Paper for the VCA4D Conference: **Value Chain Analysis for Development: providing evidence for better policies and operations in agricultural value chains**

18-19 January 2023

PATHWAYS FOR REDUCING THE SMALLHOLDER LIVING INCOME GAP IN AGRICULTURAL VALUE CHAINS

Ruerd Ruben[1] and Yuca Waarts[2]

[1] Wageningen University & Research (WUR), Wageningen, The Netherlands

[2] Wageningen Economic Research (WEcR), Wageningen, The Netherlands

The paper was produced through the financial support of the European Union (VCA4D CTR 2017/392-416). Its content is the sole responsibility of its authors and does not necessarily reflect the views of the European Union nor of the VCA4D project.

Abstract

Poverty reduction through rural development can be supported by the engagement of smallholders in commercial value chains that are based on rewarding market prices for the creation of inclusive rural livelihoods. It is increasingly acknowledged that engagement in cash crop activities by smallholder farmers (and rural workers) meets several structural constraints for guaranteeing farmer welfare and food and nutrition security.

In this paper we assess the net incomes of smallholder farmers in eight specific agricultural VCs in seven Sub-Saharan countries and their contributions for guaranteeing living income conditions as well as other household welfare goals. We look at potential strategies focussing on (technological) yield improvements, area expansion, better output prices (increasing margins) and/or engagement in off-farm employment as strategic pathways for supporting further rural poverty reduction.

Our study relies on an analytical framework for deriving the living income gap for family farms engaged in specific commercial commodity chains, using a stylized income analysis framework that combines information on cropping area, yield and production with data on prices, wages, profits and production costs, making assumptions for the share of land and labour required for their production. This framework is used to assess how the current income gaps could be reduced. We identify four specific pathways for land-constrained, yield-constrained, price-constrained and labour-constrained smallholders.

We find that almost all smallholder farmers face binding land constraints. Strategies for reducing the existing yield gaps and increasing the output price have considerable potential for reducing the living income gap. Value chains that are strongly market-oriented have more options available for overcoming income constraints. In addition, in some cases outside options for engagement in off-farm work provide viable additional income opportunities.

We outline some major consequences of living income gaps for household nutrition, for gender disparities and for the constraints to adoption of innovation. Finally, we discuss implication for selection appropriate policy instruments for reducing the living income gap by enhancing access to resources and information or through market- or institutional reforms.

Keywords*: Living Income; Yields; Prices; Farm Size; Labour Markets*

1. Introduction

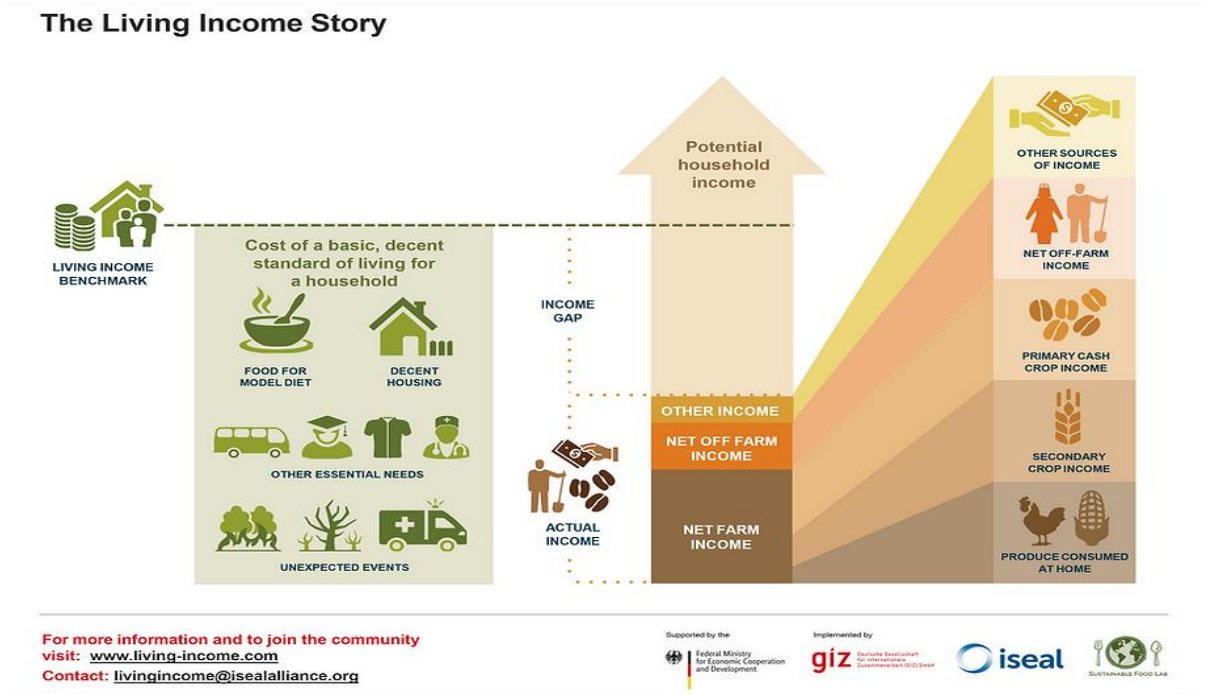
Strategies towards more inclusive rural development aim to identify feasible pathways for improving smallholder farm-household income. Most attention is usually given to opportunities for either improving the resource base or strengthening the bargaining position of rural farmers. Since rural households strongly depend on agriculture for their livelihoods, investments for increasing land productivity or labour remuneration are critically important.

Main determinants of agricultural income among smallholder farmers are the farm size (land quality and cultivated area), the family size (labour supply) and agricultural returns (yield and prices). Many farmers are engaged in multiple activities, and therefore off-farm and non-farm income sources complement household income. In addition, farmer's organizations may reinforce their bargaining power on input and output markets to reduce costs or increase unit prices. In a similar vein, incentives for making household investment in farm upgrading largely depend on opportunities for reducing transaction costs and for managing perceptions of risk (Mugwagwa et al., 2020)

This paper compares different strategies for reducing the living income gap of smallholder farmers in selected agricultural value chains for major commercial crops. Most attention is given to opportunities for expanding land use, strategies for improving returns to land (yields) or for raising output prices, and pathways for complementing household income with off-farm wages or remittances. We assess available options in local-market and export-oriented supply chains and compare between labour-intensive and input-intensive technologies with different factor substitution opportunities.

We use a definition of living income as that covers the needs of a household in a particular place to afford a decent standard of living for all members (including a nutritious diet, clean water, decent housing, education, health care and other essential needs, plus a little extra for emergencies and savings), as illustrated in Figure 1.

Figure 1: Key Components of Household Living income



Source: The Living Income Community of Practice: Living Income | Living Income Community of Practice (living-income.com)

Within this framework, we focus attention on possible pathways for reaching living income benchmarks, and pay attention to two key research questions (RQs):

a) How far do current production and trade conditions enable smallholder farmers to earn a living income?

b) What are the different strategic opportunities for reducing the living income gap?

The definition of 'living income' and the calculating a 'living income benchmark' encompasses the idea of the cost of a decent standard of living for maintaining a farm household. Total household income for a farming household may come from multiple sources: on-farm income sources (net revenues from farming or livestock activities) and off-farm income sources (such as revenue from wage work). On-farm sources might also include home consumption of food or timber produced on their own farm.

While much attention is usually given to adequate measurement of current farm-household income and living income benchmarks, it is equally relevant to identify underlying mechanisms that influence the size and composition of household income. Local land and/or labour market constraints strongly influence opportunities for farm expansion or crop intensification. Otherwise, under conditions of high labour substitution, rising off-farm wages might reduce labour use in farm production (Pfaffermayr et al., 1991). More recently, female may have to substitute for male labour if urban and international migrant job opportunities present themselves. Poor and vulnerable households tend to refrain from farm-level specialization – but may be interested in off-farm activity diversification - in order to reduce risks (Danso-Abbeam et al., 2020). Finally, true pricing might be used as a mechanism for guaranteeing inclusive welfare and sustainability outcomes (IEF, 2020).

Living income benchmarks can be used for a variety of purposes, such as a benchmark for evaluating current farmer income against the poverty line, as an inspirational goal for establishing measurable and achievable targets for specific sectors or commodities, and as an input into models of farm economics to derive information on the possible impact of interventions towards fair prices or equitable wages (Komives et al., 2015).

In this paper we analyse causes and consequences of the existing living income gaps for different perishable commodities (green beans, mango), cash crops (coffee, cocoa, cotton) and food staples (groundnut, maize, sorghum) in three East African and four West African countries. Attention is given to structural farm-household determinants of living income gaps and the identification of possible strategies for reducing the gap. We therefore rely on a stylized income simulation approach to understand which factors represent key strategic constraints.

The remainder of this paper is structured as follows. Section 2 discusses the importance of the living income concept and explains different procedures for empirical measurement. Section 3 outlines the methodological framework for estimating living income gaps from crop-level budgets. Hereafter, section 4 analyses differences in living income between countries against the background of different socio-economic macro-conditions and the diversity in institutional conditions governing the commodity VCs at meso level. Section 5 discusses major strategies for reducing living income gaps and Section 6 outlines the wider consequences for agricultural and rural development. Section 7 concludes with responses to the research questions and implications for policy and further research.

2. Analytical Framework : the importance of living income

This study relies on ‘’living income’’ analytical framework and tries to extend this (static) analysis to further understanding of the dynamics of raising household income beyond the defined benchmark. While much time has been devoted to the definition of key components of living income (from the consumption side) and ample efforts are made for field-level measurement of income (from the production side), it is now important to make next steps and focus attention on the opportunities and constraints for bridging the living income gap.

The living income framework has been developed as an objective measure to assess the basic needs of rural households to afford a decent living standard (Anker & Anker, 2020). Main attention is given to cropping income from production and net margins realized from sales. It is increasingly acknowledged that rural off/non-farm employment are critical for guaranteeing farmers livelihoods and food and nutrition security outcomes. Different strategies for reducing the existing living income gap focus on farm-level intensification (increasing yields and land use), improving market conditions (higher prices and better margins) as well as greater engagement in supplementary off-farm income creation.

Earlier studies for the Farmer Income Lab identified five major categories of interventions for improving smallholder income, ranging – in the order of decreasing effectiveness for reaching living incomes - from direct income support, improving access to resources, strengthening linkages to markets and information to post-harvest interventions and direct market interventions. These interventions differ in terms of scale, long-term sustainability and gender impact (see Table 1).

Table 1: Possible interventions for improving farm household income

Intervention Category	Type of intervention	Income	Scale	Durability	Gender
Income guarantees	Poverty graduation				
	Outgrower schemes				
Producer organization	Savings groups				
	Producer cooperatives				
Public investments	Agri-corridors				
	Land tenure				
	Crop insurance				
Market support	Certification				
	Post-harvest loss prevention				
Market regulation	Pricing				
	Input subsidies				

Source: based on: Dalberg/WUR 2018. Landscape Review ‘What works to increase smallholder income?’

Note: positive | mixed | negative

The calculation of the benchmark for a decent living includes four major expenditure categories (Anker & Anker, 2020) - food, housing, essential needs and unforeseen events – and includes:

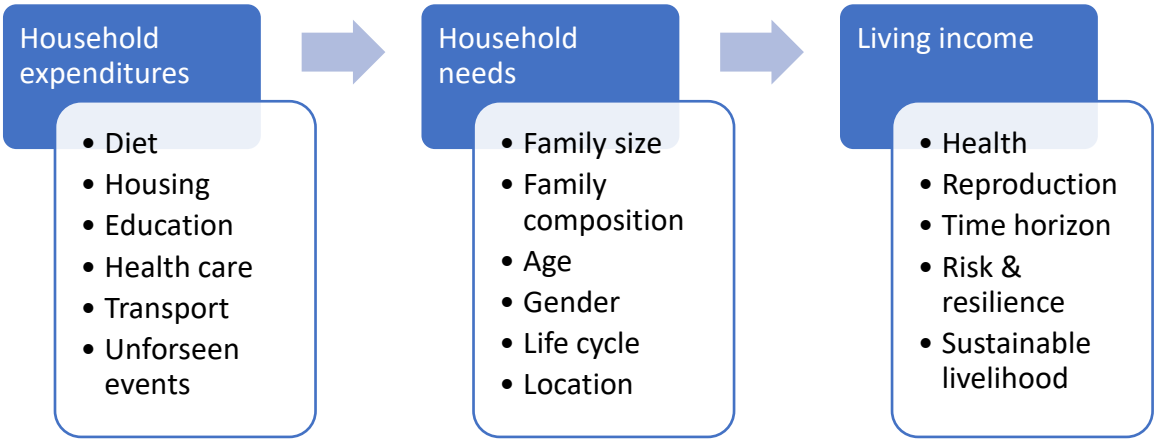
- Food costs are estimated based on nutritious diets that meet WHO recommendations on calories, macronutrients and micronutrients and is consistent with local food preferences and a country’s development level, valued against local food prices for the types, qualities and quantities of foods that households typically buy.
- Housing costs are estimated using international (UN-HABITAT) and national standards for decency (e.g. dwellings that have permanent walls, roofs that do not leak, and

adequate ventilation; amenities such as electricity, water, and sanitary toilet facilities, and sufficient living space so parents can sleep separately from children).

- Cost of essential needs for health care, education and transport (energy) are estimated using an extrapolation method based on secondary household expenditure data. In addition, costs for communication and childcare become increasingly important
- Small margin for unforeseen events, such as health shocks or natural disasters.

The living income benchmark aggregates individual data to household-level standards, using the following procedure (Figure 2):

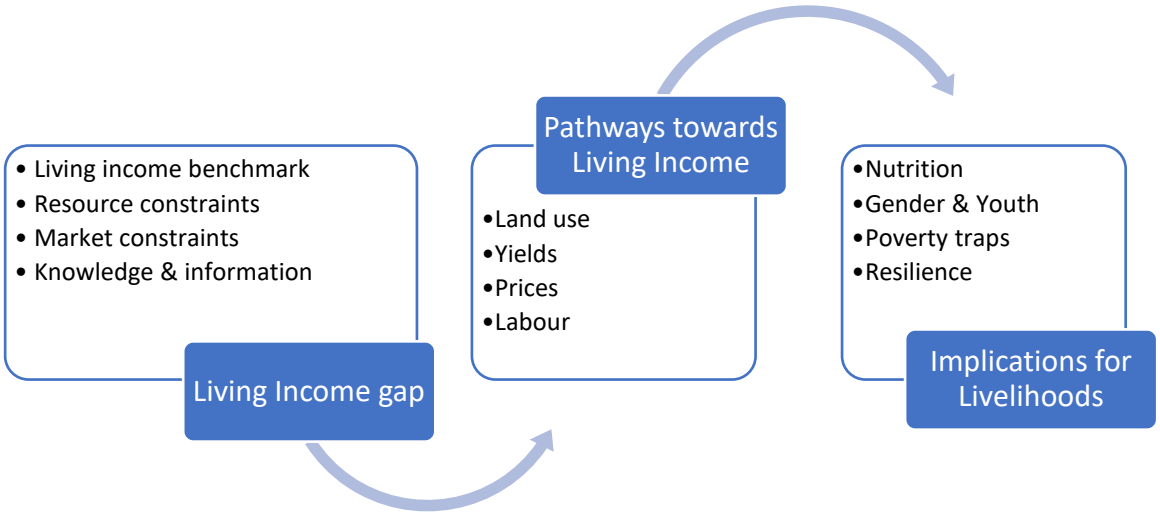
Figure 2: Establishment of Living income benchmarks



For the empirical analysis we rely on a stepwise analysis that involves three stages (see Figure 3):

1) Assessment of living income gap (benchmark -/- net value generation);
2) Appraisal of the potential contributions of possible pathways for reducing the living income gap;
3) Discussion on the implications of living income gap for wider rural development opportunities.

Figure 3: Analytical framework



The living income benchmark can be considered as a proxy indicator for value chain inclusiveness and is therefore helpful to assess possible poverty reduction strategies. In this study, we include four different pathways for improving living income:

a) more resources: increasing cultivated area or farm size (either more productive use of existing area or purchase/hire/lease of additional land);
b) better technologies : improving yields (or reducing the yield gap or crop losses, using better inputs and seeds and more appropriate knowledge)
c) economic strategy: higher crop prices for sales on markets (either through better bargaining or more scarcity);
d) generating additional revenues: income from labour used in other crops (on the same farm), family labour wages generated from engagement in off-farm or non-farm activities and/or income from migration (remittances received from abroad)

Earlier studies pay most attention to opportunities for technological improvement (using more or better inputs for higher yields), but tend to underestimate the rising input costs and the risks associated to more intensive production systems (van Dijk et al., 2017). Other analysis mainly look at strategies for improving the prices and margins for commodity sales, either through quality upgrading or by using certification (Ruben, 2017). Changes in farm size are strongly dependent on local land market arrangements and prevailing land tenancy regimes, whereas adjustments in land use can be supported through farmer's training and input support facilities. Finally, opportunities for reducing living income gaps increasingly depend on engagement in off-farm employment or non-farm work. These activities generate a more continuous flow of income that also contribute to reduced risks and improved diets (Rogers and Jenkins, 2021).

3. Methodological Approach

We rely on a simple methodology to assess determinants that influence smallholder household income and identify several possible (internal and external) causes of living income gaps in order to be able to outline feasible strategies for improving income performance and strengthen household welfare.

The income profile of agricultural production is widely different between commodities. Many cash crops strongly rely on family labour and include hired labour for seasonal (harvesting) activities. Commercial commodity production requires investments in yield-improving inputs (seeds, fertilizers) and for crop maintenance and (farm-level) processing.

There is, however, no unique and unambiguous definition of a smallholder. Often scale - measured in terms of the farm size - is used to classify farmers into small, medium and large. Several analyses limit smallholders based to farms between 2 and 4 hectares (Dixon et al., 2001). The distribution of farm sizes across countries depends on agroecological and demographic conditions, as well as on economic and technological factors. In this study we use the **family farm-household** as a threshold for 'viable farmers'. This farm type mainly depends on its land resources and ample reliance on family labour as key aspects for sustaining its livelihood (Rapsomanikis, 2015).

Table 2 shows current living income gaps, considering land use, production and yields and relevant price levels in eight countries that are further discussed in the subsequent sections.

Table 2: Cash crop production and living income gaps

Country	Commodity	Local Currency	Exchange rate (per US$)	Living Income (US$)	Living Income benchmark (local currency)	Living Income Gap (local currency)	Living Income Gap (%)
Ethiopia	Cotton	Birr	52	633	104.630	65,187	62
Kenya	Green beans	KSH	103	2.436	250.908	95,261	38
Tanzania	Coffee	TSh	2.280	2.400	5.472.000	2,797,232	51
Burkina Faso	Mango	FCFA	580	1.944	1.127.520	198,179	18
Cameroon	Cocoa	FCFA	550	3504	1.9227.200	461,913	54
Ghana	Groundnut	GHS	5.4	3.552	19.181	3,591	39
Ghana	Sorghum	GHS	4.8	3.552	17.050	6,607	19
Nigeria	Maize	Naira	360	4.224	1.520.640	356,256	23

Source: benchmarks based based on Living Income CoP Dataset

Note: Current Income gap is calculated as indicated in section 3 (using current production and price data from VCA4D studies and assumptions regarding land use and income shares)

Living income gaps are more than half of household income in Ethiopia, Cameroon and Tanzania, reach a third to a quarter of income in Kenya and Ghana (groundnut), and are somewhat smaller in Burkina Faso and Ghana (sorghum). Households engaged in cash crops (cotton, coffee, cocoa) suffer largest living income gaps, while the living income gap in farms

that are less dependent on one crop and diversify into several other crops (such as farmers that grow cereals or recollect harvests from tree crops) is more manageable.

We can now assess the available options for reducing these living income gaps. Since VCA4D data only focus on returns from particular crops, we had to make a number of assumptions regarding the farm land share used for this crop (and thus the remaining land area for other crops) as well as the average income share generated with the sales of the core crop. Key assumptions are (see also Annex 1):

- Only a particular part of the farm area – ranging from 20 to 60 % - is used for cultivating the focus activity. The remainder of the land can be used for other (commercial or subsistence) cropping or livestock activities.
- Net revenues from sales of the focus activity represent only a part of household income and therefore the living income gap is calculated as the contribution of commodity sales to the percentual share of revenues that could be generated;
- Total available household labour is defined at 600 days/year; this is based on the assumption that up to 2 (adult) family members are available for on-farm and off-farm activities (Jayne et al., 2017). Note that this does not influence the living income gap and is only used as a benchmark for calculating the share of labour engaged in off-farm employment required to fill the living income gap with wage revenues.

We used a simple calculation framework for identifying the potential effects of changes in production and market parameters to reduce the living income gap. This includes four steps:

(1) Net crop revenues : $C_{NR} = P_{NR} * (S_L * S_Y)$

where C_{NR} = net crop revenues. P_{NR} = plot revenues, S_L = land share, S_Y = income share.

(2) Living income gap : $¥_L = \hat{Y} - C_{NR}$

where $¥_L$ = Living Income Gap , $\hat{Y}$= Living income benchmark and C_{NR} = net crop revenues.

(3) Factor multipliers :

$$\delta C_A = C_{NR} / Area$$

$$\delta C_Y = C_{NR} / Yield$$

$$\delta C_P = C_{NR} / Price$$

$$\delta C_L = C_{NR} / Labour$$

where A = Area, Y = Yield, P = (Output), P = Price and L = (off-farm) labour are key factor inputs and rewards that can be modified in order to pursue $\hat{Y}$ (Living income benchmark).

(4) Income gap closure:

$$₡_A = ¥_L / \delta C_A$$

$$₡_Y = ¥_L / \delta C_Y$$

$$₡_P = ¥_L / \delta C_P$$

$$₡_W = ¥_L / \delta C_L$$

where ₡ refers to the percentual change compared to the base line for reducing $¥_L$ (Living Income Gap) and thus reaching $\hat{Y}$ (Living income benchmark).

This is mainly an **explorative analysis** regarding the potential options for closing the living income gap within existing resource endowments and market mechanisms. It should be noted that these closure mechanisms only look at the effectiveness of instruments and do not

consider differences in costs, the responsiveness of farmers, companies or the government, or real-life possibilities (i.e. whether increases in farm size would be possible).

We assess the net incomes gap of smallholder farmers in selected agricultural VCs with respect to their contributions for guaranteeing living income.[1] We can distinguish between four types of agri-food systems:

a) land-constrained smallholder households

   Smallholder farmers that require considerable expansion of their cultivated cropping area for reaching the living income benchmark. This is particularly the case when local land markets limit lease or purchase of land, or land prices are fairly high. When current yield levels are close to technical maximums and output markets offer limited margins for improvement, area expansion remains as main option for bridging the living income gap.

b) yield-constrained smallholder households

   Producers that can still rely on yield-improving inputs and better land management practices for improving farm-household revenues. This strategy is preferred when there is a considerable yield gap and ample opportunities for applying improved seed and fertilizer packages for reaching higher marketable production or lower crop losses.

c) price constrained smallholder households

   Farmers with a considerable marketable surplus but facing low prices that if increase could improve their net sales margins. Low-input and high-value crops still offer wide opportunities for bargaining better output prices and/or improving market efficiency. This situation occurs in cropping systems with high value added potential and constrained market competitiveness.

d) labour-constrained smallholder households

   Smallholders that are able to increase their engagement in off-farm employment as a key strategy for reaching the living income benchmark. This is the case of crops with low permanent and high seasonal labour demands, and when market wages are higher than returns to family labour.

[1] Only occasionally we refer to rural wage labourers that work on temporary or permanent base on the farms, since this information is scarcely available in most of the VCA4D studies.

4. Descriptive appraisal

This study mainly uses data materials generated by the VCA4D project and tries to embed this information in the analytical framework for identifying pathways towards living income benchmarks for smallholder farmers.

The VCA4D program analyses agricultural value chains according to the sequence of processes from the primary production to its end uses. It considers a system of different types of actors (such as farmers, collectors, processors, wholesalers and retailers) orientated towards the markets of production factors, inputs and outputs. As such, the structure of production and value added is assessed considering all VC stages.

The VCA4D approach starts with a functional analysis that provides a detailed description of the different farm types and production systems, including the technical properties of the transformation process and the economic-financial implications for farmer welfare. In addition, attention is given to land, labour and capital resources that constrain farm-level outcomes, and the perversive role of market price distortions on inputs and output markets.

The purpose of Value Chain Analysis is to provide decision makers with evidence-based information to support inclusive and sustainable development strategies. It is directed to policy makers and other key stakeholders, and supports policy dialogue. The analysis of income levels at primary production level sheds light on the unequal welfare distribution and permits to uncovers major pathways for improving which actors, investment and support can generate minimum conditions for sustainable and inclusive livelihoods.

We selected from the VCA4D project portfolio eight studies that cover different regions and categories of products and production systems, focussing on cases from East and West Africa where major cash crops are grown. Attention has been focused on in-depth analysis of the contribution of these cash crops to household income, especially for the segment of 'viable' family farms that possess sufficient resources for guaranteeing a decent livelihood.

For measuring living income benchmarks, we used the methods developed by Anker & Anker (2017) and available international databases for Living income benchmarks (see: https://www.living-income.com/living-income-benchmarks). We assess the current (annual) net crop revenues in a number of selected cash crop VCs in seven sub-Saharan countries:

- East Africa:
  - Ethiopia (cotton) ,
  - Kenya (green beans)
  - Tanzania (coffee)

- West Africa:
  - Burkina Faso (mango)
  - Cameroon (cocoa)
  - Ghana (sorghum)
  - Ghana (groundnut)
  - Nigeria (maize)

Table 3 provides an overview of the production conditions and the commercial regimes for each of these crop/market combinations. They show clear differences in farm organization (small-scale to family farmers) and production technologies (traditional to semi-intensive use of purchased inputs) accompanied by a diversity in labour arrangements (family, hired, contract) and marked variation in market outlets (custom, contract, auction).[2]

Table 3: Cash crop production and trade characteristics

Country	Commodity	Smallholder Farm Type	Market outlets	Production technology	Labour use
Ethiopia	Cotton	Small-scale farmer	Cooperatives and Contracts	Rainfed / conventional	Family labour and temporary contract labour
Kenya	Green beans	Small-scale (with self-help groups)	Contract farming for exports	Greenhouse	Family and hired labour (permanent)
Tanzania	Coffee	Smallholder + (wet)processor	Auction	Conventional / Shaded	Family & hired labour
Burkina Faso	Mango	Communal land	Exports	Biological / certified	Labour gangs (*equipe de collecte)*
Cameroon	Cocoa	Small-scale producers	Producers groups & regional confederations	Input intensive	Family labour
Ghana	Groundnut	Small-scale producers	Input-output contracts	Labour-intensive system	Family & hired (planting & harvesting)
Ghana	Sorghum	Small-scale commercial farmers	Customary deliveries to aggregators and processors	Semi-technified; Input-credit by large aggregators	Family labour & seasonal hired labour
Nigeria	Maize	Commercial smallholders	Contracts with aggregators (Regional sales to urban centres & for livestock feed)	External-input technology	Family labour complemented by wage labour

Living income levels and current income gaps are not only related to production systems and market linkages, but also depend on local circumstances (Waarts et al., 2021), such as:

- Prices and production volumes are volatile over years: data for calculating current income is mostly based on an 'average' production year and therefore may be biased due to extraordinary high/low prices as well as production volumes (e.g. weather related).

- Plantations have a living cycle; perennial crops often only provide yields after several years, with a clear peak and declining yields towards the end of their lifetime (coffee, Cocoa,

[2] For a comparison with country-level parameters on smallholders production and resource use, see: https://www.fao.org/family-farming/data-sources/dataportrait/farm-size/en/

mango). The current age of the plantation highly influences the production volume and therefore the crop income.

- Labour costs are usually under-estimated: besides producing crops for the market farming households often produce goods (such as vegetables and food staples) for their own consumption. Their market value needs to be taken into account for calculating the total household income.

- Prices differ from market regimes: for tenant under sharecropping arrangements, payments to landlords and other input providers need to be considered that are based on agreed contractual prices that may differ from market prices. The same holds for sales prices agreed under an advance payment regime.

While the living income benchmark calculations are based on norms for minimum household expenditures necessary to guarantee a decent living at local level, the level of living income benchmark is likely to be influenced by several country-wide characteristics. We therefore looked at the correlation of living income benchmark (in US$) with GDP per capita, primary education, poverty rate (headcount), life expectancy (at birth) and employment rate (defined as share of the population > 18 years that is engaged in work). We note that most macro-economic determinants perform in line with expectations (see Annex 2). Living income benchmark levels increase as a result of higher GDP per capita and higher degree of education. On the other hand, increasing living income benchmarks have a downward effect on the poverty level. Living income benchmarks are hardly related to national employment levels or life expectancy.

5. Comparative analysis: Strategies for improving living income

The comparison of living income benchmarks with net revenues generated in specific cropping activities provides information on the living income gap (see Table 3). Thus, is used as the starting point for the subsequent assessment of the different strategic opportunities for reducing the living income gap.

We therefore rely on the household income simulation framework (outlined in Section 3) that identifies different pathways for reducing the income gap through changes in land use (plot area devoted to selected crop), crop yields, prices and shifts to off-farm employment (wage labour). Income gaps vary between 20% (maize, mango, groundnuts) and 40% (green beans, sorghum) to > 50% (cocoa, coffee, cotton). We calculated the percentual changes in these instrument variables compared to their baseline performance (see Figure 4). This provides information about the magnitude of changes in parameters required but cannot directly be related to differences in costs for introducing these adjustments.

5.1. Pathways towards closing the living income gap

We use the required changes in key parameters (i.e. land size, yield, crop price and off-farm work) for reaching living income benchmarks as a criterion to classify farmers according to their most-limiting factor for development. This leads to 4 categories of farm households:

a) land-constrained smallholder households

Almost all smallholder family farms are severely constrained in reaching their living income benchmark by the scarce availability of land resources. Land constraints appear to be critical for sorghum in Ghana, while area expansion still has potential for green beans in Kenya (but conditional on water resources) and coffee in Tanzania (at risk of expansion in highland areas). This is mostly due to the relatively small crop areas compared to farm size. These smallholder farmers can still rely on increasing the cultivated cropping area (and sometimes land redistribution for creating larger farms) to be able to reach the living income benchmark.

b) yield-constrained smallholder households

All crops show important opportunities for increasing yield within the technical potential. Yields would need at least to be doubled in most crops, but yield constraints are found to be critical constraints for coffee in Tanzania and mango in Burkina Faso. Both crops still offer important opportunities for improving yields through better land management and cultivation practices.

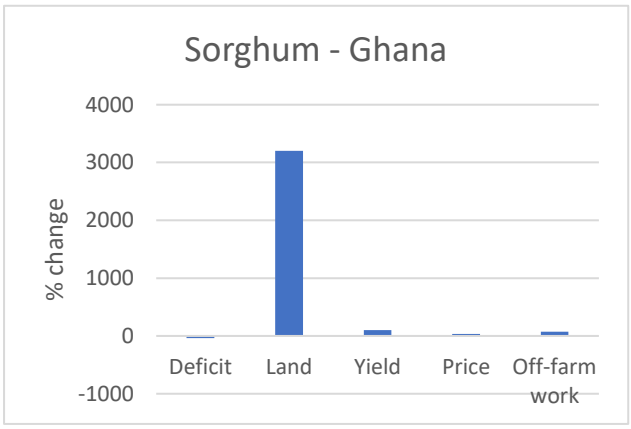
c) Price-constrained smallholder households

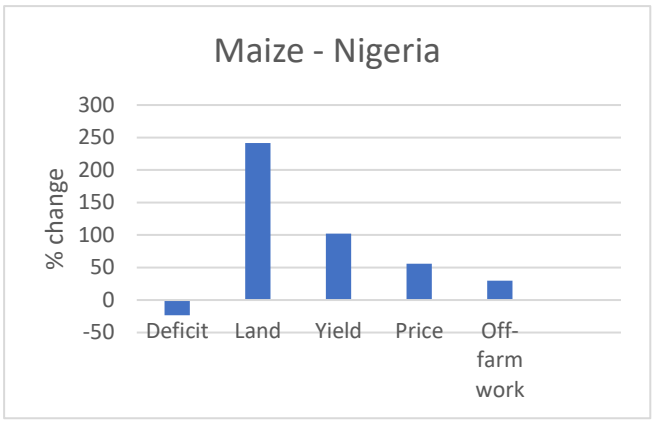
Improvements in market prices – with given yield level and production volume – should be particularly large for cocoa in Cameroon and mango in Burkina Faso. In many other settings, the output price should increase with at least 50-100% to guarantee a living income. Prices are most critical constraints in market settings with low competition or limited transparency.

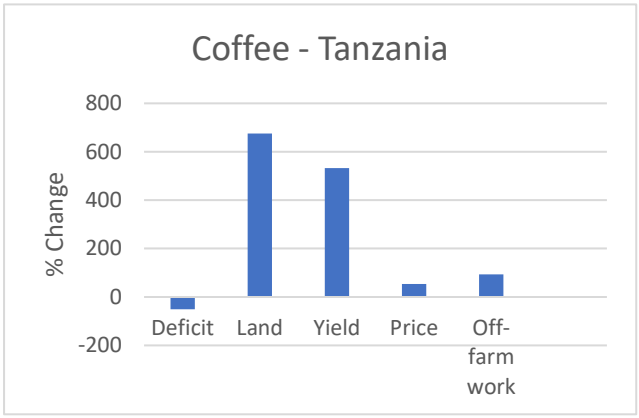
d) labour-constrained smallholder households

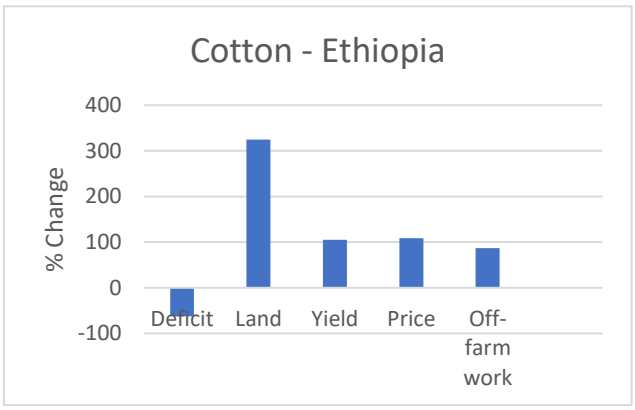
Several low-rewarding cropping systems require considerable complementary income from off-farm employment to guarantee achieving a living income. Export crops like coffee in Tanzania and cotton in Ethiopia need to increase their engagement in off-farm work with 80-90% for reaching living income. Maize and groundnut households in Ghana rely up to 50% on off-farm income, while off-farm income is only viable for farmers that have surplus labour (large families) and in regions with a well-developed labour market.

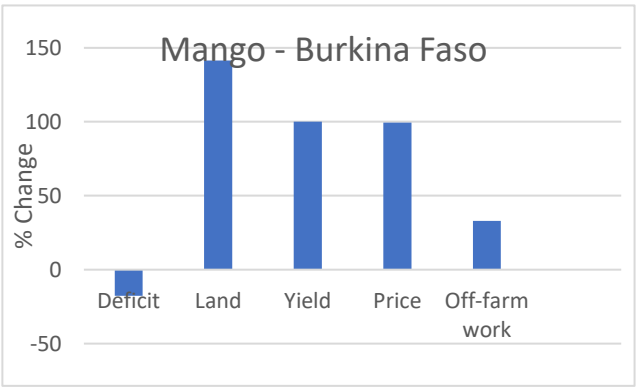
Figure 4: Options for reducing the living income gap

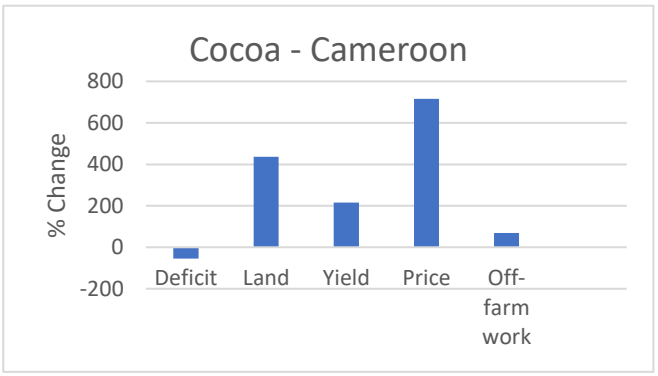


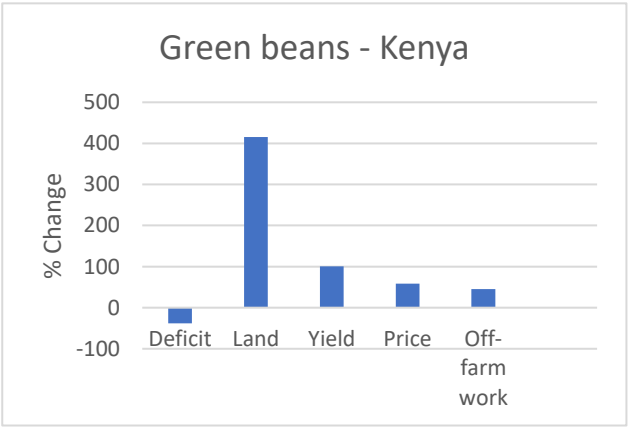


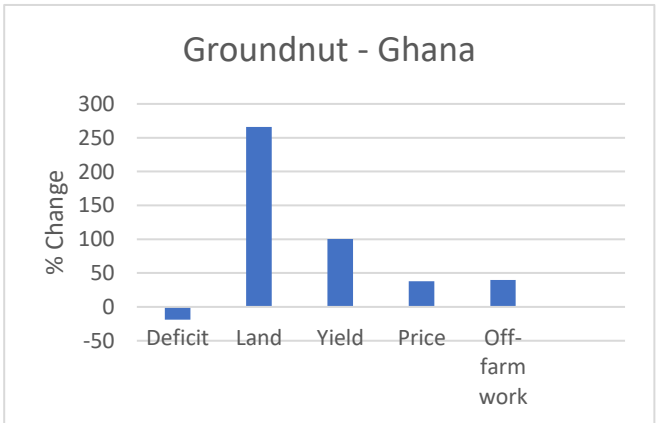












Notes to Figure 4

Figure 4 illustrates the changes that are required in each of the 4 parameters to minimally fill the living income gap. These are presented as a percentage change compared to their value in the baseline scenario.

The living **income deficit is** calculated as a percentage share of the family-level living income benchmark.

The change in **land** for reaching the living income benchmark is calculated as the percentage change in land devoted to the particular crop. Note that crop substitution is not included as an option.

The change in **yields** is calculated as the percentage change in actual yields (per hectare) required for reaching the living income benchmark. Yield increases > 100% refer to a doubling of yield levels. We assess the technical feasibility by comparing with potential yields (from literature).

The change in **prices** refer to the percentual increase in the commodity market price compared to the prices in the baseline study.

The change in **labour use** analyses the engagement in off-farm employment (valued as market wage rates) to gain additional income for closing the living income gap, expressed as a % of total available household labour.

For these calculation, the following assumptions are used (see Table A1):

- Land share devoted to the commercial crop varies between 25 and 60% (depending on specific local conditions)
- Crop revenues contribution to household income varies between 30 to 80%

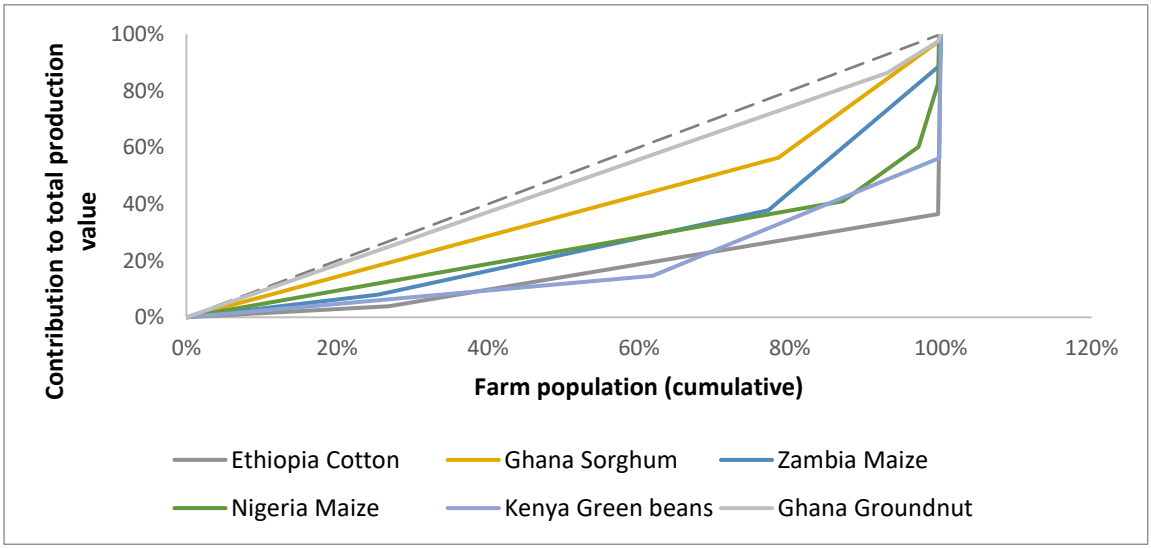
Living wages gaps are particularly sensitive to changes in income shares derived from the target crops coffee (Tanzania) and mango (Burkina Faso): a 10 % decrease in income share lowers the living income gap with more than 30% (see Annex 1, Figure A1). On the other hand, crops like cotton (Ethiopia) and sorghum (Ghana) are less sensitive to effects of income diversification.

5.2. Land constraints

Many smallholder farms face severe constraints for reaching their living income benchmark due to their small farm size and the scarce availability of land resources. Land constraints are most critical in regions with high inequality in land distribution and/or constraints for hiring land. Gini-ratio's for land distribution vary between countries and tend to be higher for more commercial crops (see Figure 5) and are usually biased in favour of men.

Land distribution (proxied by value added shares for different groups of farmers) is fairly equal for groundnut and sorghum in Ghana (Gini 0.07 and 0.22) and cocoa in Cameroon (Gini 0.41), but large for green beans in Kenya (Gini 0.50) and cotton in Ethiopia (Gini 0.69). This is mostly caused by the relatively small plot size. These smallholder farmers can still rely on a considerable expansion of their cultivated cropping area (and sometimes land redistribution for creating larger farms) to be able to reach the living income benchmark.

Figure 5: Land distribution (Gini ratio) in different agri-food systems



Source: Kuijpers & Ruben (2022), VCA4D Synthesis paper

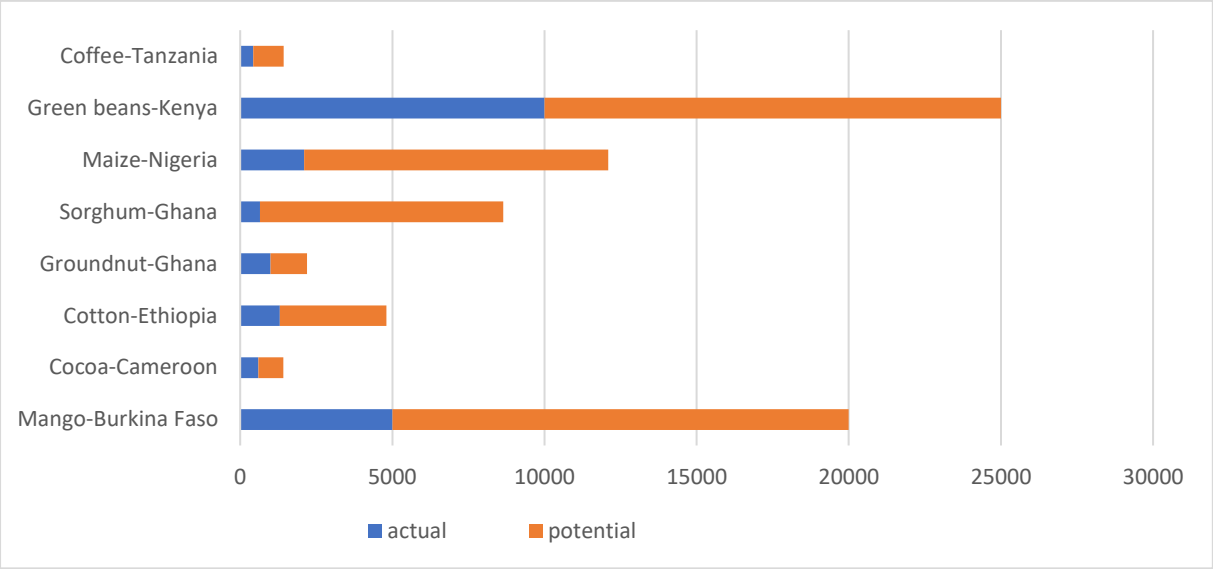
Land constraints are more severe in settings of strong market-orientation and when markets for renting or purchasing additional land become constrained, either because of absolute land scarcity or because of customary rules limit possibilities for hiring-out of land. In such settings, sharecropping arrangements (frequently applied in cocoa and cotton) or contract farming (green beans in Kenya) can be used to circumvent land scarcity, but this is usually at the cost of higher input costs or lower output prices. (Meemken & Bellemare, 2019).

5.2. Yield gaps

Yield gaps can be defined for several crops and under specific biophysical conditions in order to assess the difference between actual production and potential production under optimal crop management regimes and considering opportunities for overcoming local nutrient and water constraints (van Ittersum & Cassmann, 2013).

Potential production of basic grains (maize, sorghum) is considerably higher than actual yields resulting in an extremely large yield gap (> 350%). But also for perishable export crops (mango, green beans) the yield gap is quite considerable (see Figure 6). For other crops, reducing the yields gaps remains an interesting technological option, but sometimes involves considerable input costs.

Figure 6: yield gaps in selected crops (in kg/ha)



Sources:

- Fonking, EE. 2014. Cocoa yield evaluation and some important yield factors in smallholder Theobroma Cacao agrogorests in Bokito Centre, Cameroon. MSc Thesis University of Dschang, Faculty of Agronomy
- van den Broek, J., Apenteng-Sackey, N., Arnoldus M., Keita S., Waardenburg R. 2016. Scoping study West Africa Fruit. Study commissioned by the Netherlands Enterprise Agency (RVO)and implemented by Resilience, SENSE and the Rock Group
- Kotu BH, Nurudeen AR, Muthoni F, Hoeschle-Zeledon I, Kizito F (2022) Potential impact of groundnut production technology on welfare of smallholder farmers in Ghana. PLoS ONE 17(1): e0260877. https://doi.org/10.1371/journal.pone.0260877;
- Koskey, G., Mburu, S. W., Njeru, E. M., Kimiti, J. M., Ombori, O., & Maingi, J. M. (2017). Potential of native rhizobia in enhancing nitrogen fixation and yields of climbing beans (Phaseolus vulgaris L.) in contrasting environments of Eastern Kenya. Frontiers in plant science, 443.
- Seyum E., Ibrahim, AM, Abebe, A., Nebiyu, A. 2014. Growth and yield response of green beans (Phaseolus vulgaris L.) in relation to time of sowing and plant spacing in the humid tropics of Jimma, southwest Ethiopia.. International Journal of Soil and Crop Sciences. 2. 61-67.
- Oppong-Sekyere, D., Asumboya, G and Yintii, B. 2018. Sorghum Production Practices: A Case Study of Four Districts in Navrongo, Ghana J. Basic. Appl. Sci. Res., 8(7)1-15.

There are different pathways for reducing the yield gap. Low cost adjustments are improving plant density and reducing spacing, usually asking for increased labour use in weeding and harvesting). In a similar vein, shifting sowing time could improve the yield potential but labour may compete with other commitments. Other more capital-intensive options rely on improved soil fertility management (fertilizers, mulching) and upgrading of seed varieties but this comes at a cost

In the VCA4D studies, strategies for yield gap reduction appear to be particularly relevant for green beans (Kenya) and cotton (Ethiopia), and – to a minor extent – for mango (Burkina Faso). In these cases, relatively simple adjustment in land management (sowing time and spacing) still offer considerable potential for approaching the living income benchmark.

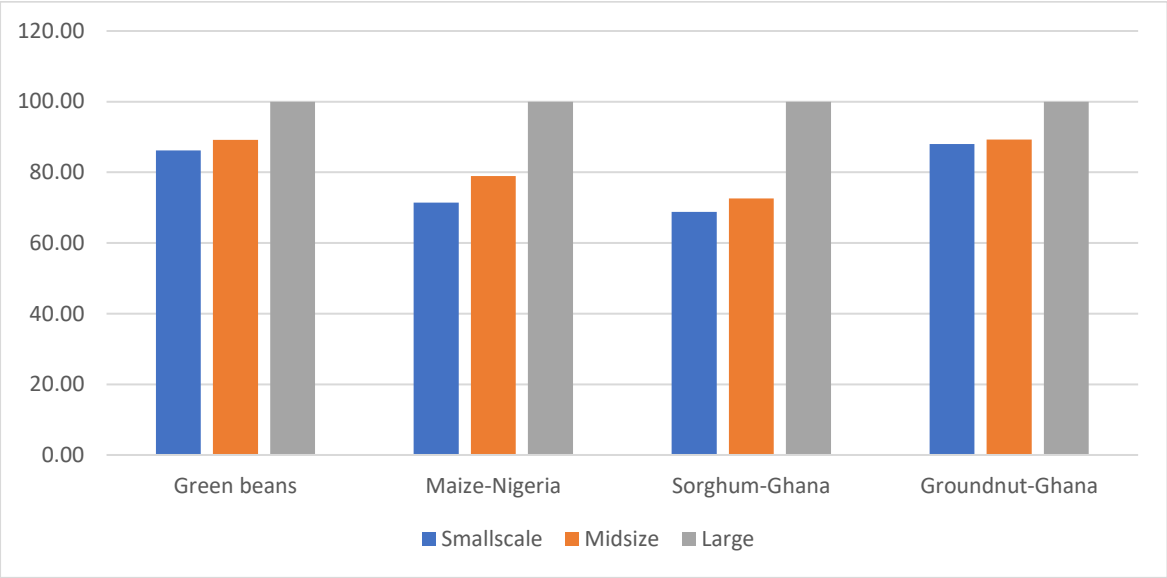
5.4 Prices and market failures

Prospects for improving household revenues towards living income benchmarks are highly dependent on strategies for raising output prices or net sales margins. The likelihood of such

changes mainly depends on opportunities for reducing market failures and/or strategies for improving the bargaining position of smallholder farmers.

Small-scale family farmers receive on average a 30% lower unit prices (for basic grains like maize and sorghum) and some 15 % lower price for commercially processed crops (such as green beans and groundnut) compared to large farms (see Figure 7). Differences in net margins per hectare are likely to be higher. Prices for export crops (such as cocoa in Cameroon and mango in Burkina Faso) can be increased by increasing competition between traders and improving marketing arrangements (including lower taxation). Farmer organization (collective action) and contract arrangements can be particularly helpful for reaching more competitive farm-gate prices.

Figure 7: Price differences by farm size (in % of large-holder price)



Source: based on information from VCA4D studies

5.3. Employment and labour markets

The analysis of the potential of the labour market for reducing the living income gap relies on the assumption that off-farm and non-farm income represent important additional income sources that may complement farm-level income. Our calculations for estimating the prospects for generating additional nonfarm income assumes a total family workforce of 600 days (2 fulltime persons), and we assess the number of days required to complement the farm income as a share of the total family workforce.[3]

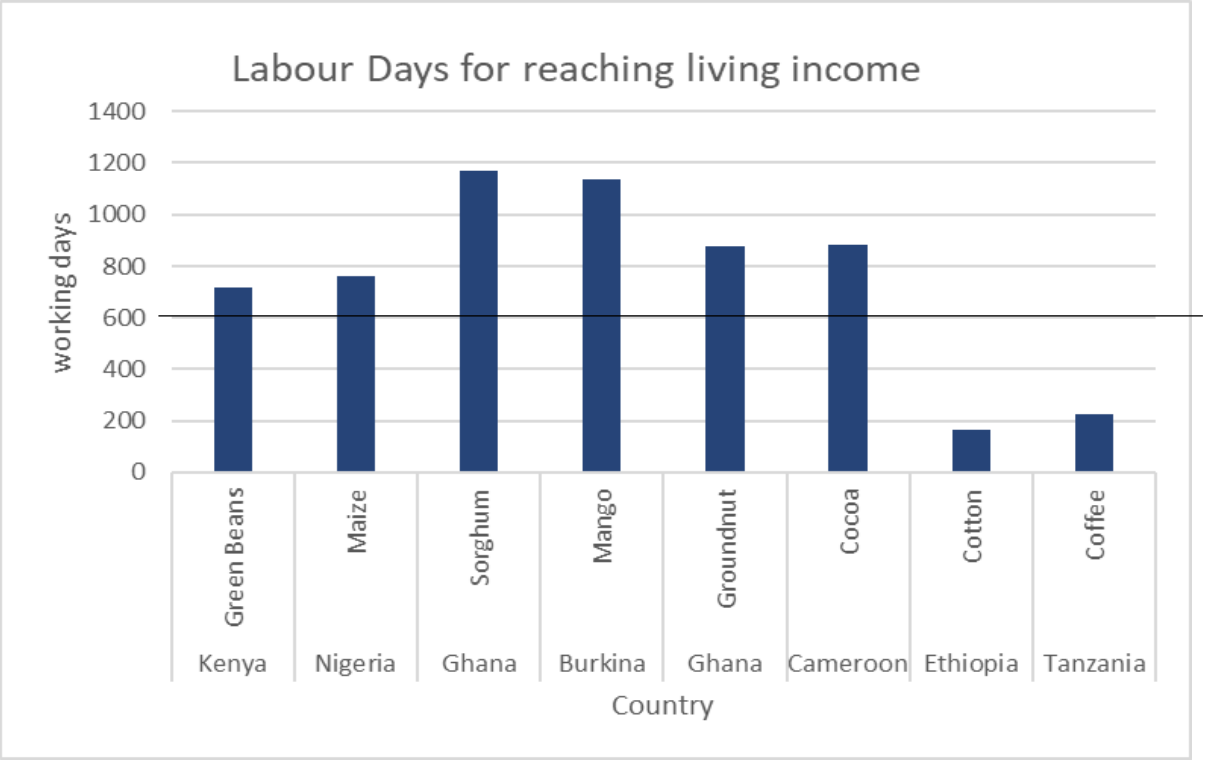
Off-farm income is only a feasible strategy if local employment opportunities are in place. This can be based on seasonal employment with neighbouring farmers, non-farm work in midstream trading or agro-processing, or temporary or permanent migration to (peri-)urban centres. Farmers engaged in the production of crops like coffee in Tanzania and cotton in Ethiopia can easily increase their engagement in seasonal off-farm work, whereas farmers that produce food crops like maize and groundnut are frequently engaged in home processing

[3] Unfortunately, it is difficult to calculate in a consistent manner the family labour requirement for these cropping activities from VCA4D data. We therefore cannot estimate the farm/non-farm distribution of employment.

and non-farm self-employment for generating additional income. Off-farm income is only feasible for large families and in regions with an integrated labour market.

For reasons of comparison, we assess whether the full living income benchmark could be reached only by wage labour. As shown in Figure 8 this is very difficult or virtually impossible to reach in 6 of the 8 countries. Only in cash crops such as coffee and cotton the wage income can become potentially sufficient for reaching the living income benchmark. Average wages should increase with 20% (green beans, maize) and 40% (cocoa, groundnuts) to more than 90% (sorghum, mango) to guarantee living incomes.

Figure 8: Labour days required for reaching living income benchmark



Source: based on information from VCA4D studies

6. Implications of living income gaps for rural development

There are different reasons why smallholder farmers cannot reach their established living income benchmarks. This can be caused by shortage of resources (land, capital), limited access to knowledge and information, unequal market conditions, and institutional failures in governance regimes that limit opportunities for improving VC efficiency or inclusiveness or off farm employment (Waarts & Kiewisch, 2021).

Living income gaps not only affect prospects for reaching sustainable and inclusive livelihoods but can also be considered responsible for other socio-economic and cultural barriers that further reinforce livelihood insecurity. In addition, household resilience to shocks will be hampered when minimum living income standards cannot be reached. We identified three main areas for negative spillovers of living income gaps on household welfare:

6.1. Nutrition and Health

Living income gaps are directly related to shortages in household nutrition and may result in health problems. This will in turn have repercussions for scarcity of family labour for common farm operations, such as weeding or harvesting. The linkages between household poverty and undernutrition are widely confirmed (Sidiqqui et al., 2020). The two-way links between malnutrition and poverty create a vicious cycle fuelling each other: malnutrition produces conditions of poverty by reducing the economic potential of the population and likewise, poverty reinforces malnutrition by increasing the risk of food insecurity.

Farmers involved in diversified production for regular commercial sales (mango in Burkina Faso, green beans in Kenya, sorghum in Ghana) are usually better able to guarantee minimum nutrition requirements, whereas deficits in diets are registered amongst producers of more specialized cash crops (cotton in Ethiopia, cocoa in Cameroon). This implies that risks of malnutrition tend to be higher in VCs with large variation in yields and prices.

6.2 Gender and Youth

Female workers play a very important role in cropping activities and contribute the main share of agricultural labour. Females face higher living income gaps because women have less equitable access to agricultural inputs, including improved seeds, pesticides, and fertilizer. In several countries (Burkina Faso, Cameroon) land rights are severely biased against women. The same holds for access to credit that usually requires a land collateral and is thus constrained for women and youth. Equalizing women's access to resources and agricultural inputs, including time-saving equipment, and increasing the return to these inputs is thus critical to reduce gender disparities in wages and income.

In most SSA countries wage payments to women and youth are below legal minimum standards and wages are also lower for women compared to men. The gender wage gap shows that women earn 60-75% of men's wages for doing similar jobs (Kilic et al., 2015). Gender inequality on the labour market requires legal reforms, adjustments in social norms and investments in parity education.

From our sample, we find that VCs of mango (Burkina Faso), cocoa (Cameroon) and cotton (Ethiopia) maintain a rather strict gender division of labour, where women play a marginal role in production but are very actively involved in the processing and sales. More integrated VCs for green beans (Kenya), sorghum and groundnut (Ghana) offer some opportunities for

women, representing 60-80% of the workforce in all VC segments. Integration of women in local self-help groups or rural societies proves to be helpful for reducing gender disparities.

Gender equality becomes an even more important issue for export crops that rely on certification (cocoa from Cameroon, coffee from Tanzania, green beans from Kenya) where equal rights, protection against discrimination and just payments are considered important for consumers. Higher willingness to pay for these socio-economic attributes creates opportunities for improving market prices and working conditions.

6.3 Innovation and Transformation

Living income gaps are responsible for slow adoption (or even dis-adoption) of improved agricultural practices and thus seriously hinder the innovation diffusion process (Thuijsman et al., 2022; Oyetunde-Usman, 2022). This is mainly due to scarce reserves and higher risk-aversion amongst resource-poorer households that reinforces their initial disadvantages.

Many agricultural VCs offer wide opportunities for technological and social innovation that can be used as a strategy for improving the yield potential, enhancing the resource use efficiency. or increasing the quality or value added of the agricultural produce. Major yield-increasing innovations in basic grains (maize, sorghum) and tree crops (cocoa, coffee) are based on improved seeds, better plant nutrition (fertilization) and plant protection practices that are usually not very scale-sensitive, although uptake could be limited due to credit access or other market constraints. Other innovation like irrigation (cotton) and greenhouses (green beans) require more in-depth investments and are therefore considerable resources.

A large number of VCs already rely on some form of delivery contract for guaranteeing access to inputs and commitments for output procurement (see Table 2 for an overview). Some export contracts are rather formal and strict and combine input and output arrangement (green beans; cocoa), while others are based on customary deliveries (maize, sorghum). These contracts seem to improve smallholder certainty and reduce living income gaps.

Further innovation of digital technologies and climate-smart practices can be very helpful to improve incomes. Some of these innovations are also labour-saving and thus enable farmers' engagement in non-farm activities for additional income generation. This is helpful to diversify income and to reinforce household resilience against shocks. Adoption of these practices and technologies can be promoted through collective action. Social organization in self-help groups (Kenya), cooperatives (Ethiopia, Ghana) and producers groups & regional confederations (Cameroon) can contribute to wider diffusion of knowledge and innovative practices for improving production practices and reducing yield gaps.

7. Discussion, Outlook & Conclusions

This study assesses the net incomes of smallholder farmers engaged in specific agricultural VCs and their contributions for guaranteeing living income conditions as well as other household welfare goals. Substantial living income gaps - varying between 20 and 60% - are registered and could be related to key pathways for reaching living income benchmarks by increasing plot area of farm size, reducing yield gaps, more-rewarding crop price and engagement in off-farm employment.

In addition, we identified important drawbacks of living income gaps for affecting household nutritional intake, limiting gender equality and women empowerment, and hindering innovation. These wider implications indicate that living income gaps will not be eliminated only by targeted interventions, but need a more structural VC transformation in order to become anchored, besides the need for wider economic development facilitating off-farm employment. We therefore need to discuss which strategic opportunities are available for overcoming living income gaps and how potential leverage points can be identified.

Based on the analysis in section 4-6 there are several leverage mechanisms that are likely to be effective for reducing or closing living income gaps. Their effectiveness ultimately depends on the interplay between (a) internal constraints that hinder production systems integration or livelihoods diversification, and/or (b) the external constraints that limit the functioning of local and regional markets and institutions.

Table 4: Policy alternatives for reducing living income gaps

Policies	Land constrained	Yield constrained	Price constrained	Labour constrained	VC cases
Land registration and tenancy					Cotton (Ethiopia) Groundnut (Ghana) Green beans(Kenya)
Rural extension & training					Green beans (Kenya) Cotton (IEthiopia) Mango (Burkina Faso)
Public investment in Market Infrastructure					Cocoa (Cameroon) Cotton (Ethiopia) Maize (Nigeria) Groundnut (Ghana)
Rural credit & crop insurance					Groundnut (Ghana) Cotton (Ethiopia)
Vocational Education					Mango (Burkina Faso) Sorghum (Ghana)
Social organization					Cotton (Ethiopia) Coffee (Tanzania) Mango (Burkina Faso)
Certification & labelling					Cocoa (Cameroon), Coffee (Tanzania) Mango (Burkina Faso)

Source: based on author's appreciation of VCA4D case studies

Note: positive | mixed | negative

Table 4 summarizes the likelihood of effective policy interventions for substantially reducing living income gaps, given the available knowledge about policy effectiveness (see Table 1)

and the specific production and trade characteristics that prevail in the selected agri-food VCs (see Table 2).

Public investments in rural infrastructure (roads, energy, communication) offer a useful strategy for increasing wages and incomes in different circumstances. The same holds for rural extension and training, even while this shows a lower potential impact for land- and labour-constrained farm households. In a similar vein, efforts to strengthen social organization (cooperatives, VSLA, farmer groups, etc.) are generally useful for improving incomes, but may be less effective for lifting the bottom line (living in extreme poverty) and only reach more substantial effects if medium-size family farmers are also included.[4]

Land registration is considered as a strategy that can favour family farmers to strengthen property rights and enable more land-attached investments, but easily meet its limits for very poor farmers that depend mostly on off-farm employment for their income. Credit and insurance are considered particularly effective to support yield-increasing investments. On the other hand, rural finance opportunities and certification strategies tend to bypass farmers with smaller plots and unsecure land rights. Potential effects of credit support and certification for gender equity and long-term sustainability are hardly reported.

In summary, we can conclude that there are a range of potential strategies for supporting achieving living incomes and their feasibility depends on the type of constraints that households meet. It is therefore important to be able to identify which are the main causes of living income gaps (market prices, access to technology, available resources, opportunities for diversification). Most smallholder farming households are likely to meet several coinciding constraints, and therefore a 'package' of suitable interventions has to be identified in concrete situations.

There are some interventions (notably market infrastructure, technical training and rural cooperation) that deliver overall positive effects and therefore may reinforce each other. Programs that only focus on (technological) yield improvements tend be less effective for raising farmers' income if not combined with simultaneous support for establishing rural organization and/or with interventions to strengthen market competitiveness. In some cases, real trade-offs are likely to emerge, for instance between the focus on technological intensification (through input support and training) and the objective of inclusion of marginal smallholder farmers.

Key factors that are responsible for maintaining living income gaps can be considered as 'poverty traps'': vicious circles that reinforce each other and are responsible for maintaining structurally low income levels below living income standards. In general, small land size is a limiting factor for yield-increasing investments, whereas low market prices take away incentives for on-farm work and thus reduce labour-intensive innovations. This implies that policy strategies need to consider a systematic package of interventions that permits to transform these dis-incentives for agricultural and rural development (including off farm diversification).

Such a political economy appraisal of the structural constraints for reaching living incomes is beyond the scope of our analysis, but certainly deserves major attention. Upgrading and transformation of value chains and agri-food systems needs to be foremost based on the establishment of a favourable 'food environment' that creates the governance conditions that enable VC stakeholders, including the governments, to take action. Furthermore, attention

[4] Cooperatives with only poor farmers are usually less effective, since the 'coalition of the poor' offers limited opportunities for internal resource exchange.

should be given to wider economic development that enables off-farm diversification as well as to social protection measures for households that cannot substantially increase incomes based on their current conditions.

References

Adamopoulos, T., Restuccia. D. (2014).The size distribution of farms and international productivity differences. American Economic Review, 104(6).

Anker. R, Anker M. 2017. Living Wages Around the World: Manual for Measurement. Cheltenham, UK: Edward Elgar Publishing.

Dalberg/WUR 2018. Landscape Review 'What works to increase smallholder income? Farmer Income Lab. https://www.farmerincomelab.com/sites/g/files/jydpyr621/files/2019-09/What%20Works_FINAL_9.19.pdf

Danso-Abbeam, G., Dagunga, G., Sedem Ehiakpor D. 2020. Rural non-farm income diversification: implications on smallholder farmers' welfare and agricultural technology adoption in Ghana, Heliyon 6 (100). https://doi.org/10.1016/j.heliyon.2020.e05393.

Dixon, J., Gulliver, A. with Gibbon, D. 2001. Farming systems and poverty: improving farmers' livelihoods in a changing world. Malcolm Hall, ed. Rome/Washington, FAO and World Bank

IEF-Impact Economy Foundation (2020). Principles for true process. Amsterdam: Trye Price Institute.

Jayne, T.S., Kwame Yeboah, F and Henry, C. 2017). The future of work in African agriculture: Trends and drivers of change. Research Department Working Paper No. 25. Geneva: ILO.

Kilic, T., Winters, P, Carletto, C. 2015. Gender and agriculture in sub-Saharan Africa. Special issue. Agricultural Economics, 46: 281-284. https://doi.org/10.1111/agec.12165

Kuijpers, R. Ruben, R. 2022. Farm stratification and market segmentation in agri-food systems and value chains. Amsterdam/The Hague: VCA4D Synthesis paper

Komives, K. Grunze, S., Krain E., Tschanz, A., Daniels, S. and Seville , D. 2015. Defining, calculating and using a living income benchmark in the context of agricultural commodities, Discussion note. ISEAL, GIZ & Sustainable Food Lab

Koskey, G., Mburu, S. W., Njeru, E. M., Kimiti, J. M., Ombori, O., & Maingi, J. M. (2017). Potential of native rhizobia in enhancing nitrogen fixation and yields of climbing beans (Phaseolus vulgaris L.) in contrasting environments of Eastern Kenya. Frontiers in plant science, 443.

Meemken EM, Bellemare MF. 2019. Smallholder farmers and contract farming in developping countries. Proc Natl Acad Sci 117(1):259-264. https://doi:10.1073/pnas.1909501116

Mugwagwa, I., Bijman, J., Trienekens J. 2020. Typology of contract farming arrangements: a transaction cost perspective, Agrekon, https://doi:10.1080/03031853.2020.1731561

Pfaffermayr, M., Weiss, C.R. & Zweimüller, 1991. J. Farm income, market wages, and off-farm labour supply. Empirica 18, 221–235. https://doi.org/10.1007/BF00924913

Rapsomanikis, R. 2015. The economic lives of smallholder farmers An analysis based on household data from nine countries. Rome: FAO. https://www.fao.org/3/i5251e/i5251e.pdf

Reardon, T, C. B. Barrett, J. Berdegue, and J Swinnen (2009). Agrifood industry transformation and small farmers in developing countries. World Development, 37-11

Rogers, R. Jenkins, B. 2021. Disrupting commodities: building thriving rural communities and more sustainable, resilient agricultural supply chains. Chicago/Mars: Farmer Income Lab

Ruben, R. 2017. Impact assessment of commodity standards : Towards inclusive value chains. Enterprise Development and Microfinance 28 (1-2.): 82 - 97. https://doi.org/10.3362/1755-1986.16-00020

Siddiqui F., Salam RA., Lassi ZS., Das JK. 2020. The intertwined relationship between malnutrition and poverty . Frontiers in Public Health 8. DOI=10.3389/fpubh.2020.00453

Thuijsman, E.S., den Braber, H.J., Andersson, J.A. et al. 2022. Indifferent to difference? Understanding the unequal impacts of farming technologies among smallholders. A review. Agron. Sustain. Dev. 42, 41. https://doi.org/10.1007/s13593-022-00768-6

van Dijk, M., T Morley, R Jongeneel, M van Ittersum 2017. Disentangling agronomic and economic yield gaps: An integrated framework and application. Agricultural Systems 154: 90-99.

van Ittersum, MK, Cassman, KG. 2013. Yield gap analysis—Rationale, methods and applications, Field Crops Research (143): 1-3. https://doi.org/10.1016/j.fcr.2012.12.012.

van Vliet JA., Slingerland MA., Waarts YR., Giller KE 2021. A Living Income for Cocoa Producers in Côte d'Ivoire and Ghana? Frontiers in Sustainable Food Systems 5. DOI.10.3389/fsufs.2021.732831

Waarts, Y., Kiewisch. 2021. Balancing the Living Income Challenge: Towards a multi-actor approach to achieving a living income for cocoa farmers. Wageningen UR. https://edepot.wur.nl/557364

Waarts, Y.R., Janssen, V., Aryeetey, R. *et al.* 2021. Multiple pathways towards achieving a living income for different types of smallholder tree-crop commodity farmers. *Food Sec.* **13,** 1467–1496. https://doi.org/10.1007/s12571-021-01220-5

Oyetunde-Usman Z. 2022. Heterogenous Factors of Adoption of Agricultural Technologies in West and East Africa Countries: A Review. Frontiers in Sustainable Food Systems 6. DOI=10.3389/fsufs.2022.761498

List of VCA4D studies used

Kleih, U., Allen, C., Basset-Mens, C., Edewa, A. 2017. Green Beans Value Chain Analysis in Kenya. Report for the European Commission, DG-DEVCO. Value Chain Analysis for Development Project (VCA4D CTR 2016/375-804), 171p + annexes.

Kleih, U., Bosco, S., Kumar, R., Apeeliga, J., Lalani, B., Yawlui, S., 2020, Groundnuts Value Chain Analysis in Ghana. Report for the European Union, DG-DEVCO. Value Chain Analysis for Development Project (VCA4D CTR 2016/375-804), 150p + annexes.

Onumah, G., Plaisier, C., Villani, R., Komlaga, G., 2020, Sorghum Value Chain Analysis in Ghana. Report for the European Union, DG-DEVCO. Value Chain Analysis for Development Project (VCA4D CTR 2016/375-804), 168 p + annexes.

Lescuyer, G., Boutinot, L., Goglio, P., Bassanaga, S., 2019. Analyse de la chaîne de valeur du cacao au Cameroun. Rapport pour l'Union Européenne, DG-DEVCO. Value Chain Analysis for Development Project (VCA4D CTR 2016/375-804), 117 p.

Parrot, L., Klaver, D., Biard, Y., Kabré, K., Vannière, H. 2017. Analyse de la chaîne de Mangue au Burkina Faso. Rapport pour l'Union Européenne, DG-DEVCO. Value Chain Analysis for Development Project (VCA4D CTR 2016/375-804), 181p + annexes.

Nicolay, G; Estur, G; Walsh, C; Desalegn, P, 2020. Cotton Value Chain Analysis in Ethiopia. Report for the European Union, DG-DEVCO. Value Chain Analysis for Development Project (VCA4D CTR 2016/375-804), 128 p + annexes.

Onumah, G., Dhamankar, M., Ponsioen, T., Bello, M., 2021, Maize Value Chain Analysis in Nigeria. Report for the European Union, INTPA/F3. Value Chain Analysis for Development Project (VCA4D CTR 2016/375-804), 155p+ annexes.

Ruben, R., Allen, C., Boureima, F., Mhando, D., Dijkxhoorn, Y. 2018. Southern Highlands coffee value chain analysis in Tanzania. Report for the European Commission, DG-DEVCO. Value Chain Analysis for Development Project (VCA4D CTR 2016/375- 804), 124p + annexes.

Acknowledgements

Data for the analysis in this paper are derived from country studies made within the framework of the project Value Chain Analysis for Development (VCA4D) funded by the European Commission / DEVCO and implemented through Agrinatura (grant VCA4D # CTR 2016/375-804). This report benefitted from the financial support of the European Union. Its content is the sole responsibility of its authors and does not necessarily reflect the views of the European Union.

Biographical Information

Ruerd Ruben (PhD) is emeritus professor impact evaluation of food systems at Wageningen University and former coordinator of the research programs on food security, value chains and impact assessment at Wageningen Research, the Netherlands. He has widely published on smallholder participation in tropical food value chains, the effectiveness of rural organizations and the impact of certification.

Ruerd lived and worked for 14 years in Central America where he was engaged in programs of land reform, cooperative development and smallholder agriculture. He coordinated several multidisciplinary research and training programs at Wageningen University on food security and sustainable land use in sub-Sahara Africa and Latin America and was a visiting research fellow at the International Food Policy Research Institute (IFPRI) in Washington, D.C.

He worked earlier as director of the independent Policy and Operations Evaluation (IOB) department at the Netherlands Ministry of Foreign Affairs and professor in Development Effectiveness and Director of the Centre for International Development Issues (CIDIN) at Radboud University Nijmegen. [ruerd.ruben@wur.nl].

Yuca Waarts holds and MSc in Agricultural and Environmental Economics from Wageningen University (2003) after which she worked at an NGO to ensure rural economic development while conserving or enhancing biodiversity. Yuca works at Wageningen University & Research since 2008 as a Senior Researcher and Project Manager for sustainable value chain development.

Yuca's key topic of research is evaluating the impact of innovations and interventions such as certification, training programmes and service delivery aimed at smallholder producers and workers in developing countries, and their organisations. Evaluations she leads or has led include cocoa service delivery in evaluations in multiple countries for the private sector, tea program evaluations in Kenya, Malawi, Tanzania, Rwanda and South Africa (Rooibos). She has also been involved in evaluations and sector studies in the cocoa, cotton, fruits, vegetables and palm oil sectors, in various countries in West Africa, Asia and Latin America.

Next to a scientist, she is an experienced project and program manager, working with partners and team members from all over the world. She delivers high quality research results in accessible reports and brochures as well as through face-to-face discussions, (virtual) seminars and professional and public conferences [yuca.waarts@wur.nl].

Annex 1: Key parameters used for estimation living income gap

Table A1: Land use and Income share

Country	Activity	Farm Area (ha)	Plot area (ha)	Land share (%)	Income share (%)
Ethiopia	Cotton	1.6	0.8	50	90
Kenya	Green beans	0.4	0.1	25	50
Tanzania	Coffee	8.8	3.5	40	60
Burkina Faso	Mango	16.7	10	60	60
Cameroon	Cocoa	5.0	2.5	50	70
Ghana	Groundnut	8.0	1.6	20	30
	Sorghum	5.0	1,5	30	40
Nigeria	Maize	7.0	3.5	50	40

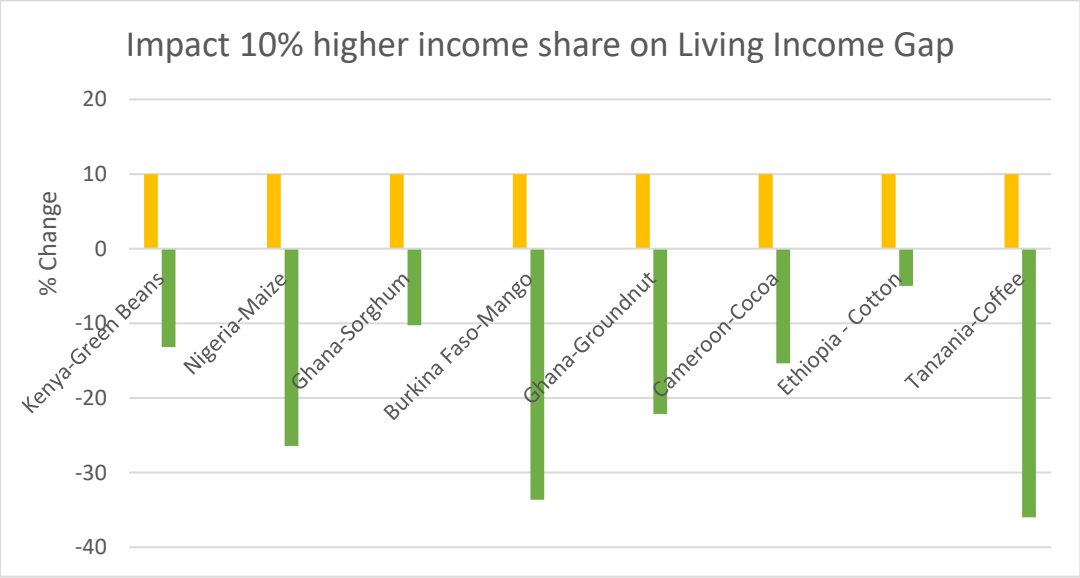
Note: indicators defined by authors

Table A2: Area, Yield, Production and Prices

Country	Focus activity	Area (ha)	Yield (kg/ha)	Production (kg)	Price/kg (local currency)	Wage/day (Local currency)
Ethiopia	Cotton	0.8	1.300	1.040	30	125
Kenya	Green beans	0.1	10.000	1.000	60	360
Tanzania	Coffee	3.5	430	1.505	4.000	5.000
Burkina Faso	Mango	10	5.000	50.000	800	1.000
Cameroon	Cocoa	2.5	600	1.500	85	2.500
Ghana	Groundnut	1.6	650	1.040	2.5	15
	Sorghum	1,5	650	975	10	15
Nigeria	Maize	3.5	2.100	7.350	110	2.000

Note: data derived from VCA4D country studies

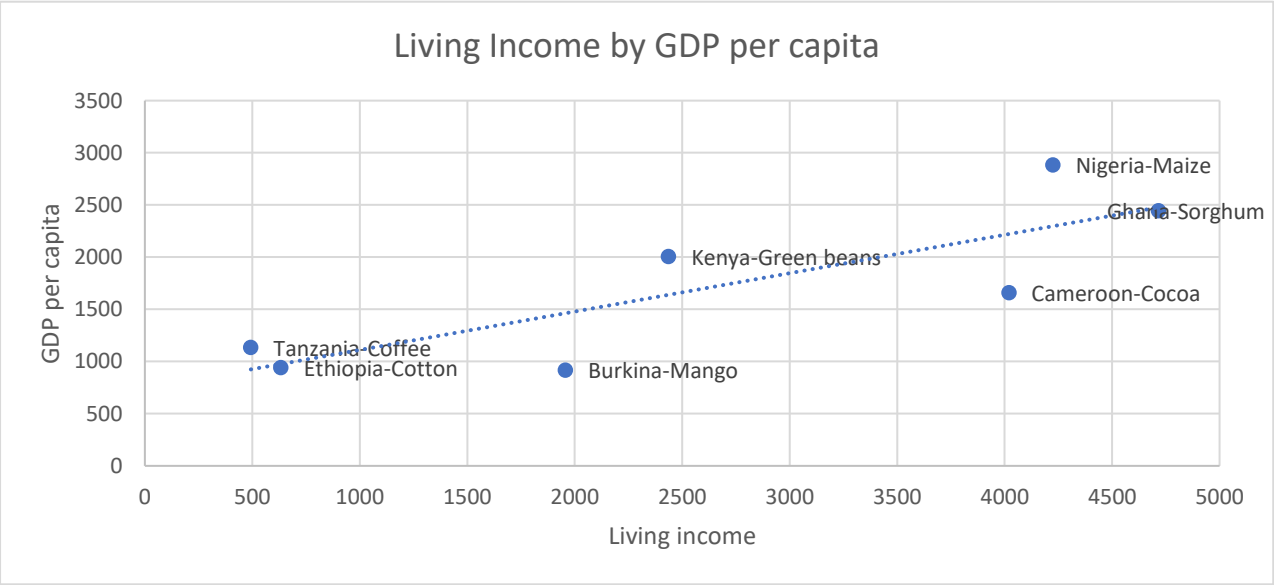
Figure A1: Sensitivity analysis: impact of income share on living income gap

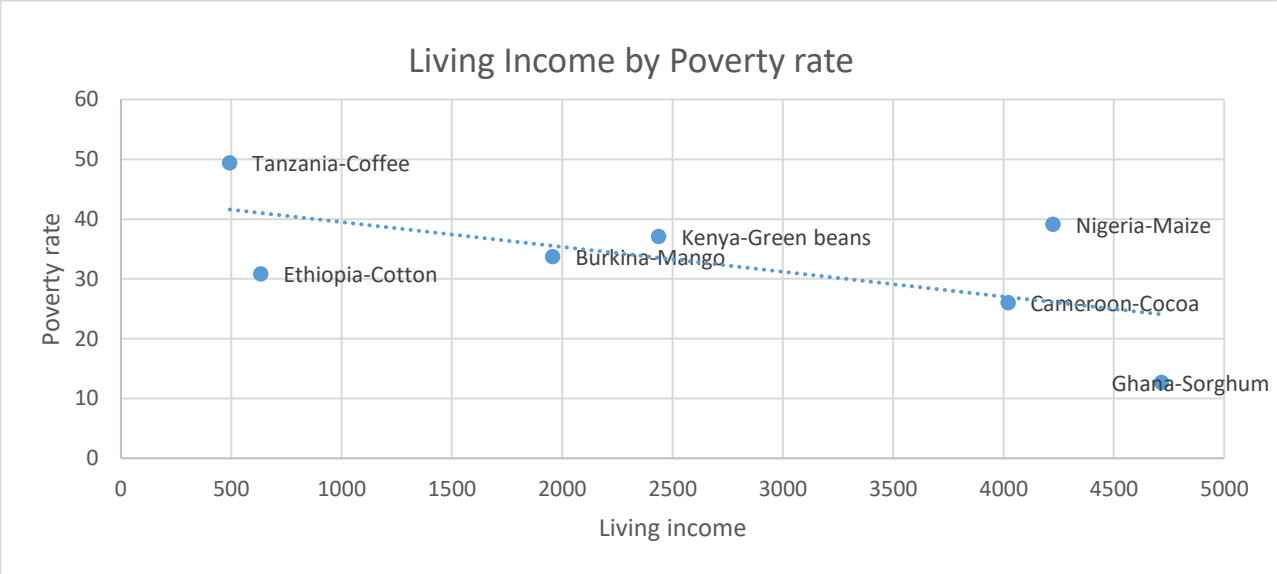


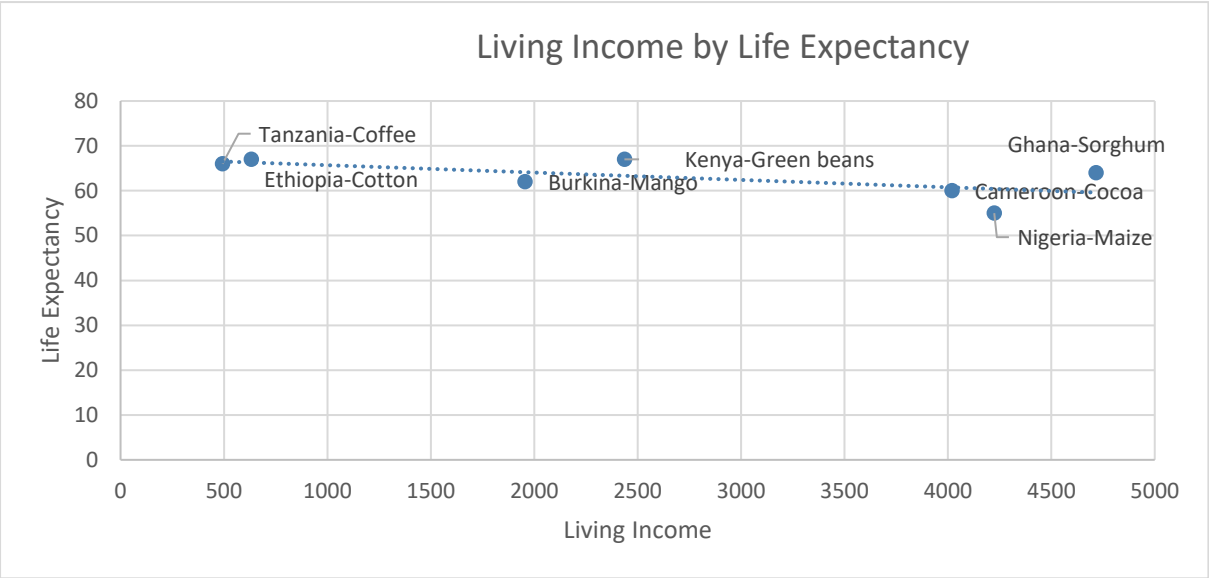
ANNEX 2: Differences in living income benchmarks between SSA countries

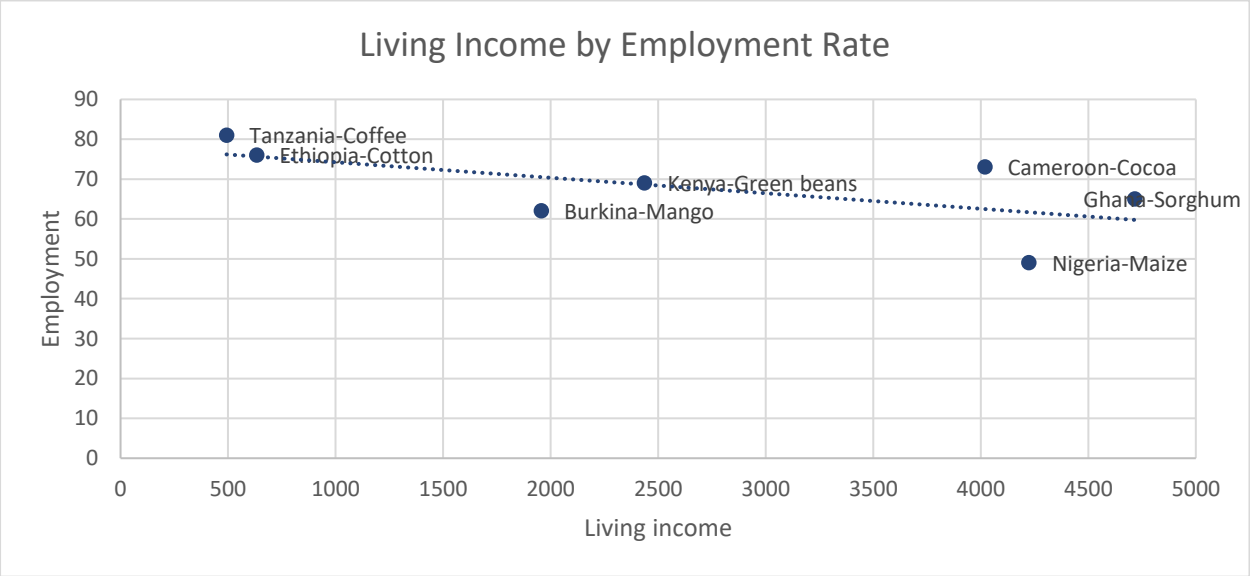
Country	Living Income Benchmark (US$)	GDP per capita (USD)	Education (% finalised primary school)	Life Expectancy (years)	Employ-ment (% >18 yr)	Poverty (headcount)
Kenya	2436	2007	100	67	69	37.1
Nigeria	4224	2885	74	55	49	39.1
Ghana	4716	2445	94	64	65	12.7
Burkina	1956	918	65	62	62	33.7
Cameroun	4020	1662	65	60	73	26.0
Ethiopia	633	944	68	67	76	30.8
Tanzania	493	1136	69	66	81	49.4

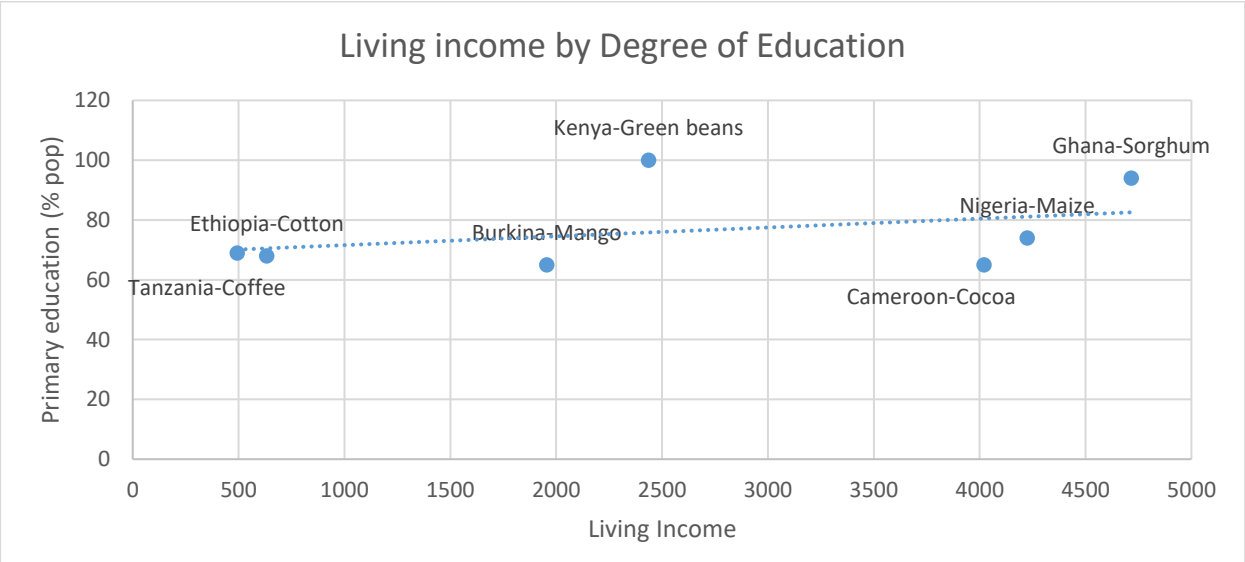
Source: World Bank indicators and CoP Living Income






Living Income by Life Expectancy
Life Expectancy
Living Income
Tanzania-Coffee
Ethiopia-Cotton
Kenya-Green beans
Burkina-Mango
Ghana-Sorghum
Cameroon-Cocoa
Nigeria-Maize


Living Income by Employment Rate
Employment
Living income
Tanzania-Coffee
Ethiopia-Cotton
Kenya-Green beans
Burkina-Mango
Cameroon-Cocoa
Ghana-Sorghum
Nigeria-Maize


Living income by Degree of Education
Primary education (% pop)
Living Income
Kenya-Green beans
Ghana-Sorghum
Nigeria-Maize
Ethiopia-Cotton
Burkina-Mango
Tanzania-Coffee
Cameroon-Cocoa