5	421500	0.80	0.10	0.10	Ok	0.00	0.00		337200	42150	54879		388006	44092	57407
1-Fixed cost	Colman	5	14050	0.80	0.10	0.10	Ok	0.00	0.00		11240	1405	1829		12934	1470	1914
2-Tradable input	Trays	0	63225	0.80	0.10	0.10	Ok	0.00	0.00		50580	6323	6323		55638	6323	6323
2-Tradable input	Agric Inputs	0	927822	0.70	0.20	0.10	Ok	0.00	0.00		649475	185564	92782		714423	185564	92782
2-Tradable input	Bags	0	16632	1.00	0.00	0.00	Ok	0.00	0.00		16632	0	0		18295	0	0
2-Tradable input	Fuel	0	6506785	0.90	0.05	0.05	Ok	0.00	0.00		5856107	325339	325339		6441717	325339	325339
2-Tradable input	Packaging material	0	52688	0.80	0.10	0.10	Ok	0.00	0.00		42150	5269	5269		46365	5269	5269
2-Tradable input	Sealing machine	0	105375	0.80	0.10	0.10	Ok	0.00	0.00		84300	10538	10538		92730	10538	10538
2-Tradable input	Vegetable oil	0	47068	1.00	0.00	0.00	Ok	0.00	0.00		47068	0	0		51774	0	0
2-Tradable input	Wheat Flower	0	30208	1.00	0.00	0.00	Ok	0.00	0.00		30208	0	0		33228	0	0
2-Tradable input	Pot	0	2108	1.00	0.00	0.00	Ok	0.00	0.00		2108	0	0		2318	0	0
3-Service	Transportation	0	73269	0.50	0.20	0.30	Ok	0.00	0.00		36635	14654	21981		40298	14654	21981
4-Tradable output	Kernels	0	1211813	1.00	0.00	0.00	Ok	0.00	0.00	1211813	0	0	0	211 813	0	0	0
4-Tradable output	RCN	0	51210000	1.00	0.00	0.00	Ok	0.00	0.00	51210000	0	0	0	210 000	0	0	0
4-Tradable output	RCNQ3	0	1384600	1.00	0.00	0.00	Ok	0.00	0.00	1384600	0	0	0	384 600	0	0	0
5-Salary	Attendants	0	170500	0.00	0.00	0.00	Error	0.00	0.00		0	0	0		0	0	0
5-Salary	Mandays	0	66825	0.00	0.00	0.00	Error	0.00	0.00		0	0	0		0	0	0
5-Salary	Nursery attendant	0	84300	0.00	0.00	0.00	Error	0.00	0.00		0	0	0		0	0	0
5-Salary	Nursery Supervisor	0	1800	0.00	0.00	0.00	Error	0.00	0.00		0	0	0		0	0	0
5-Salary	Seasonal work	0	7912000	0.00	0.00	0.00	Error	0.00	0.00		0	0	0		0	0	0
5-Salary	Supervisor	0	155500	0.00	0.00	0.00	Error	0.00	0.00		0	0	0		0	0	0
5-Salary	Wage	0	87391	0.00	0.00	0.00	Error	0.00	0.00		0	0	0		0	0	0
Intermediate Totals									0.00	53806413	15855101	1677541	2046681	53806413	17899463	1729792	2001440

	Tradable output	Tradable input	Labor	Capital	Net income
Market price	53806413	28528829	1677541	2046681	21553361
Reference price	53806413	17899463	1729792	2001440	32175718
Transfer	0	10629366	-52251	45241	-10622356

Financial Cost-Benefit Ratio	0.081
Dometic Ressource Cost	0.104
Social Cost-Benefit Ratio	0.365
Nominal Protection Coefficient	1.000
Effective Protection Coefficient	0.704
Profitability coefficient	0.670
Producer subsidy ratio	-0.197
Equivalent producer subsidy	-20%

CIRAD-AFA-2017

Full contribution analyses of midpoint indicators from the environmental assessment

8.6.1 National exportation system

Midpoint indicator results for the national exportation system are presented in Figure 76.

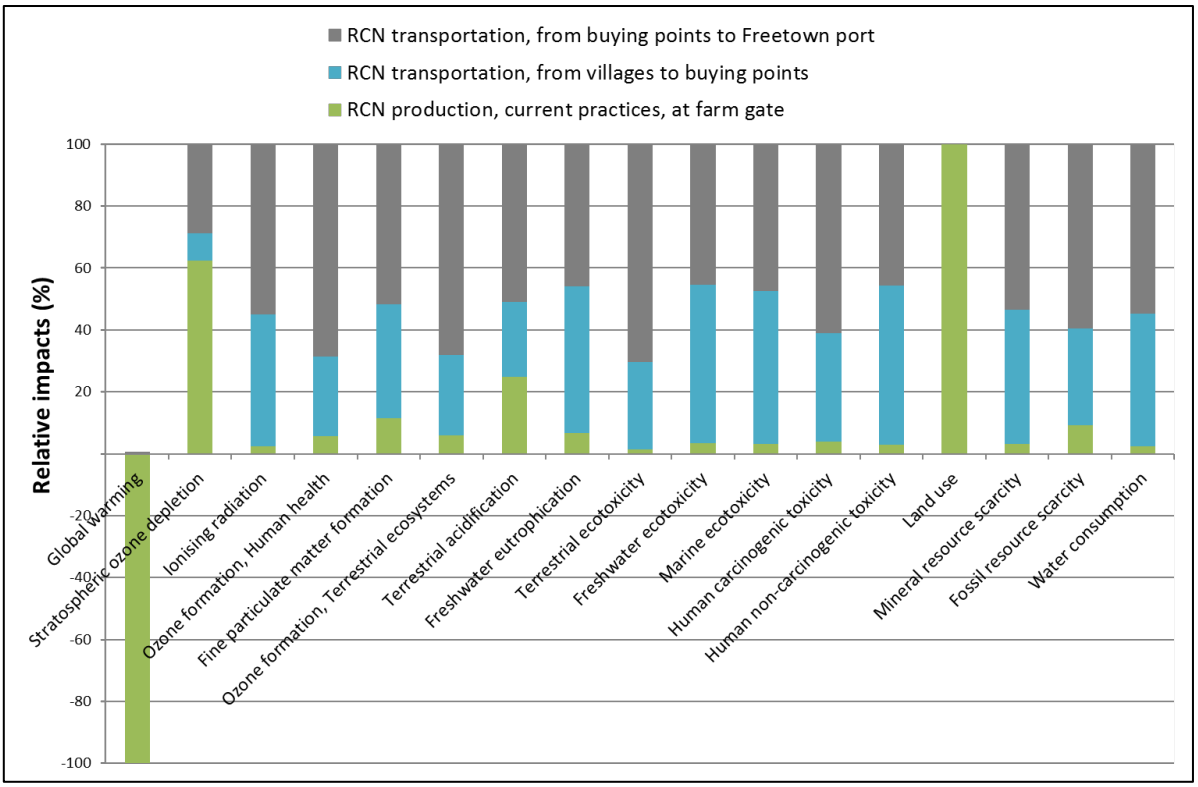


FIGURE 76: MIDPOINT IMPACTS OF THE NATIONAL EXPORTATION SYSTEM (RECIPE2016 LCIA METHOD)

Cashew cultivation is the main contributor for three impact categories: global warming, land use, and stratospheric ozone depletion. Among these three categories, the global warming indicator is particular since the result is negative, meaning that the value chain presents an environmental benefit. This benefit is due to the land use change from bushland to cashew plantations, which involves a carbon storage. Overall, the greenhouse gas emissions due to the value chain represent less than 1% of the carbon storage benefit.

Conversely, cashew cultivation is also responsible for the potential biodiversity losses arising from land use. Among these potential losses, 85% come from land occupation, and 15% from bushland conversion. Regarding stratospheric ozone depletion, 92% of the total impact is due to N_2O emissions, which mainly come from compost used in cashew seedling nurseries.

For all other impact categories, cashew cultivation only contributes from 1% to 25% of the results, and RCN transportation is then the main contributor. Among transportation steps, RCN transportation from buying points to Freetown port is generally the main contributor, representing from 47% to 76% of the impacts, depending on impact categories.

8.6.2 National consumption system based on artisanal processing

Midpoint indicator results for the national consumption system based on artisanal processing are presented in Figure 77.

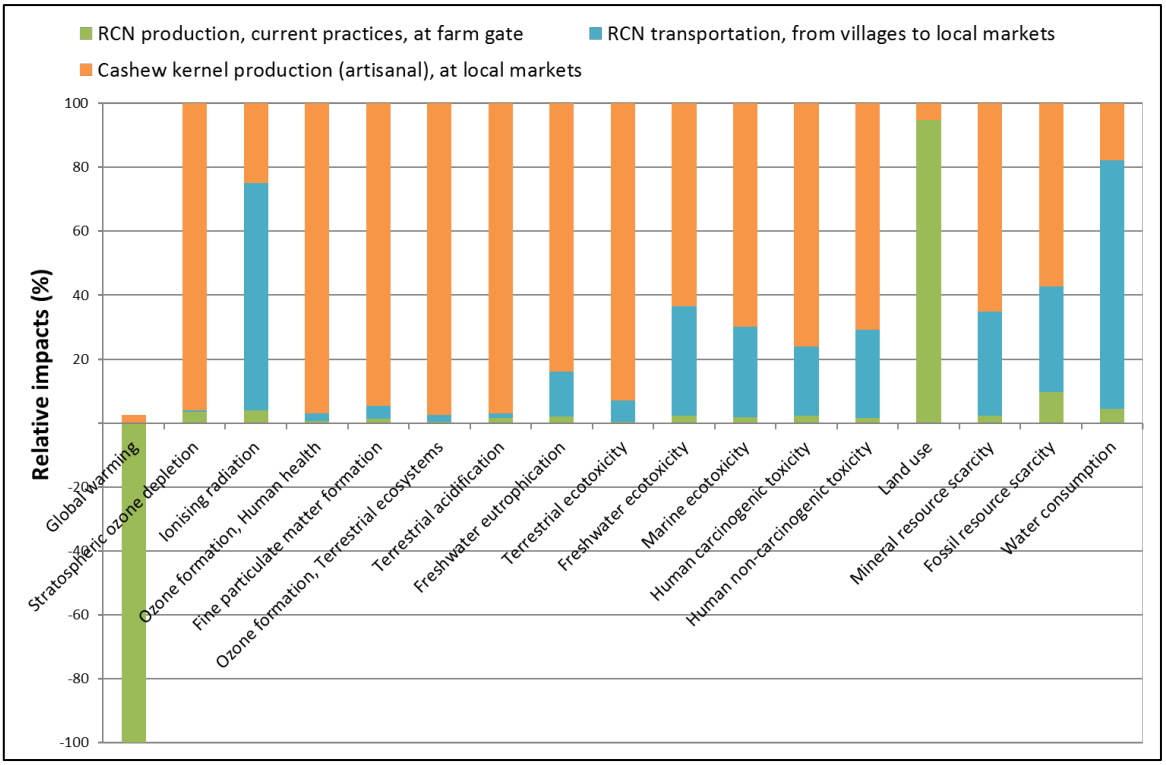


FIGURE 77: MIDPOINT IMPACTS OF THE NATIONAL CONSUMPTION SYSTEM BASED ON ARTISANAL PROCESSING (RECIPE2016 LCIA METHOD)

As for the national exportation system, cashew cultivation is the main contributor to global warming and land use impacts, for the same reasons. RCN transportation is the main contributor to ionising radiation and water consumption impacts, due to background processes related to electricity production: nuclear power plants for ionising radiation, and hydropower plants for water consumption.

Then, for all other impact categories, artisanal production of cashew kernels is the main contributor. Details on kernel production impacts are presented in Figure 78. RCN roasting is the main source of impacts, due to the use of crude palm oil and charcoal. Recovery of CNS by-products as a fuel generally contributes to the mitigation of some impacts, but to a lesser extent than the contribution of charcoal production and use. In some cases, related to freshwater and marine ecotoxicity and human toxicity, CNS recovery even contributes to impacts, because of the phenolic compounds present in greater quantities in the combustion smoke from CNS than from fuelwood or charcoal.

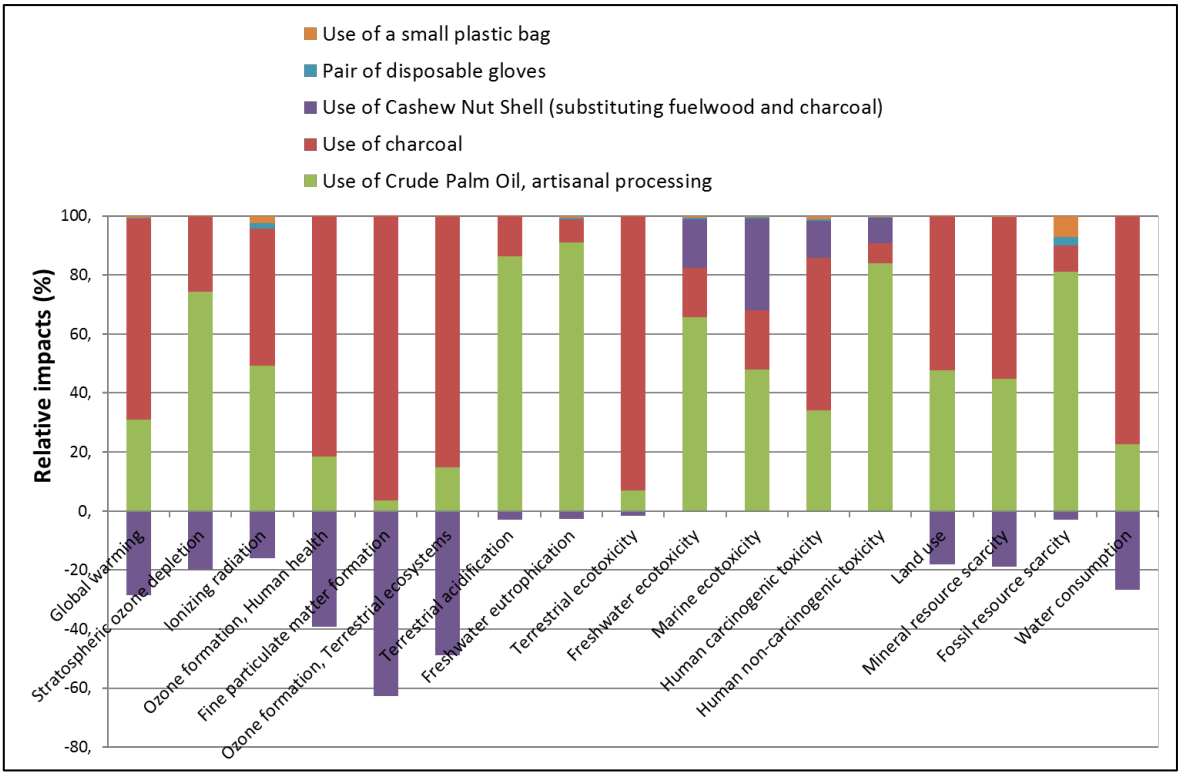


FIGURE 78: MIDPOINT IMPACTS OF ARTISANAL CASHEW KERNEL PRODUCTION (RECIPE2016 LCIA METHOD)

8.6.3 National consumption system based on semi-industrial processing

Midpoint indicator results for the national consumption system based on semi-industrial processing are presented in Figure 79. As for previous systems, cashew cultivation dominates global warming and land use impact categories.

Semi-industrial production of cashew kernels is the main contributor in the following impact categories: stratospheric ozone depletion, ozone formation, fine particulate matter formation, terrestrial acidification, terrestrial ecotoxicity, and human carcinogenic toxicity. For all these impact categories, emissions from CNS combustion are the main source of the impacts of cashew kernel production, representing between 60% and 95% of the impact results.

In all other impact categories, transportation steps of RCN or cashew kernels contribute either as much or more than RCN processing. Among transportation steps, impacts are quite evenly distributed between RCN transportation and cashew kernel transportation.

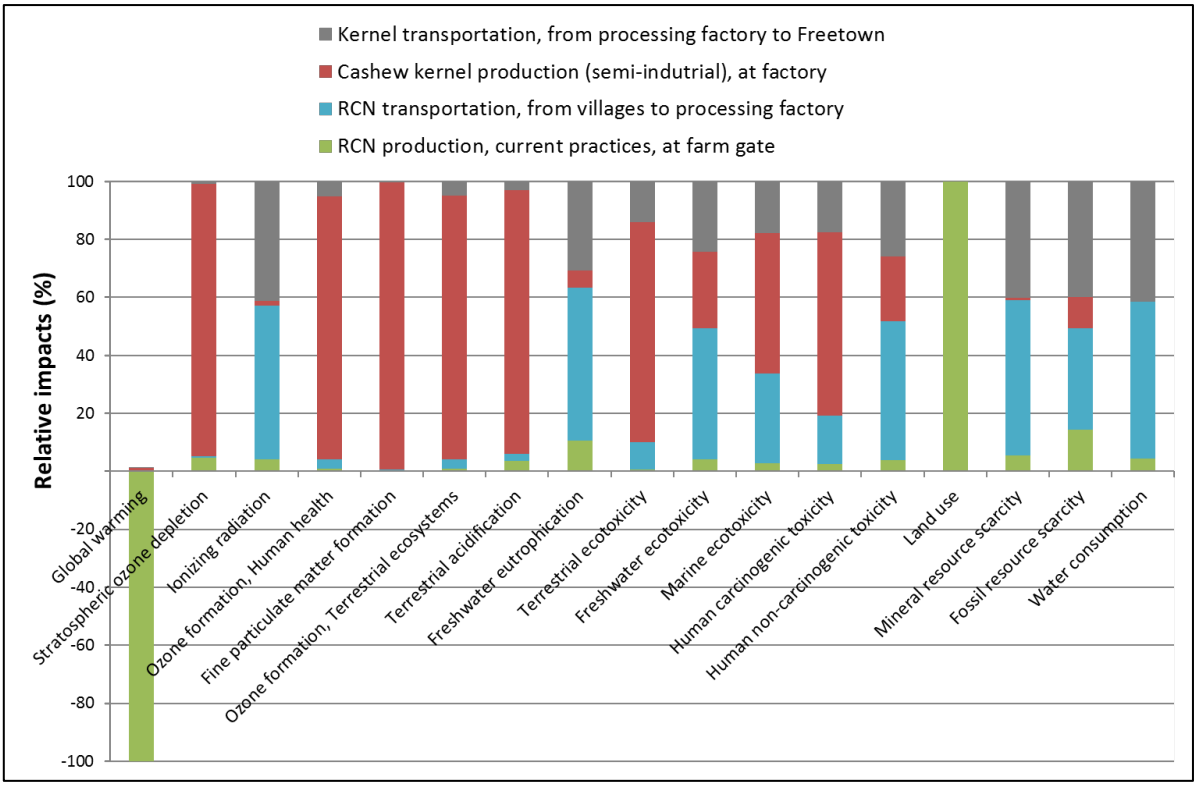


FIGURE 79: MIDPOINT IMPACTS OF THE NATIONAL CONSUMPTION SYSTEM BASED ON SEMI-INDUSTRIAL PROCESSING (RECIPE2016 LCIA METHOD)