Food and Agriculture Organization of the United Nations

FAO COMMODITY AND TRADE POLICY RESEARCH WORKING PAPER

No. 58

Bottlenecks, stresses and risks in the cocoa supply chain in Ghana: recommendations to increase its resilience

Background paper prepared for the "Guidelines to increase the resilience of agricultural supply chains: Getting on the Right Track to Stabilize Production and Markets" project

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Bottlenecks, stresses and risks in the cocoa supply chain in Ghana: recommendations to increase its resilience

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Abstract

Cocoa is a key sector of Ghana's economy, contributing about 2 percent of GDP as well as providing a livelihood, or part thereof, for about 30 percent of the population. This study, based on stakeholder answers to detailed questionnaires and conducted from October 2021 to April 2022, aims to identify and evaluate risks as well as major bottlenecks, threatening and constraining the cocoa supply chain and limiting its resilience. The results show that extreme temperatures, droughts, and pests and disease are the most important risks and stressors that cocoa farmers face. This is also reflected in what stakeholders considered the most important bottlenecks, i.e. inadequate rainfall, the lack of irrigation and weather insurances, and limited domestic processing capacity. Climate change is an important driver of some of these risks and stressors. Key recommendations to strengthen the resilience of the cocoa supply chain in Ghana, that emerge from the study's findings, include building preventive and anticipative resilience by investing in climate information services and promoting agroforestry; building absorptive resilience through weather insurance and customized finance; building adaptive resilience through irrigation programmes, and; building transformative resilience through improving ICT systems, increasing domestic capacities for processing cocoa beans and investing in productivity.

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Acknowledgements

The authors are grateful to Pascal Liu for helpful comments provided during the review process and to Laura Del Castillo Buelga and Jonathan Hallo for their support in editing, formatting and preparing the layout of the publication.

FAO gratefully acknowledges funding for this research provided by the Government of Japan under the project "Guidelines to increase the resilience of agricultural supply chains: Getting on the Right Track to Stabilize Production and Markets." The project, which was in operation from April 2021 to June 2022, was conceived in the wake of the COVID-19 pandemic, which, through the imposed containment measures and a myriad of direct and indirect transmission channels, has harmed economic activity, impacted food systems, disrupted agricultural value chains and put households' food security at risk by undermining their livelihoods and capacity to access food. In particular, low- and middle-income countries could be severely affected, as large shares of their populations depend on agriculture for their livelihoods. As the COVID-19 pandemic unfolds, considerable attention has focused on the resilience of food supply chains in times of crises. Agricultural and input supply chains have had to adjust rapidly to demand side shocks, including panic buying and changes in food purchasing patterns, as well as plan for any supply side disruptions due to potential labour shortages and disruptions to transportation and supply networks. Drawing on its experience and expertise in agricultural markets, trade and economic analysis of agricultural policies, FAO has undertaken research, including the case study presented in this paper, on the impacts of the COVID-19 crisis, as well as of other natural disasters, on agricultural supply chains and markets. The findings have fed into the preparation of the "Guidelines for increasing the resilience of agricultural supply chains." For additional information on the project and copies of the background papers and the "Guidelines for increasing the resilience of agricultural supply chains," please contract Cristian Morales Opazo, Senior Economist, Agrifood Economics Division, FAO or Pascal Liu, Senior Economist, Markets and Trade Division, FAO.

Abbreviations

CHED	Health and Extension Division
CIS	Climate Information Services
CMC	Cocoa Marketing Company
COCOBOD	Ghana Cocoa Board
CODAPEC	National Cocoa Diseases and Pest Control
COVID-19	coronavirus disease
CRIG	Cocoa Research Institute of Ghana
FAO	Food and Agriculture Organization of the United Nations
GDP	gross domestic product
ICCO	International Cocoa Organization
ICT	Information and Communication Technologies
LBC	Licensed Buying Company
LID	Living Income Differential
NGO	non-governmental organization
PPRC	Producer Price Review Committee
QCC	Quality Control Company
R&R	Renovation and rehabilitation programme
SPU	Seed Production Unit
USD	US dollar

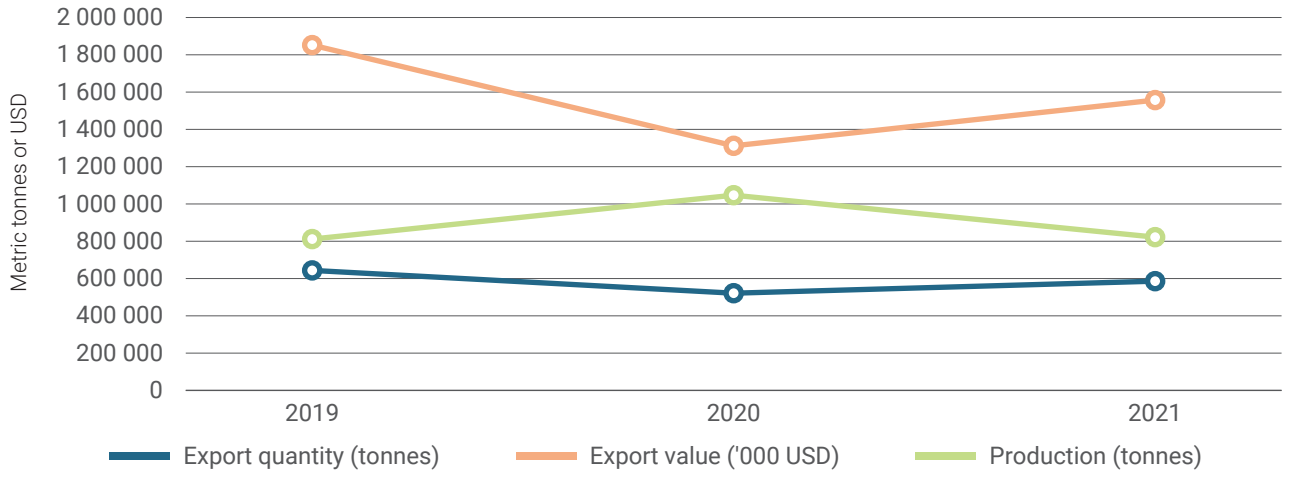
1. Introduction

1.1. Problematic

Ghana is the second largest producer of cocoa beans in the world after Côte d'Ivoire, and between 2019 and 2021, accounted for 15 percent of global production and 16 percent of the value of global exports, on average. About 80 percent of cocoa produced is exported, but Ghana's cocoa processing has expanded by about 69 percent between 2012 and 2017, to reach 225 000 tonnes (Bockel, Gopal and Ouédraogo, 2021). The cocoa sector generates about 30 percent of Ghana's export earnings and, in 2017, an estimated USD 2.71 billion in government revenues (Abbadi *et al*., 2019), accounting for about 2 percent of GDP in 2014 (Vigneri and Kolavalli, 2018). About 850 000 farm families make a living from cocoa, and overall the sector contributes to the livelihoods of about 30 percent of the population and generates about 10 percent of agricultural GDP (AsokoInsight, 2022; World Bank, 2013; Peprah, 2015; Ahoa, Kassahun and Tekinerdogan, 2020; Vigneri and Kolavalli, 2018).

The COVID-19 pandemic, and the accompanying containment measures, resulted in an unprecedented change of the global economic conditions that affected the international cocoa market and supply chains. In 2020, the real global GDP growth rate was -3.5 percent (IMF, 2021), the worst contraction since the 1960s, with implications, inter alia, for unemployment rates and incomes. With regard to international cocoa supply chains, the pandemic had less impact on harvests, which ended in early 2020, but disrupted exports as reflected in the aggregate data for exports and production (**Figure 1**).

Figure 1. Production and export quantity and value of cocoa beans, for Ghana, 2019–2021



Source: FAO. 2023. FAOSTAT. Rome. [Cited March 2023]. http://www.fao.org/faostat/en/#home

The data indicate that in the 2020/21 market season, the cocoa industry experienced a bumper crop together with weak global demand due to the COVID 19 containment measures (Nartey, 2021) and this resulted in high stocks and pressure on prices and the newly implemented Living Income Differential (LID). Introduced by Ghana and Côte d'Ivoire, the LID is a pricing mechanism that requires any buyer on the international cocoa market to pay an additional USD 400 per ton on the export price from the 2020/21 crop, and onwards. The LID is intended to be passed on directly to cocoa farmers (Boysen *et al*., 2021) to help improve incomes and reduce poverty among cocoa farmers of whom an estimated 30 percent fall below the World Bank's extreme poverty line (Duho, 2021; van Vliet *et al*., 2021).

Like all agricultural supply chains, Ghana's cocoa supply chain faces many challenges and in the future, challenges associated with climate change, such as changes in precipitation and drought, will in all likelihood increase. This study intends to identify major cocoa supply chain bottlenecks, risks and stresses with the purpose of deriving lessons to strengthen its resilience capacity and development, and with it, to improve the situation of the millions whose livelihoods depend on the cocoa supply chain in the country.

1.2. Purpose

The study has the following objectives with respect to the cocoa supply chain in Ghana:

- To assess the impact of the COVID-19 pandemic;
- To identify the main constraints and bottlenecks hindering the development of the supply chain and its capacity to respond to shocks and stresses;
- To identify the major risks; and
- To summarize the lessons learnt and to derive recommendations to increase the resilience of the supply chain.

1.3. Methodology

For drawing lessons for the analysis of strengthening the resilience and development of the cocoa supply chain in Ghana, FAO conducted a study from October 2021 to April 2022 to identify and assess the risks and major bottlenecks that threaten the supply chain and limit its resilience. With bottlenecks, we refer to the characteristics of the supply chain, which constrain its capacity to prevent, anticipate, absorb, adapt, and transform when faced with

shocks, stresses and risks. The analysis was based on a detailed questionnaire, which was distributed among key stakeholders in the sector, including several cooperatives, The Health and Extension Division (CHED) of the Ghana Cocoa Board (also called COCOBOD[1]), Serendipalm[2], the International Institute of Tropical Agriculture, several farmers, the Cocoa Research Institute of Ghana (CRIG) (a subsidiary of COCOBOD), and staff of other COCOBOD divisions. Seventy-seven responses were received and evaluated.

The FAO Representation in Ghana[3] and COCOBOD supported the implementation of the survey provided guidance on the details of the cocoa supply chain, identified the relevant actors, and supported the communication and follow up with the respondents of the questionnaire.

1.4. Organization of the report

The paper is organized according to the specific objectives. The section "Description of the cocoa supply chain in Ghana" gives a detailed description of the cocoa sector in Ghana as a background needed for the identification of the key vulnerabilities of the cocoa supply chain in the country; the section "The impact of the COVID-19 pandemic" presents the analysis of the impact of COVID-19; the sections "Identification of the bottlenecks" and "Identification of stresses and risks" identify the major bottlenecks, stresses and risks, and; the section "Recommendations to increase resilience" summarizes the lessons learnt and derives recommendations to strengthen the resilience of the cocoa supply chain.

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1 In 1940 the government established the West African Produce Control Board to address cocoa farmer's grievances with cocoa pricing. Dissolved in 1946, the Produce Control Board was replaced by the Cocoa Marketing Board in 1947 and then dissolved and replaced by COCOBOD in 1979. It is a state-run board that serves as the exclusive marketing intermediary between farmers and local and foreign buyers. Its subsidiaries include the Cocoa Research Institute of Ghana, the Seed Production Division, the Cocoa Health and Extension Division, the Quality Control Company and the Cocoa Marketing Company (Ghana Cocoa Board. 2023. Subsidiaries and divisions. Ghana Cocoa Board. [Cited February 2023]. Accra, Ghana, COCOBOD. https://cocobod.gh/subsidiaries-and-divisions).

2 Serendipalm produces organic & fair trade palm oil and cocoa in Ghana. It is one of several fair trade & organic projects established in Ghana, Sri Lanka, Samoa, India and Kenya, by Dr Bronner's, a US company specializing in organic soaps.

3 The author acknowledges that the study was made possible only by the support received from the FAO Representation in Ghana.

2. The cocoa supply chain in Ghana

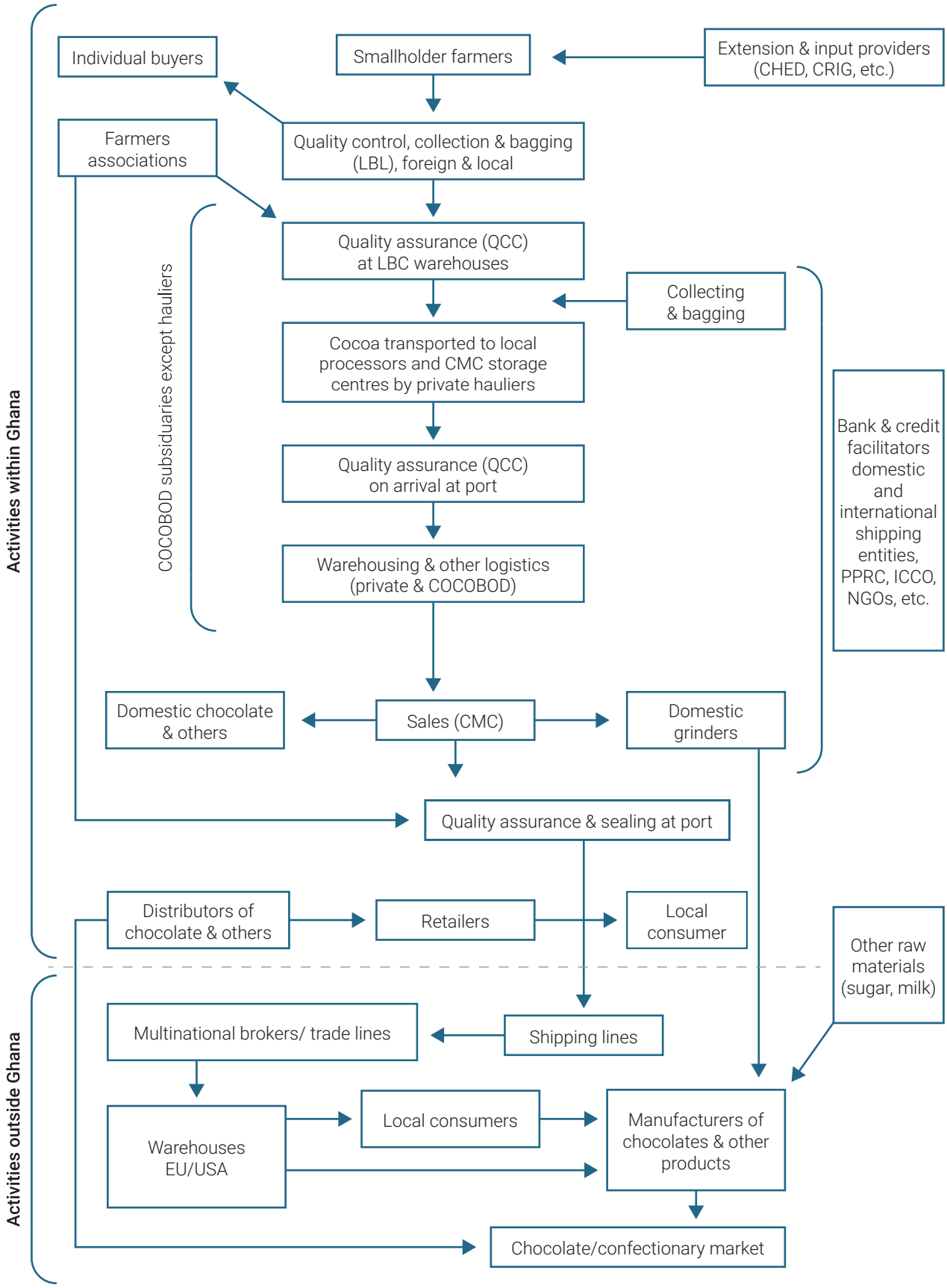
The cocoa supply chain is a process that includes farmers, buyers, transportation and trading, collection, certification, quality control, storage, processors and chocolatiers, and distributors (**Figure 2**). While the supply chain has many private actors, the government retains a major presence in the form of COCOBOD and its divisions, which regulate the activities of all other stakeholders in the industry. COCOBOD oversees the entire supply chain in Ghana, starting with farmers and ending with exports. The early 1990s have seen a move to greater private sector involvement in internal marketing, but COCOBOD still plays a major role in the cocoa supply chain through, inter alia, providing a wide-range of support to farmers, including seeds, subsidized fertilizer, and phytosanitary measures, and regulating the marketing of Ghanaian cocoa on international markets. COCOBOD retains a portion of the export price, which is used to cover its operating expenses as well as providing farmer bonuses, educational scholarships, input supply subsidies, research, and the improvement of road networks (World Bank, 2013).

COCOBOD's regulation of the supply chain and its support to farmers are implemented through its various specialized divisions and programmes. The Cocoa Health and Extension Division[4] (CHED) is responsible for the control of cocoa swollen shoot virus disease, the rehabilitation of old and unproductive cocoa farms, as well as extension services. The Seed Production Unit (SPU) works to multiply and distribute improved cocoa planting materials to farmers. The National Cocoa Diseases and Pest Control (CODAPEC) program assists cocoa farmers to combat cocoa mirids (capsids) and black pod diseases. The Cocoa Research Institute of Ghana (CRIG) undertakes research into challenges relating to the production, processing and utilization of cocoa and other tree species. The institute also researches into developing by-products from cocoa.

The Quality Control Company (QCC) is responsible for maintaining quality standards and oversees quality control measures at all stages of the supply chain. More specifically, the QCC inspects and certifies the private storage depots, grades, seals and certifies cocoa at these depots, samples cocoa on arrival at one of three Cocoa Marketing Company port warehouses (located at Kaase, Tema, and Takoradi) as well as prior to export. The QCC also inspects and fumigates storage sheds, warehouses, shipping vessels, and all cocoa consignments prior to shipment, and promotes and sensitizes farmers through training on optimal pre- and post-harvest practices required to maintain quality standards. The Cocoa Marketing Company (CMC) has exclusive rights to the marketing of cocoa beans to local and foreign buyers.

[4] Formerly the Cocoa Swollen Shoot Virus Disease Control Unit (CSSVDCU).

Figure 2. The cocoa supply chain



Source: Adapted from GCB. 2022. Sector Industry Analysis-Cocoa Sector Report 2022. Strategy & Research Department. Accra, GCB Bank.

Farmers, cocoa buying companies and hauliers are among the key private sector actors in the cocoa sector. About 850 000 farm families are engaged in cocoa farming in six of ten regions and the activity accounts for 70 to 100 percent of their incomes (Kolavalli and Vigneri, 2011). Farm sizes are in the 2 to 3 hectare range, with fewer than 10 percent of farmers operating on a larger scale (Opoku-Ameyaw *et al*., 2010). Pre-harvest activities include the preparation of farmland and tending of existing plantations. Newly planted cocoa trees reach peak production after three to five years and can maintain that level for about 10 years (GCB, 2022). The main inputs for cocoa production are cocoa seedlings, fertilizers, pesticides, fungicides as well as farming equipment, such as harvesting hooks, cutlasses, pruners and spraying machines (Bockel, Gopal and Ouédraogo, 2021). Pesticides and fungicides are widely used against common threats of cocoa production, and about 90 percent of cocoa areas are fertilized (Cobbina, 2015). Inputs are mostly obtained from private companies, but COCOBOD does operate a subsidized fertilizer programme.

Productivity in the cocoa sector is very low. A recent study found that cocoa productivity was about 234 kg/hectare resulting in income of about Cedi 568 (about USD 150) per hectare (Kongor *et al*., 2018). Productivity is substantially lower than in Côte d'Ivoire (580 kg/hectare) or Indonesia (770 kg/hectare) (World Bank, 2013). Key factors contributing to low yields are pests and disease and the advanced age of many cocoa trees. In response, COCOBOD has instituted a renovation and rehabilitation (R&R) programme for 2018–2028 that includes the improved management of existing trees, the planting of new trees on existing farms, to implement improved agroforestry measures and promote the appropriate use of fertilizer and pesticide application, and to use improved seedlings (Bockel, Gopal and Ouédraogo, 2021). A recent study showed that this R&R programme could raise gross income per farmer by almost 38 percent and create about 278 000 additional jobs (Bockel, Gopal and Ouédraogo, 2021).

The cocoa pods are ready for harvesting when they become deep yellow for most varieties and each pod yields about 20 to 50 beans. There are two harvesting seasons for cocoa in Ghana, with the main crop being harvested from September to March and the mid-crop from May to August. During harvesting, ripe cocoa pods are cut from the tree, broken open and the extracted beans are then fermented for some days. Fermentation is achieved by placing beans in a heap under banana leaves with the layer of pulp that naturally surrounds the beans heating up and fermenting the beans. This process takes up to six days with frequent manual turning after which the beans are dried on raised bamboo mats for a week to ten days or longer depending on the weather conditions, yielding what is described as the classic 'West African' cocoa flavor (Kolavalli and Vigneri, 2011). COCOBOD argues that "Good fermentation of Ghana's cocoa has unarguably remained the cardinal reason for which the country's beans have become the benchmark for measuring cocoa the world over" (Ghana Cocoa Board, 2022).

After drying, the beans are bagged and transported to a local buying station. There the beans are graded for size and quality by the agent of a Licensed Buying Company (LBC) who also ensures that the beans have been properly dried after fermentation (World Bank, 2013).[5] Those beans meeting the necessary standards are sold to the LBC at a minimum producer price set by the Producer Price Review Committee (PPRC). The bags of cocoa beans are then trucked to LBC owned warehouses in the districts where the cocoa is again weighed and tested for humidity levels by the QCC. After testing, the accepted cocoa is taken into the warehouse and the LBC receives a receipt from the CMC. There are currently over 44 active LBCs with the largest accounting for 29 percent of the market and the top 3 for about 54 percent of the market (GCB, 2022). From the LBC warehouses, the cocoa is transported by private trucking companies, at rates fixed by the PPRC, to either local processors, or to one of three CMC operated storage centers located at Kaase, Tema, and Takoradi, from where the cocoa is exported. At the point of transfer from the LBCs to the CMC, the cocoa is again checked by the QCC and those batches that are accepted are given a 'purity certificate.' A final 'check-sampling' is conducted for all consignments prior to shipment to ensure that only good quality cocoa is exported.

The output of local processing are typically semi-finished goods (cocoa paste/liquor, cocoa butter, cocoa powder) which are then exported or consumed locally. The processing segment is dominated by three multinationals, Cargill, Barry Callebaut and Olam, which together have a market share of 71 percent (AsokoInsight, 2022).

The extensive quality control effected throughout the supply chain results in a higher quality cocoa because of the slightly higher-than-average fat content, the low levels of debris in beans, and low levels of bean defects. Ultimately, this results in higher cocoa butter yields and a cocoa liquor flavour preferred by some end users (Kolavalli and Vigneri, 2011). Because of its higher quality, Ghanaian cocoa earns a price premium of between 7 to 10 percent (Gockowski *et al*., 2011), although other estimates suggest a lower premium of 3 to 5 percent relative to Côte d'Ivoire (Gilbert, 2009). In addition, the high quality of Ghana's cocoa and the good reputation of COCOBOD allows the CMC to sell 60 to 80 percent of its cocoa on forward markets at a fixed price with international merchants and cocoa processors, thus hedging against price volatility and protecting producers from short-term volatility in world prices (Staritz *et al*., 2023; World Bank, 2013).

[5] LBCs are private companies, regulated by COCOBOD.

3. The impact of the COVID-19 pandemic

Ghana's GDP grew at an average annual rate of 6.8 percent between 2010 and 2019, and GDP per capita grew at 4.3 percent per year on average during this period (World Bank, 2023). This strong growth helped reduce poverty from 24.2 percent in 2012 to 10.7 percent in 2021 (AfDB, 2022).

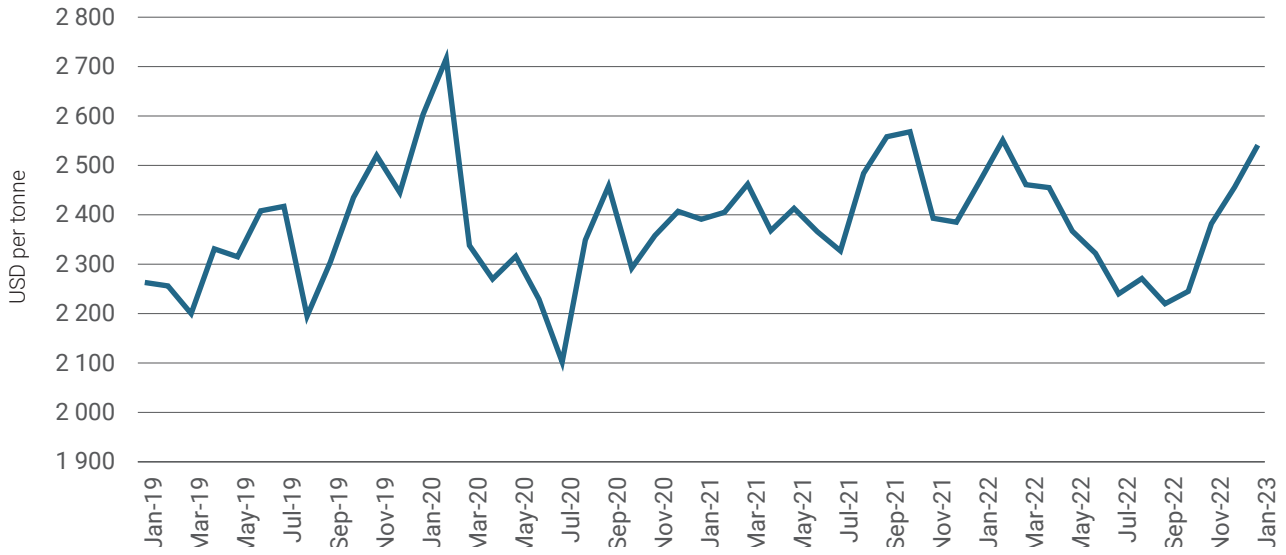
With the first cases of COVID-19 recorded in early March, the government of Ghana closed all borders and imposed a partial lockdown in the Greater Accra and Greater Kumasi regions of the country, to prevent transmission of the virus. The measures curtailed people's movement and assembly and, more generally, curtailed labour migration in the country. An estimated 42 000 people, mostly small-scale traders, day-workers and wage-labourers, lost their jobs by April. In addition, a significant number of salaried workers lost their jobs, and over 400 000 businessmen and women lost their businesses by July 2020 (Aduhene and Osei-Assibey, 2021). The economic disruption was significant, with GDP growth slowing to 0.5 percent and GDP per capita falling by 1.5 percent. Although 2021 saw a significant recovery, with GDP growth of 5.4 percent and GDP per capita growth of 3.3 percent, the costs to individuals and the country continue to be felt (World Bank, 2023).

In 2020, the harvesting and internal marketing of cocoa was mostly completed by the time COVID-19 restrictions were implemented. Nevertheless, the cocoa sector was impacted through the temporary disruption of international supply chains due to port restrictions as well as by the fall in demand for chocolate products. The drop in international demand led to a fall in international cocoa prices from just over USD 2 700 per tonne in February 2020 to USD 2 100 by July 2020, thereafter recovering (**Figure 3**). Aggregate data (see **Figure 1**) show that the export quantity fell from 644 thousand tonnes in 2019 to 521 thousand tonnes in 2020 and then recovered to 586 thousand tonnes in 2021. The drop was more marked in value terms: cocoa exports were USD 1.9 billion in 2019 but then fell to USD 1.3 billion in 2020, to then recover to USD 1.6 billion in 2021. Weak demand from international buyers left COCOBOD with "difficulties with getting an annual syndicated loan that is collateralized with forward sales and provides working capital to local traders in Ghana" (Cromwell, 2021). Despite these adverse conditions in the international market, COCOBOD has maintained the producer price at Ghana Cedi 10 560 per tonne, about 87 percent of the FOB value (GCB, 2022). Nevertheless there are indications that Côte d'Ivoire and Ghana's Living Income Differential has been undermined by these market pressures (Nartey, 2021; Maile *et al*., 2022) .

Lower export earnings impact Ghana negatively by reducing the availability of foreign exchange and government revenue. This weakened the economic resilience of the country and with the

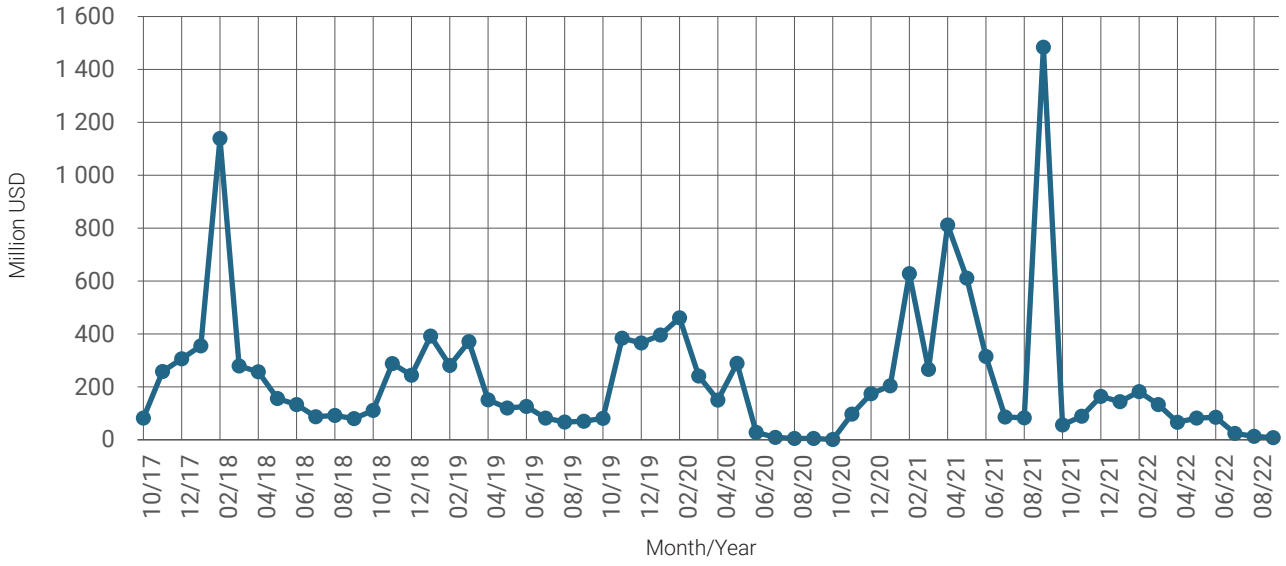
strengthening dollar, capital flight and the Russian war on Ukraine, the country faced high levels of inflation, substantial currency weakening and ultimately the need to request support from the International Monetary Fund.

Figure 3. Monthly international cocoa price, USD per tonne, January 2019–January 2023



Note: Monthly average of the International Cocoa Organization (ICCO) daily price for cocoa beans. The daily price is the average of the quotations of the nearest three active futures trading months on Intercontinental Exchange (ICE) Futures Europe (London) and ICE Futures US (New York) at the time of London close.
Source: ICCO. 2023. Cocoa Daily Prices (Monthly average). Abidjan, Côte d'Ivoire, ICCO. [Cited February 2023] https://www.icco.org/statistics/

Figure 4. Total value of cocoa exports by Ghana (million USD), October 2017–August 2022



Source: TDM. 2023. Trade Data Monitor – Monthly. [Cited February 2023]. Geneva, Switzerland, Trade Data Monitor. https://tradedatamonitor.com/

The answers to the section of the questionnaire that focused specifically on the impact of the COVID-19 pandemic (**Figure 5**) highlight that the impact of the COVID 19 pandemic on the cocoa supply chain in Ghana in the 2019/20 market season (October/September) were mainly on poverty and food security, the availability of labour, the availability of inputs, and the reduction of exports. Fifty three percent of the respondents consider that the farmer groups (cooperatives) helped to alleviate the impact of the pandemic (i.e. coordination to cope with higher labour costs or information campaigns on hygiene and physical distancing requirements during the pandemic).

For the 2020/21 market season, according to respondents the largest impact of the pandemic was again on poverty and food security. The second largest impact was also on labour, however now followed by the impact on the conditions of producer contracts: i.e. late payments by the government and buying companies due to subdued international demand for cocoa. Again, cooperatives were considered an asset in dealing with the challenges posed by the pandemic. Perhaps surprisingly, poverty and food insecurity rose even though producer prices were kept stable. Evidence from two surveys conducted in Asunafo South district in Ahafo Region and Suhum district in Eastern region indicate that half of the respondent households had suffered an income loss equal to 21 percent of the average annual household income (within the sample). The reasons identified for this income loss were the high cost of hired labour (when labour was actually available) and income loss from non-cocoa activities (ICI, 2022).

Figure 5. The impact of the COVID 19 pandemic in the seasons 2019/20 and 2020/21

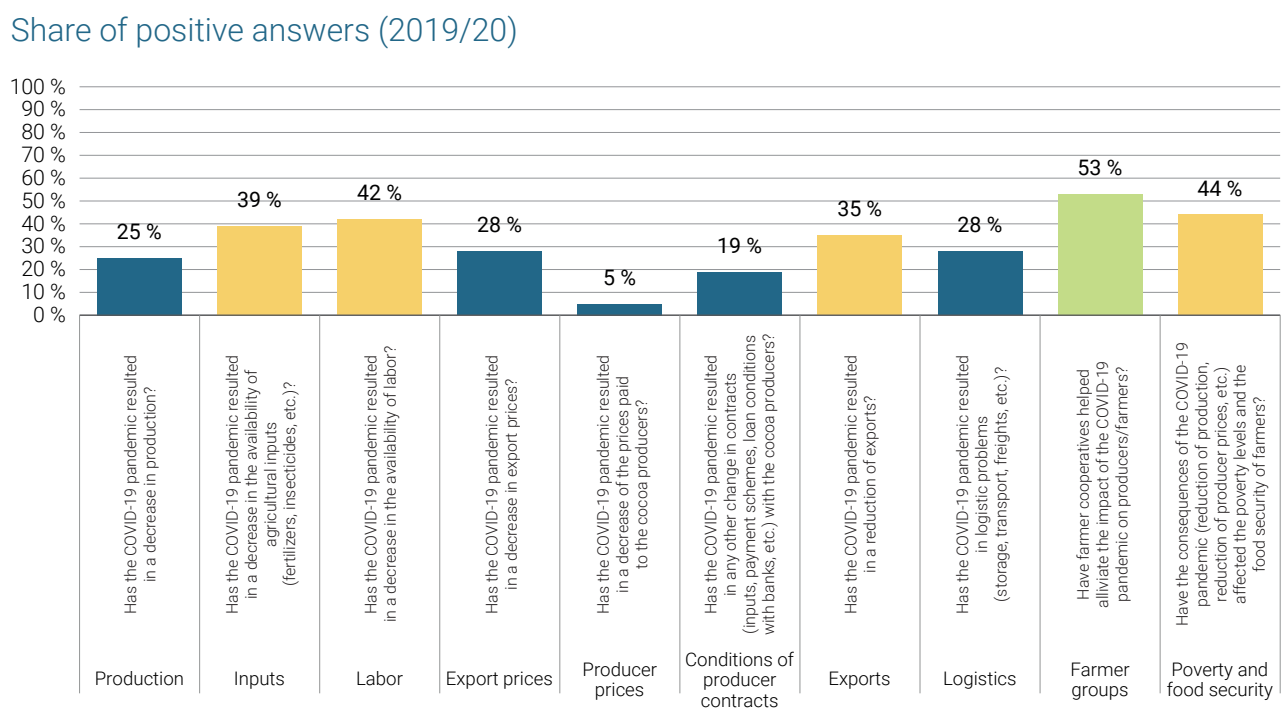
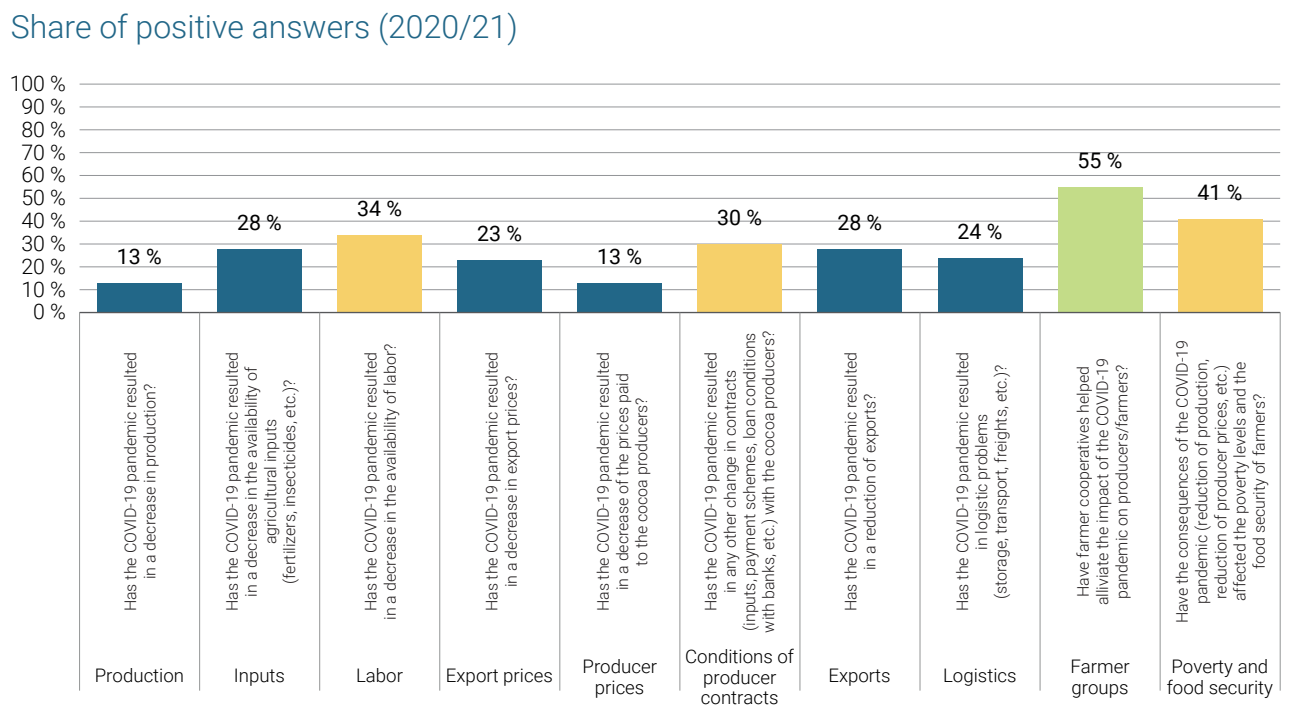


Figure 5. The impact of the COVID 19 pandemic in the seasons 2019/20 and 2020/21



Source: Authors own elaboration based on questionnaire results.

4. Identified bottlenecks

The questionnaire had one section dedicated to the identification of the major bottlenecks in the cocoa supply chain in Ghana. The questions were elaborated based on the theory of change developed by Steinbach *et al*., (2017) that identifies the key pathways associated with absorptive, adaptive and transformative resilience. They focused on how changes in five livelihood capitals (natural, physical, human, social and financial) serve to link a household's wellbeing with their capacity to respond to climate change. We took the five livelihood capitals and identified specific elements of the cocoa supply chain, which correspond to each of the livelihood capitals. For example, for natural capital we identified 'soil fertility', 'soil degradation', and 'pests' as some of the specific elements. Then for each of the identified elements, we asked the questionnaire respondents whether these were constraining the development of resilient cocoa supply chains. To capture the respondent's evaluations, we used a scale with four options: '1 = not a constraining factor', '2 = slightly constraining factor', '3 = medium constraining factor', and '4 = strongly constraining factor'. In a second step, we convert the 1 – 4 scale to a 1 – 10 scale, as used in the figures. The respondents also had the possibility to add comments to each of their answers, to justify or explain additional details of their assessments.

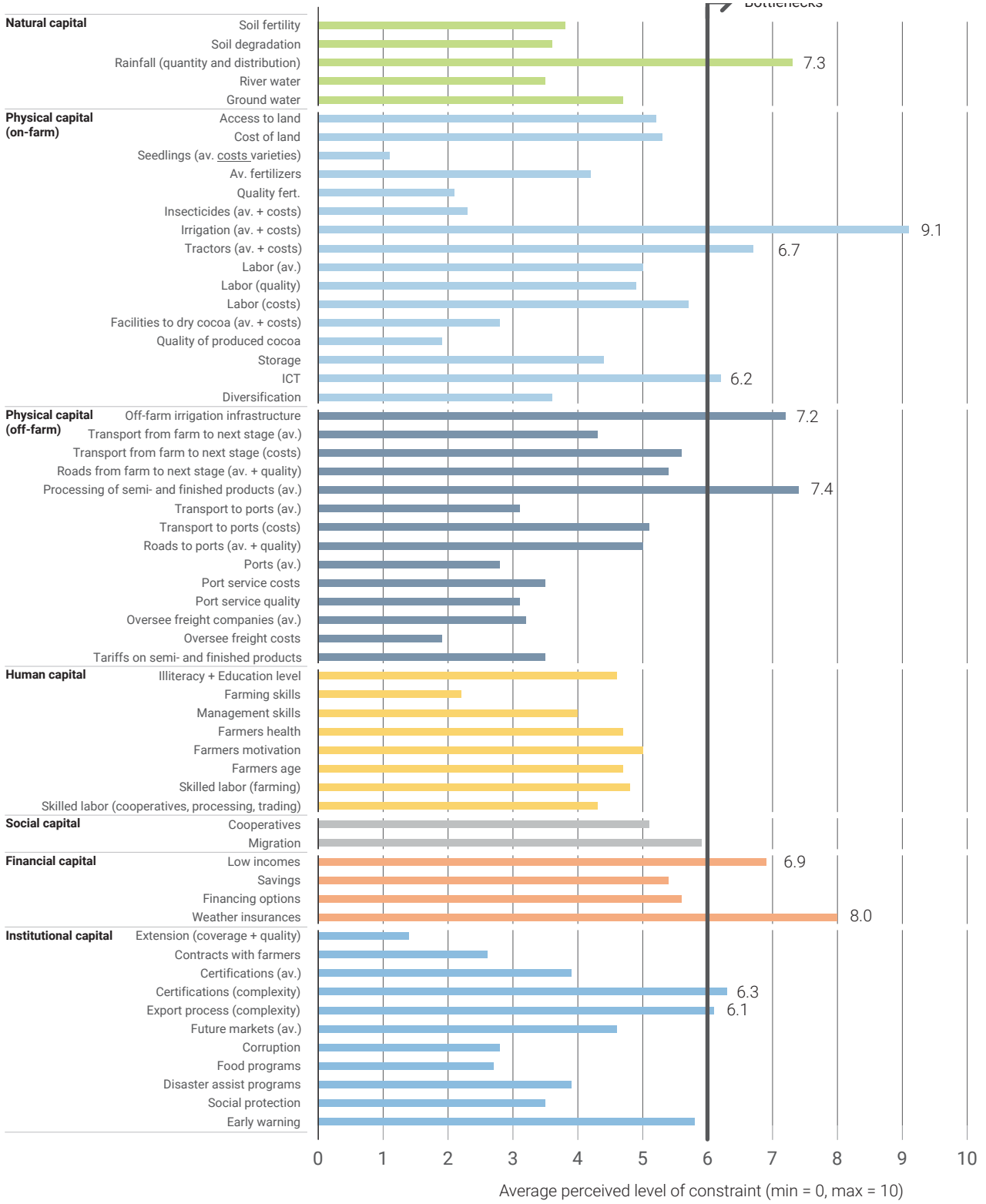
When explaining what the livelihood capitals are, Steinbach *et al*., (2017) state that poverty is not just a lack of income, that people rely on a combination of capital assets to build sustainable livelihoods. Based on Steinbach *et al*., (2017) and the extensions applied in this study, the livelihood capital categories adapted to the cocoa supply chain in Ghana and used in the questionnaire can be described as follows:

- **Natural capital:** value that resides in natural resources to produce cocoa.
- **Physical capital:** value derived from durable and non-durable infrastructure, which contributes to the production process and export of cocoa.
- **Human capital:** value derived from skills training, consisting of people's health, skills, knowledge, and motivation.
- **Social capital:** value derived from social networks and institutions that improve people's social status and help them maintain and develop human capital in partnership with others.
- **Financial capital:** value derived from income sources, assets, and consumption patterns, which enables households to own or trade other capitals.

Two groups of strong constraints to resilience (bottlenecks) were identified: The first group, with the highest level of perceived constraints (above 8 in the x axis scale, **Figure 6**), contains two elements: (i) low availability and high costs of on-farm irrigation technologies, and (ii) low availability of agricultural and weather insurances. The second group, with slightly lower perceived levels of constraint (above 6 but below 8 in the x axis scale), are: (i) low domestic generation of value added (low processing capacities of semi finished and finished products, e.g. cocoa powder or solid plain chocolate), (ii) irregular rainfall (quantity and distribution), (iii) low availability of off farm irrigation infrastructure, (iv) low incomes, (v) low availability and high costs of tractors, (vi) high complexity of certification schemes, (vii) the lack of use of information and communication technologies (ICT), and (viii) the complexity of the export process.

The perception of low incomes as a constraint is in part related to the low level of productivity of cocoa farming in Ghana, which we return to below.

Figure 6. Bottlenecks in the cocoa supply chain in Ghana (average level of constraint)



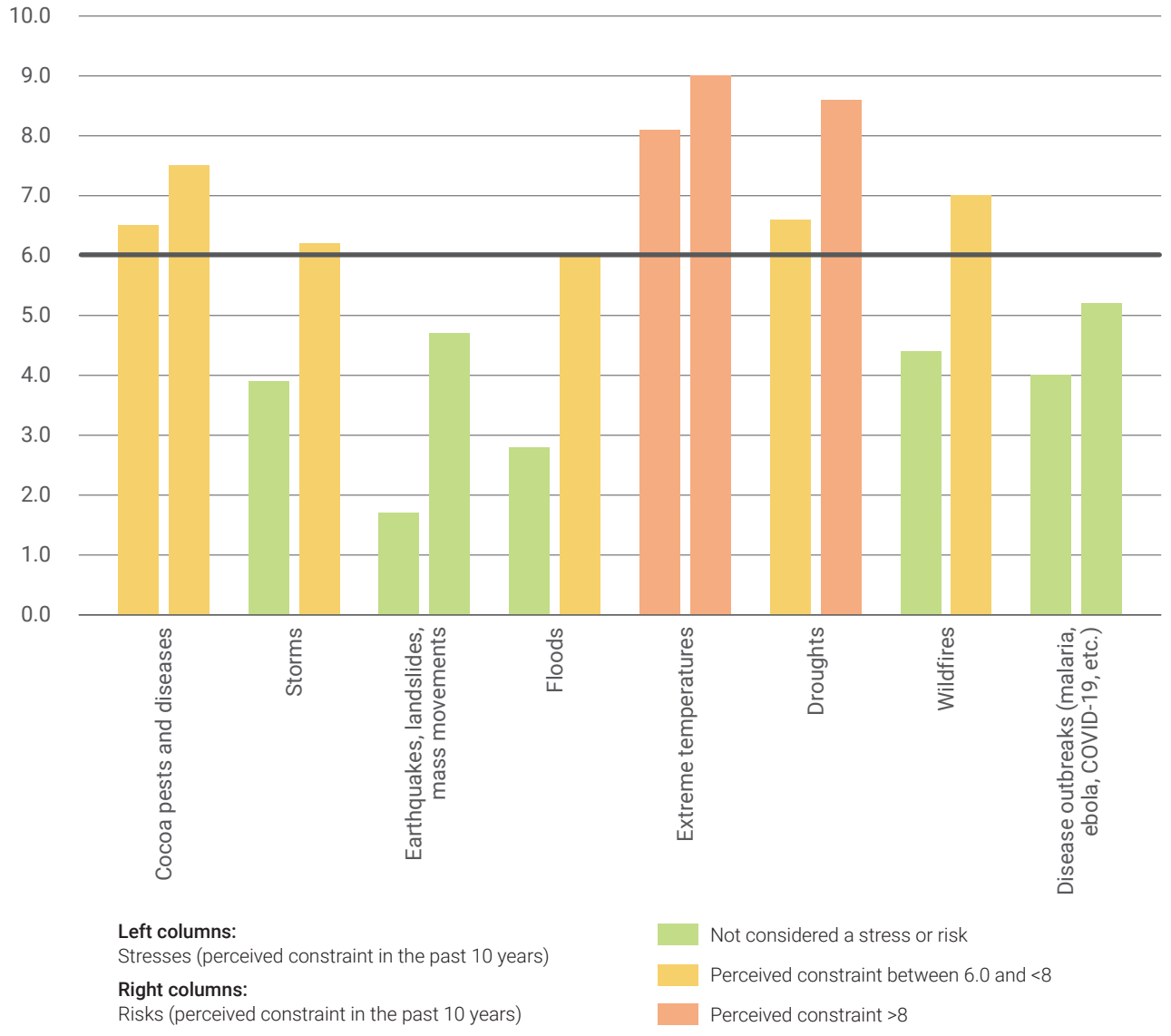
Note: Level 6 is arbitrarily chosen as the threshold used to define the bottlenecks. It is larger than the median in the 10 point scale and not too high to exclude too many factors. The average level of constraint is calculated using the following approach: the respondents assigned the level of constraint to each element using a 4 step scale: not constraining, slightly, medium, and strongly constraining. To compute the numeral average, the categories were associated with the values 0.0, 3.3, 6.6 and 10.0 correspondingly.

Source: Authors own elaboration based on questionnaire results.

5. Identified stresses and risks

The questionnaire also included a section on the perceived stresses and risks facing the cocoa supply chain. The assessment of stresses and risks identified the following elements by their order of the magnitude of the perceived negative impact on the cocoa supply chain (**Figure 7**). Stresses that had or have an impact on production are extreme temperatures, droughts, and cocoa pests and diseases. Risks that had or have an impact on production (possible future shocks) are extreme temperatures, droughts, cocoa pests and diseases, wildfires, storms and floods.

Figure 7. Perceived impact (and possible future impact) of stresses and risks in the cocoa supply chain in Ghana



Source: Authors own elaboration based on questionnaire results.

A (World Bank, 2013) study identified crop diseases (black pod disease and swollen root virus) and insect pests (capsids) as posing by far the greatest risk to the cocoa supply chain in Ghana. One study estimates that swollen root virus and capsids reduce yields in Ghana by 40 percent and 25 percent, respectively (N'Guessan, 2013; Padi and Owusu, 2003). It is perhaps an indication of the increased relevance of climate change and the associated natural disasters (storms, floods, extreme temperatures, droughts and wildfires) that the results in **Figure 7** show that although pests and diseases remain significant stressors and risks, extreme temperatures are today a more important stressor and together with droughts are considered the highest risk factors. Aligned with the finding that extreme temperatures and droughts are important stressors and risks, we note that rainfall, irrigation, and weather insurance was already identified as a significant constraint to resilience in **Figure 6**.

The most common and damaging pests and diseases are capsids and black pod disease and swollen root virus. As noted above, the losses associated with these pests and diseases can be very large but can be reduced substantially with efficient application of fungicides or insecticides and tree management. The (World Bank, 2013, p. 5) study found that improved pest management required timely access to spraying and called for the introduction of "'Integrated Pest Management (IPM) friendly tree architecture into the cocoa gardens themselves." With regard to the management of mirids (capsids), the study found, at that time, that there was room for considerably improved implementation of spraying as managed by CODAPEC.

Cocoa farming in Ghana is marked by low productivity. As a direct consequence, profit margins are very low, and low incomes are identified as an important bottleneck in **Figure 2**. The important constraints and risks identified in **Figure 7**, in particular temperature extremes and droughts, amplify this low productivity and prevents farmers from investing in more advanced farming practices, or from the use of fertilizers and pesticides (Hainmueller, Hiscox and Tampe, 2011). In turn, this might indirectly contribute to increased conversion of forests into cocoa farms, as expanding production is often seen as the way out of the low productivity and low-income trap.

6. Recommendations to increase resilience

The analysis presented in this study shows that extreme temperatures, droughts, and pests and disease are the most important risks and stressors that cocoa farmers face. This is also reflected in what stakeholders considered the most important bottlenecks, i.e. inadequate rainfall, the lack of irrigation and weather insurances, and limited domestic processing capacity. Climate change is an important driver of some of these risks and stressors. The recommendations, detailed below, therefore focus on climate information systems, irrigation infrastructure, agroforestry, early warning systems, pest and disease management, weather insurances and credit. Some of these interventions are also essential to improve yields, but it is imperative that additional specific investments to improve yields, such as agroforestry, research & extension, and the availability and affordability of fertilizer and other inputs are also made. Improving yields is central to the longer-term sustainability of the sector.

The resilience capacity focused recommendations are the following:

Build preventive and anticipative resilience. The questionnaires highlight an expected increase in the impact from risks and thus also the importance of preventive and anticipative capacities.

i) Invest in Climate Information Services (CIS) that help farmers make informed decisions and thereby raise yields with few additional efforts (Röhrig *et al*., 2021). CIS represent a highly beneficial climate change adaptation strategy with a relatively (when compared to related investments) small scale investment and a positive return, but it requires high institutional support for optimal application: communication needs to be timely, actionable and targeted to end user needs (Röhrig *et al*., 2021).

ii) Promote dynamic agroforestry as a production system option reducing pest pressure (through higher biodiversity), providing income diversification, increasing the variety of food groups available to households (promoting healthier, more nutritious diets), and increasing the fertility of soils and reducing their degradation. Agroforestry also plays an important role in raising yields, which we return to under transformative capacity below.

iii) Design and implement customized early warning systems for the types of risks which can be prevented, such as wildfires, and to a certain extent also to pests and diseases.

Build absorptive resilience through:

i) Customized weather insurances that provide a safety net for farmers who strongly depend on income from cocoa, contributing to food security and avoiding falling into poverty.

ii) Continuing with the implementation of the LID to combat low incomes and poverty.

iii) Customized financial options to reduce the vulnerability to low income periods and to allow for the purchase and access to machinery (tractors).

Build adaptive resilience through:

i) Irrigation programmes. These have the capacity of addressing the strongest stresses and risks (extreme temperatures, droughts, and irregular rainfall) and have the advantage of presenting a high stakeholder interest. However, options are often costly. Irrigation programmes must be accompanied by thorough institutional management ensuring the responsible use of the resource. We note that irrigation would also strengthen absorptive capacity.

ii) The promotion of information campaigns and the creation of institutions which facilitate the transmission of knowledge on export issues (certification schemes and export processes).

Build transformative resilience through:

i) Improving the capacity for the processing of cocoa beans and the use of ICT systems. Increasing domestic processing capacities would diversify output markets and result in the generation of value, which would go back into the cocoa supply chain system.

ii) Improved ICT systems, which, similarly to the CIS, help farmers to make informed decisions and can make business processes more efficient (Ahoa, Kassahun and Tekinerdogan, 2020).

iii) Raising yields through improved pest and disease management, investment in irrigation, and ensuring the availability and accessibility of inputs such as fertilizer and tractors. Capsid control, black pod control, fertilizer application and pruning have been found to effectively increase yields significantly (Kongor *et al*., 2018). It is also essential to continue to invest in research and development of new varieties that are more responsive to fertilizer and that are more resistant to drought, temperature extremes, and pests and diseases. Low productivity means low incomes for cocoa farming households, which in turn discourages investments and the use of commercial inputs, impeding the sector's long-term sustainability. Recognising and addressing this issue, COCOBOD has instituted a renovation and rehabilitation (R&R) programme for 2018–2028 that includes the improved management of existing trees, the planting of new trees on existing farms, to implement improved agroforestry measures and promote the appropriate use of fertilizer and pesticide application, and to use improved seedlings (Bockel, Gopal and Ouédraogo, 2021). A recent study showed that this R&R programme could raise gross income per farmer by almost 38 percent and create an additional 277 669 jobs (Bockel, Gopal and Ouédraogo, 2021).

References

Abbadi, S., Senadza, B., Lieuw-Kie-Song, M. & Abebe, H. 2019. Assessing the employment effects of processing cocoa in Ghana. Puplication Series - Strengthen. Geneva, International Labour Organization. https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/publication/wcms_673136.pdf

Aduhene, D.T. & Osei-Assibey, E. 2021. Socio-economic impact of COVID-19 on Ghana's economy: challenges and prospects. International Journal of Social Economics, 48(4): 543–556.

AfDB. 2022. Transforming Ghana. Country Results Brief 2012-2021. Abidjan, Côte d'Ivoire, African Development Bank.

Ahoa, E., Kassahun, A. & Tekinerdogan, B. 2020. Business processes and information systems in the Ghana cocoa supply chain: A survey study. NJAS-Wageningen Journal of Life Sciences, 92(100323). https://doi.org/https://doi.org/10.1016/j.njas.2020.100323

AsokoInsight. 2022. Ghana's Cocoa Value Chain. London, UK, Asoko Insight.

Bockel, L., Gopal, P. & Ouédraogo, S.A. 2021. Preliminary impact appraisal of cocoa value chain rehabilitation in Ghana: 2018-2028. Accra, Ghana, FAO and COCOBOD.

Boysen, O., Ferrari, E., Nechifor, N. & Tillie, P. 2021. Impacts of the Cocoa Living Income Differential Policy in Ghana and Côte d'Ivoire. Brussels, Joint Research Centre, Publications Office, European Commission.

Cobbina, J. 2015. Technical Efficiency of Cocoa Production in Ghana: A Case Study of Upper Denkyira East Municipality. Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. https://ir.knust.edu.gh/handle/123456789/6880

Cromwell, A. 2021. Cocobod admits to owing LBCs; pledges to settle debt in 7 days. MyJoyOnline, June 2021. https://www.myjoyonline.com/cocobod-admits-to-owing-lbcs-pledges-to-settle-debt-in-7-days/

Duho, K.C.T. 2021. First Year of the Living Income Differential in Ghana's Cocoa Sector: Critical Sustainability and Livelihood Issues. SSRN Electronic Journal. https://doi.org/http://dx.doi.org/10.2139/ssrn.3931201

GCB. 2022. Sector Industry Analysis-Cocoa Sector Report 2022. Accra, Ghana, Strategy & Research Department, GCB Bank.

Ghana Cocoa Board. 2022. Our premium quality cocoa: the thick & think to a taste of difference. Accra, Ghana, COCOBOD. https://cocobod.gh/news/our-premium-quality-cocoa-the-thick-thin-to-a-taste-of-difference

Gilbert, C.L. 2009. Cocoa Market Liberalization in Retrospect. Review of Business and Economics, 54: 294–312.

Gockowski, J., Afari-Sefa, V., Sarpong, D.B., Osei-Asare, Y.B. & Dziwornu, A.K. 2011. Increasing income of Ghanaian cocoa farmers: is introduction of fine flavour cocoa a viable alternative. Quarterly Journal of International Agriculture, 50: 175–200.

Hainmueller, J., Hiscox, M.J. & Tampe, M. 2011. Sustainable Development for Cocoa Farmers in Ghana. IGC Working Paper. London, UK.

ICI. 2022. Cash transfers, resilience and child labour in Ghana. Châtelaine, Switzerland, International Cocoa Initiative.

IMF. 2021. World Economic Outlook Database: October 2021. Washington, DC, International Monetary Fund.

Kolavalli, S. & Vigneri, M. 2011. Cocoa in Ghana: Shaping the Success of an Economy. In: P. Chuhan-Pole & A. Manka, eds. Yes, Africa Can: Success Stories from a Dynamic Continent. pp. 201–217. Washington, DC, World Bank.

Kongor, J.E., DeSteur, H., Van de Walle, D., Gellynck, X., Ohene Afoakwa, E., Boeckx, P. & Dewettinck, K. 2018. Constraints for future cocoa production in Ghana. Agroforestry Systems, 92: 1373–1385.

Maile, F., Tröster, B., Staritz, C. & Grumiller, J. 2022. Who to blame? The rough start for living income cocoa prices in Côte d'Ivoire and Ghana. Bonn, Germany, European Association of Development Research and Training Institutes. https://www.developmentresearch.eu/?m=202206

N'Guessan, K.F. 2013. Major pests and diseases, situations and damage assessment, protocols in Côte d'Ivoire. Accra, Ghana, Presentation at regional workshop on integrated management of cocoa pests and pathogens in Africa, 15 to 18 April 2013.

Nartey, K. 2021. Chocolate companies evading payment of Living Income Differential for Ghanaian and Ivorian cocoa farmers - CSOs. myjoyonline, 19 March 2021. https://www.myjoyonline.com/chocolate-companies-evading-payment-of-living-income-differential-for-ghanaian-and-ivorian-cocoa-farmers-csos/

Opoku-Ameyaw, K., Baah, F., Gyedu-Akoto, E., Anchirinah, V., Dzahini-Obiatey, H.K., Cudjoe, A.R., Acquay, S. & Opoku, S.Y. 2010. Cocoa Manual - A Source Book for Sustainable Cocoa Production. Tafo, Ghana, Cocoa Research Institute of Ghana.

Padi, B. & Owusu, G.K. 2003. Towards an integrated pest management for sustainable cocoa produciton in Ghana. Washington, DC, Smithsonian Institute. http://nationalzoo.sci.edu/scbi./ migratorybirds/research/cacao/padi.cfm.

Peprah, K. 2015. Sustainability of cocoa farmers' livelihoods: A case study of Asunafo District, Ghana. Sustainable Production and Consumption, 4: 2–15.

Röhrig, F., Gloy, N., von Loeben, S. Arumugam, P. Aschenbrenner, P., Baek, H., Bado, I., Chemura, A. Habtemariam, L. Kaufmann, J., Koch, H. et al. 2021. Executive Summary: Climate Risk Analysis for Identifying and Weighing Adaptation Strategies in Burkina Faso's Agricultural Sector. A summary elaborated from a scientific report prepared by the Potsdam Institute for Climate Impact Research (PIK) in coopera. https://www.pik-potsdam.de/en/institute/departments/climate-resilience/projects/project-pages/agrica/cra_burkina-faso_executive-summary

Staritz, C., Tröster, B., Grumiller, J. & Maile, F. 2023. Price-Setting Power in Global Value Chains: The Cases of Price Stabilisation in the Cocoa Sectors in Côte d'Ivoire and Ghana. The European Journal of Development Research, 35: 840–868. https://doi.org/https://doi.org/10.1057/s41287-022-00543-z

Steinbach, D., Kaur, N., Manuel, C., Saigal, S., Agrawal, A., Panjiyar, A. & Barnwal, A. 2017. Building resilience to climate change: MGNREGS, drought and flooding in Odisha. London, International Institute for Environment and Development. http://pubs.iied.org/10187IIED

Vigneri, M. & Kolavalli, S. 2018. Growth through pricing policy: The case of cocoa in Ghana. Background paper to the UNCTAD-FAO Commodities and Development Report 2017 Commodity markets, economic growth and development. Rome, Food and Agriculture Organization.

van Vliet, J.A., Slingerland, M.A., Waarts, Y.R. & Giller, K.E. 2021. A Living Income for Cocoa Producers in Côte d'Ivoire and Ghana? Frontiers in Sustainable Food Systems, 5(732831). https://doi.org/https://doi.org/10.3389/fsufs.2021.732831

World Bank. 2013. Ghana: Cocoa Supply Chain Risk Assessment. Washington, DC, World Bank. https://openknowledge.worldbank.org/handle/10986/16516 License: CC BY 3.0 IGO

World Bank. 2023. World Development Indicators. Washington, DC, World Bank. https://databank.worldbank.org/source/world-development-indicators

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