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Resilience of the Cocoa Value Chain in Ghana

Final Report

Prepared by: Jonas Joerin, Evans Dawoe, Pius Kruetli, Kenza Benabderrazik, Samuel Hauenstein, Samuel Aning, Akosua Pomaa Asabere, Braida Thom, William Thompson, Kebebew Assefa, Johan Six

KNUST

World Food System Center

About the Initiative

The Assessing and Enhancing the Resilience of the Tef and Cocoa value chain (AETRTCvc) project is part of the flagship project "Enhancing Resilience in Food Systems" of the ETH Zurich World Food System Centre. The AERTCvc project is led in joint collaboration between the Sustainable Agroecosystems group, the TdLab and the Climate Policy group of ETH Zurich as well as the Kwame Nkrumah University of Science and Technology in Kumasi in Ghana and the Ethiopian Institute of Agricultural Research in Debre Zeit in Ethiopia. This research project is funded by a COOP World Food System Grant.

Title

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Title picture

Cocoa farm in Juaboso, Western Region, Ghana

Layout

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Preface

This research project was conducted in close collaboration between the Kwame Nkrumah University of Science and Technology (KNUST) and ETH Zurich (Sustainable Agroecosystems [SAE], Climate Policy [CP] groups and the Transdisciplinarity Lab [TdLab]). The collaboration between ETH Zurich and KNUST exists since 2015. Our first joint project included a pilot study to qualitatively assess the cocoa value chain in Ghana. This pilot study was possible thanks to a kick-start grant from the University of Basel and financial support from Bühler (a major milling company in Switzerland). The objective was to map-out the system and identify the key actors of the cocoa value chain as well as apply the SAE resilience guidelines.

Based on initial findings from this pilot project and a similar pilot study on tef in Ethiopia, we applied in late 2015 for a World Food Systems Grant, funded by COOP (a major Swiss retailer), to compare the resilience of the cocoa and tef value chains in Ghana, respectively in Ethiopia. We received approval in early 2016 and started the project in the middle of 2016 (Figure 1).

In both case studies, the objective was to follow a transdisciplinary research approach and therefore to co-produce knowledge in close collaboration with local actors who are directly involved in both value chains. After having previously conducted a pilot study in Ghana, we established in a first step a transdisciplinary process together with key actors of the cocoa value chain. In our first workshop in January 2017, 8 scientists and 17 stakeholders participated, including private input suppliers, farmers, transporters, Licensed Buying Companies (LBCs), processors, retailers, a consumer representative, different units/subsidiaries (Cocoa Research Institute of Ghana, Cocoa Health and Extension Division, Seed Production Division, Quality Control Company and Cocoa Marketing Company) of the Ghana Cocoa Board (COCOBOD) and NGOs.

Subsequently, we conducted a resilience assessment in form of a survey among key value chain actors and validated the results with stakeholders from the whole value chains. In October 2017, we developed together with our stakeholders action plans for the production (farmers) and post-pro-

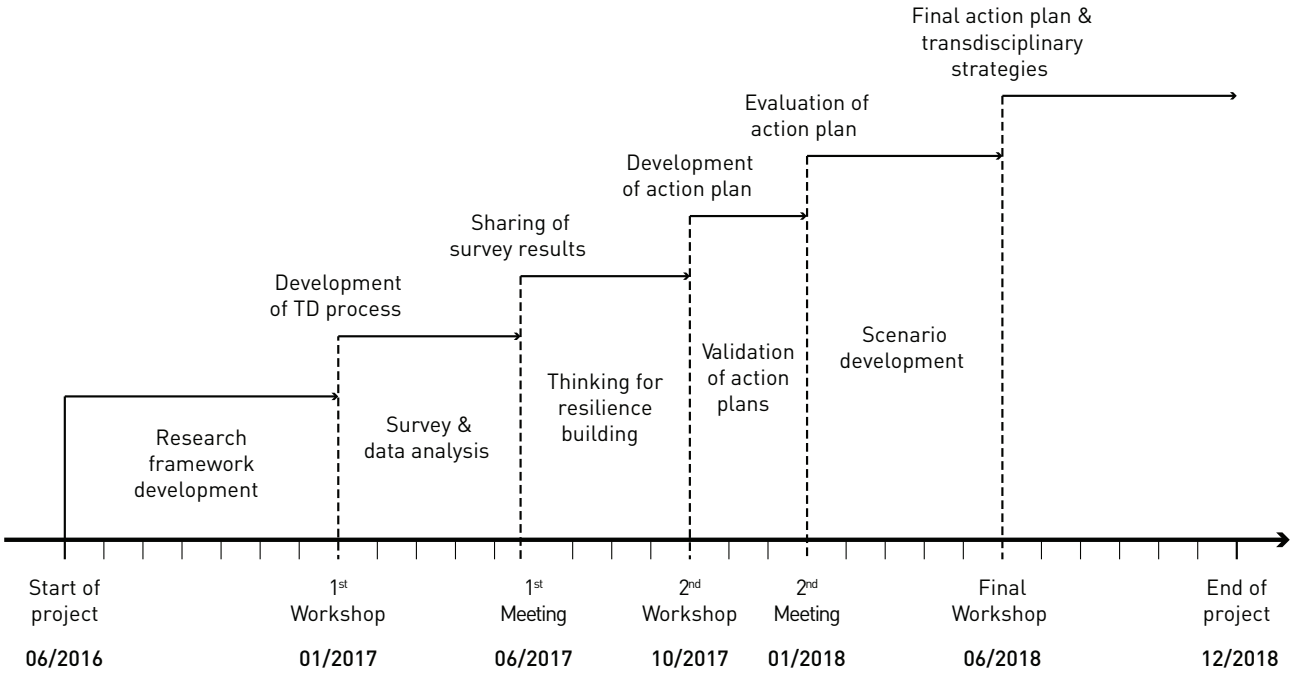

Figure 1
Project timeline

duction groups (LBCs, processors and retailers). Our stakeholders then validated these draft action plans with their peers to verify if the proposed measures for building and enhancing resilience in their value chain activity are relevant, appropriate and feasible.

In a final step, we developed action plans to identify pathways for building resilience in the cocoa value chain in Ghana. Again, 32 stakeholders from the whole cocoa value chain joined at the final workshop.

This report provides a summary of this research project and targets practitioners of the cocoa value chain, experts and policy-makers. The results and findings of this study highlight areas where intervention is needed to enhance the resilience of the cocoa value chain in Ghana. However, despite focusing on Ghana, some of the problems and solutions identified are of relevance to actors outside of Ghana, especially Ivory Coast.

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Amos Quaye (CRIG COCOBOD)
Okyere Gyinah Prince (Input supplier)
Adam Sayuba (Farmer)
Edward Amankwah (K-Badu Agrochemicals)
Frank Owusu (K-Badu Agrochemicals)
Kote Seydou (Input supplier)
Albert Yankson (Farmer)

Executive Summary

The emergence of more frequent and intense stresses and shocks challenge the functioning of stakeholders in food systems. Shocks related to climate change (e.g. drought) and market changes are of growing concern to stakeholders in the cocoa value chain in Ghana. While cocoa farmers are directly suffering from a drought shock in form of yield losses, other activities before and after the production suffer from cascading impacts. A reduced yield means for them less trading and processing opportunities. Accordingly, it requires them to be flexible to respond to a sudden change.

To display how stakeholders in the cocoa value chain in Ghana deal with shocks, we adopted the concept of resilience and combined it with a transdisciplinary research approach. In essence, this means that the research team and the stakeholders jointly identified areas of concern and actions to be taken to enhance resilience.

This report summarises the key steps, results and lessons learned from this research project that focuses on assessing and building resilience among stakeholders of the cocoa value chain in Ghana to drought shock. We identified the following key issues and findings:

- The strong role of COCOBOD to regulate and finance different activities of the cocoa value chain in Ghana leads to dependency and has implications on the resilience of stakeholders. The level of functioning of cocoa farmers, LBCs and cocoa processors directly depends on decisions made by COCOBOD. For example, COCOBOD provides a certain amount of free inputs to cocoa farmers. If this amount is insufficient, cocoa farmers may lack funding to purchase additional inputs from private input suppliers.

- Apart from cocoa farmers, stakeholders have not yet actively incorporated the possibility of a drought shock into their business activities. Although, stakeholders do have a certain robustness to avoid a drought, they rely almost exclusively on financial resources to absorb, recover and adapt to it. In particular, cocoa processors rely most on a continuous stable and safe (high quality) supply of cocoa beans. In contrast, the income of cocoa farmers relies not only on the production of cocoa, but also other crops and alternative income sources. The knowledge of stakeholders about drought is limited, except among cocoa farmers. Cocoa farmers conduct to some extent practices that help to avoid and absorb a potential drought.

- Stakeholders proposed various action measures that directly address deficits identified in the resilience assessments. In particular, farmers got convinced that since they are directly affected by a potential drought, they can improve their farm management practices, such as mulching, planting of additional shade trees, fire belts, bookkeeping, etc. However, the majority of the proposed action measures require external help. Thus, the process of building resilience in the cocoa sector in Ghana relies largely on the involvement of COCOBOD with its different units and subsidiaries and external actors from the private sector, academia and NGO.

- The way forward to transform the cocoa value chain in Ghana is to establish a dialog together with all stakeholders, including COCOBOD and those from outside of Ghana (such as cocoa traders and chocolate producers). The implementation of action measures that build resilience needs to be initiated by the concerned stakeholders in the cocoa value chain.

- From a resilience perspective, it is crucial to equip stakeholders with opportunities to diversify their activities. For example, farmers have to adjust farm management practices to better cope with drought risks and processors may create more added value by moving beyond the production of semi-finished products and instead produce chocolate products that directly reach consumers.

Introduction

Cocoa (*Theobroma cacao*) is a key ingredient for producing chocolate. Its domestication is linked to South America, notably Ecuador. Today, it is a cash crop and produced predominantly in Ivory Coast and Ghana. These two countries produce around 60% of the world production. The cultivation of cocoa requires a tropical humid climate and for a sustainable production, cocoa trees should be partially covered by shade trees and intercropped.

While cocoa is exclusively produced in tropical areas, it is largely processed and consumed in the United States, the European Union, China and Japan. As a result, there is significant trade of cocoa beans from cocoa producing countries to countries in the North. It also means that very little added value is created in the cocoa producing countries. A break-up of costs shows that cocoa farmers only receive a small fraction of the actual chocolate price paid by consumers in the North.

The spatial disconnection of cocoa production and cocoa processing has drawn our attention to analyse whether the cocoa value chain in Ghana is capable to deal with unforeseen changes or shocks. Figure 2 highlights significant volatility in world market prices of cocoa. The decline of work market prices in mid-2016 came after yield projections for the 2016 harvest were more positive compared to the 2014 and 2015 cocoa harvests which were constrained by impacts of drought – we see this as a natural shock. Amplified by the El Niño phenomenon, too high temperatures and insufficient rainfall reduced the production of cocoa in several cocoa producing countries, including Ghana. The 2017 cocoa harvests were above average which caused the world market prices of cocoa to remain stable in light of a growing demand for cocoa beans.

Figure 2 also shows that world prices of cocoa have fell rapidly within a few months from USD 3,000 per tonne in late 2016 to around USD 2,000 per tonne in mid-2017. While world market prices of cocoa fell, the producer prices in Ghana remained largely unchanged. In Ivory Coast, the producer price came as close as the world market price in mid-2017. This alignment meant that the Ivorian Government could hardly generate any foreign exchange earnings from selling cocoa beans and therefore, decided, amid protests from their cocoa farmers, to reduce the minimum producer price for the 2017/18 cocoa season. A key implication of this sudden change – we see this as an economic shock – is that recently large quantities of cocoa beans are smuggled between Ivory Coast and Ghana.

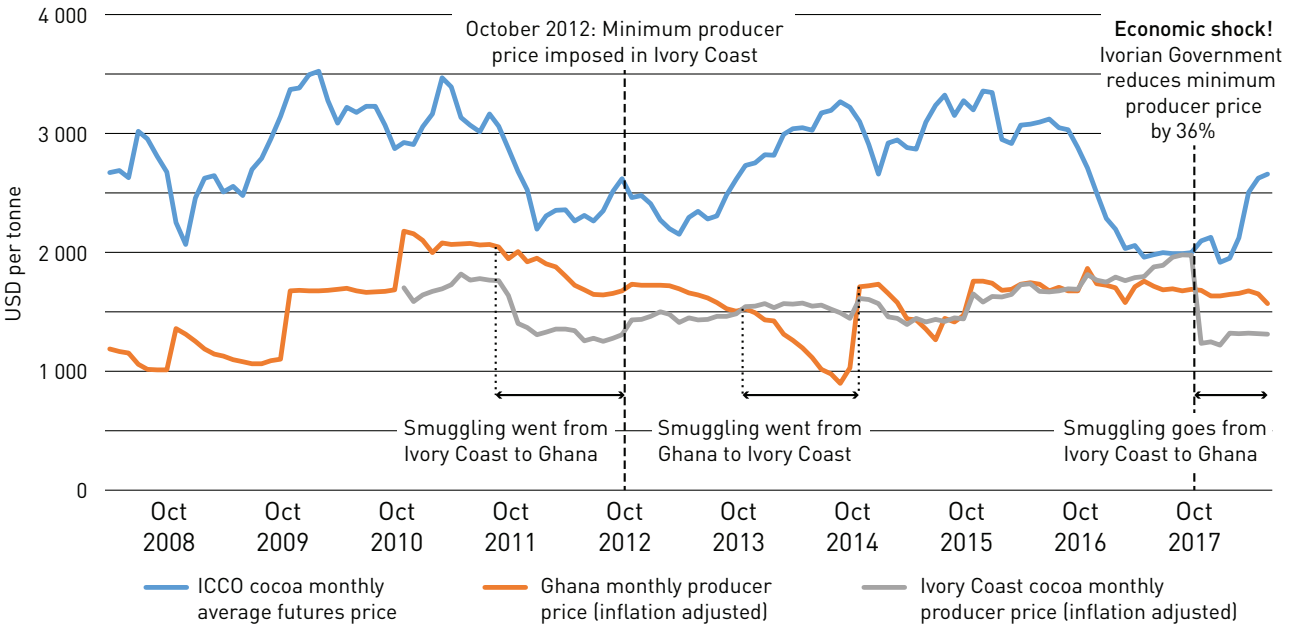


Figure 2
World market futures prices and producer prices in Ghana and Ivory Coast between March 2008 and May 2018

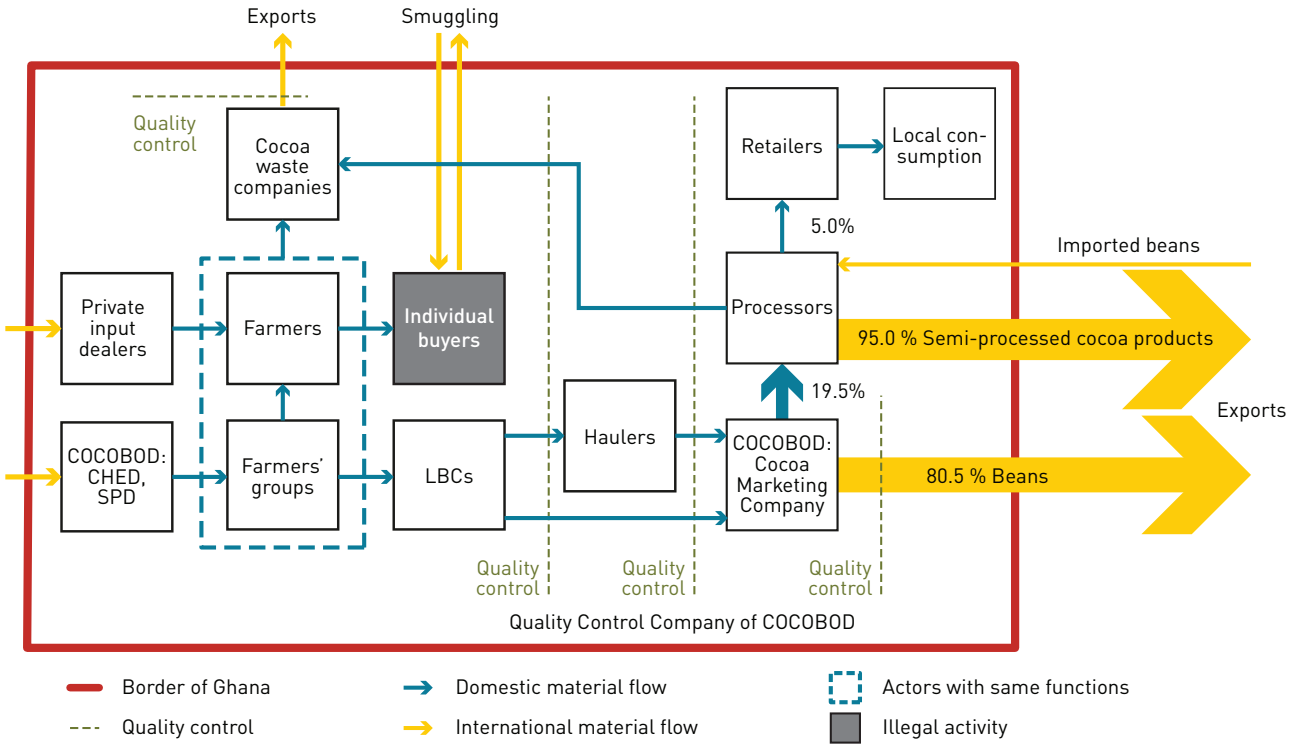


Figure 3
Material flow map of the cocoa value chain in Ghana (adapted from Monastyrnaya et al. 2016)

The growing emergence of natural and economic shocks raises questions whether the various actors in the cocoa sector are capable to deal with such unexpected changes or not. By capability we mean whether actors are resilient and therefore can withstand, absorb, maintain and recover from a shock.

In this study, we focus primarily on the ability of actors that are part of the cocoa value chain in Ghana. The material flow analysis of the cocoa value chain in Ghana (Figure 3) shows that the Ghana Cocoa Board (COCOBOD) influences all activities of the value chain. COCOBOD is the key governmental agency that ensures through its various subsidiaries and units that the partially liberalised cocoa market in Ghana delivers high yields (through sustainable production) and export earnings for the State of Ghana. This also means that from the input provision, production, internal trade, processing and export, COCOBOD will exert its influence. For example, the purchase of cocoa beans from farmers is only authorised by Licensed Buying Companies (LBCs). Thus, hardly any cocoa bean can be found on a local market in Ghana. From the LBCs, haulers deliver it to the Cocoa Marketing Company (CMC), a subsidiary of COCOBOD, which then supplies local processors with cocoa beans or prepare it for export.

Goals of study

This study adopts a transdisciplinary research approach with the aim to combine aspects of building resilience with development. This means that the knowledge of this study is co-produced together with actors of the cocoa value chain in Ghana and enriched with empirical data. Thus, the goals of this study are:

- to establish a transdisciplinary process with key stakeholders of the cocoa value chain in Ghana;
- to measure the resilience of actors of the cocoa value chain in Ghana;
- to identify strategies for building and enhancing the resilience of the cocoa value chain in Ghana.

Methodology

The concept of resilience

To assess the ability of value chain actors to deal with shocks, we use the concept of resilience. The key strength of this concept is that it tries to catch dynamically the impacts of a shock or disturbance, as shown in Figure 4. In this case, a more resilient food system is one that is capable to limit the impact of a disturbance, is able to recover from it and increases its functionality to provide food security (Tendall et al. 2015). In our case, we focus on the resilience of value chain actors. Hence, we consider a resilient actor (e.g. input supplier, farmer, etc.) one who cannot only withstand a shock, but also limit (absorb) the impacts of a shock on his functionality and is able to recover and learn (adapt) from it. By functionality, we mean whether, for example, a farmer can recover from a drought in terms of delivering the same yield as before a shock. Thus, the functionality varies for each actor.

Adopting a transdisciplinary research approach

In this study, we actively made use of the knowledge and experience of key actors (stakeholders) of the cocoa value chain in Ghana. Such an approach is called transdisciplinarity as it goes beyond the academic system of interdisciplinarity by involving actors from outside the academic system into the research process (Pohl and Hadorn 2007). This means that we involved key stakeholders from the beginning and invited stakeholders to shape the direction and outcomes of this study. In a first step, we discussed together with them what the challenges and opportunities are of their activity. One of the outcomes of this discussion was that drought is a key shock that affects all activities across the cocoa value chain. While farmers are directly affected through yield reductions, input suppliers, transporters, LBCs and processors are indirectly affected. Input suppliers cannot sell inputs (e.g. fertilizers, tools, etc.), transporters and LBCs trade less cocoa beans and processors pay more for Ghanaian cocoa beans. In a second step and in combination with a previous pilot study to review the current status of the cocoa value chain in Ghana, we developed and validated with our stakeholders a survey for assessing the resilience of key value chain activities. The survey combined conceptual aspects of resilience with contextual knowledge and resulted in the identification of a set of factors for assessing each resilience element (Figure 5). For the resilience element 'Robustness', for example, we identified that knowledge to withstand the shock is needed as well as access and affordability of resources. We also considered that for a stakeholder whose business does well, monitors his/her activities and has access to early-warning information is more likely to sustain the impact of a shock. Accordingly, for the resilience element 'Redundancy', knowledge and the quality of key resources to absorb a shock were identified as key factors. For 'Rapidity', knowledge combined with financial capacities as well as government and community support were seen as key factors to explain the ability of an

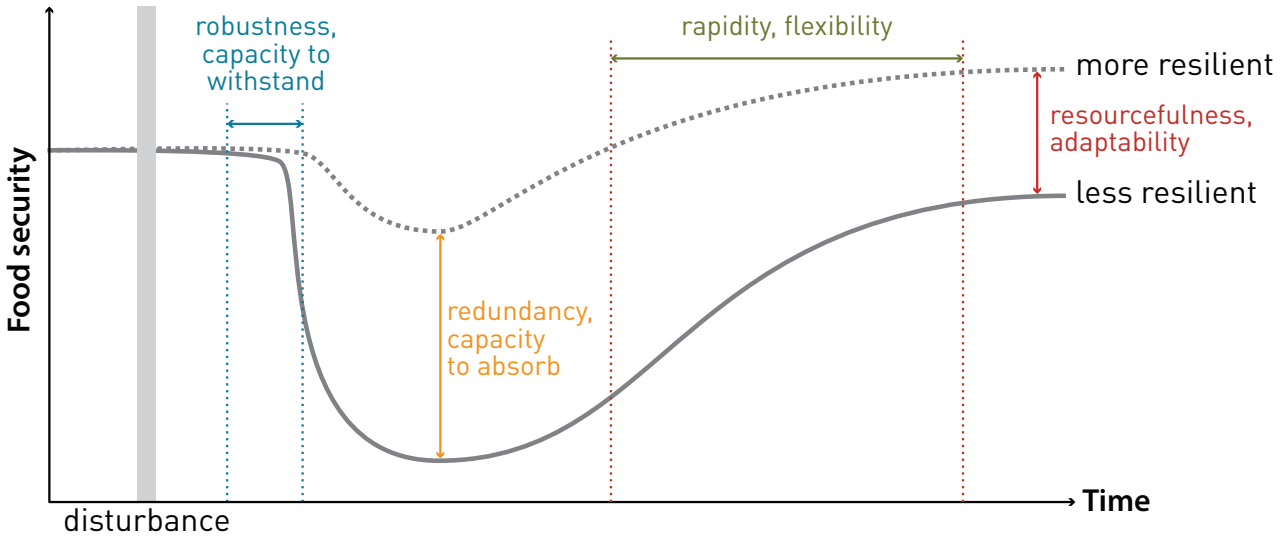


Figure 4
Food system resilience in the context of food security (Tendall et al. 2015)

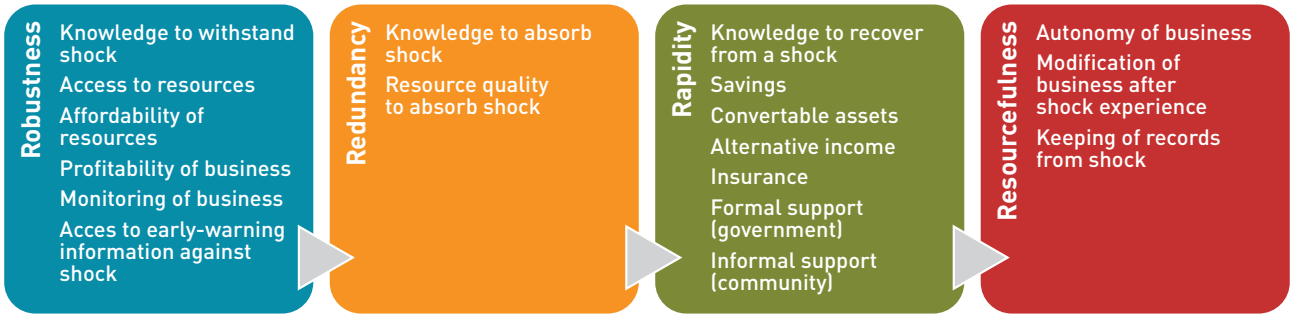


Figure 5
Conceptual framework for assessing the resilience of value chain actors

actor to recover from a shock. For 'Resourcefulness', the autonomy over a stakeholder's business, previous efforts of actors to modify the business activities and keeping records after experiencing a shock, were identified as factors that explain whether an actor would adapt and learn from a future shock.

Since for many of these identified factors no baseline data exists, we decided to conduct a survey that allows the stakeholders to self-evaluate the availability of these factors. On a scale of 0 (not available) to 100 (fully available), the surveyed actors had to determine to what extent their business has those factors. We then determined that a 'low' resilience level has a score between 0–33, a 'moderate' level between 34–66 and a 'high' level between 67–100.

Upon framing our resilience assessment, we conducted the survey by using tablets (Figure 6) and distributing the survey electronically to the relevant stakeholders. While the total number of existing input suppliers, farmers, transporters and retailers in Ghana is several thousands, we limited the distribution of the survey for these stakeholders to the Ashanti and Western regions. These two regions produced together more than 70% of Ghana's cocoa production during the 2015/16 cocoa season. For the LBCs and processors, the total number of actors in Ghana is much less and therefore, we approached all the 38 identified LBCs and 10 cocoa processors.

After conducting the survey, we discussed together with our stakeholders the results and validated them. In a final step, we developed together action plans by using 'design thinking' techniques (Brown 2008). These techniques allowed for a creative yet still structured process in identifying feasible and appropriate measures to enhance and build resilience among the stakeholders. After developing a first draft of the action plans, our stakeholders validated them with their peers and reported back changes and additional information. In a final workshop, we discussed the way forward to effectively build resilience in the cocoa value chain. This report aims to guide stakeholders in the future process of making the cocoa value chain in Ghana more resilient against shocks, particularly drought.

Figure 6
Farmer participating in survey

Overall Resilience of the Cocoa Value Chain

As our stakeholders identified *drought* to be the key shock affecting the cocoa value chain in Ghana, this resilience assessment focuses exclusively on this shock. This overall assessment (Figure 7) includes only those factors that can be compared across all the selected activities of the cocoa value chain in Ghana. For a detailed analysis of each selected stakeholder group, see the subsequent sections of this report. The data for this resilience assessment was collected between March and April 2017.

Robustness

The robustness of the cocoa value chain in Ghana is characterised by stakeholders diligently monitoring their activities and making profit from doing business with cocoa. Cocoa processors have the highest share of income from cocoa within the cocoa value chain. In contrast, input suppliers and cocoa farmers rely also on other income sources than only selling cocoa-related products. While input suppliers provide inputs to any type of farmer, farmers may intercrop and have second jobs (often in transport and construction sectors). In terms of robustness, cocoa processors are most dependent on a steady supply of cocoa from Ghana and will have to import cocoa during a drought or reduce their output. The knowledge among all stakeholders on how to withstand a drought is limited (scores range between 5 for transporters and 25 for farmers) as well as the access to early-warning information is only moderately (scores range from 33 for transporters and LBCs and 49 for farmers) available.

Redundancy

The redundancy of value chain actors to a shock focuses on their ability to minimise the impacts of a shock. The perceived impact of drought is highest among input suppliers (score of 71) followed by the transporters and LBCs (both score 52), farmers (score of 44) and processors (score of 36). These results highlight that input suppliers are suffering most from a drought because their cocoa-related products can simply not be sold as there is no demand in the event of a drought. Similarly, transporters and LBCs need to find other providers of cocoa as the farmer will only offer a reduced supply of cocoa beans. Further down in the value chain, cocoa processors will be least impacted by a drought because of their ability to switch to different providers of cocoa beans, including providers from abroad. In contrast, farmers perceive medium impacts from a drought as their farm and household income does not only depend on the production of cocoa. Similar to the knowledge of the stakeholders on how to withstand a drought, their knowledge to absorb a drought is very low. Overall, this resilience element is difficult to compare across value chain activities due to the specific characteristics of each stakeholder. Each stakeholder requires specific abilities to absorb a shock, such as drought.

Rapidity

The ability of the stakeholders to recover from a drought is higher for cocoa processors and input suppliers compared to the other stakeholders. This is largely due to the fact that many of these stakeholders have support from domestic and international investors who provide financial support to recover from a shock. Transporters focus primarily on having insurance coverage for their vehicles, but this may not be that relevant during a drought. Thus, similar to LBCs, transporters have some assets, savings and alternative income to recover from a drought, but will require time to re-build their business activities back to the pre-shock level. Farmers have lowest abilities to recover from a shock due their limited financial strength. Despite having alternative income sources as well as some savings and assets to recover. Few farmers can rely on insurance products to receive compensation for yield losses. Moreover, similar to all other stakeholders, farmers are on their own after a drought has occurred. Governmental and community support is barely available for stakeholders in the cocoa value chain in Ghana. The knowledge on how to recover is for all stakeholders low (scores range from 5 for LBCs to 18 for cocoa processors) as they have hardly established a thinking that considers dealing with shocks. The occurrence of shocks, such as drought, and how to manage them is not yet part of their business management.

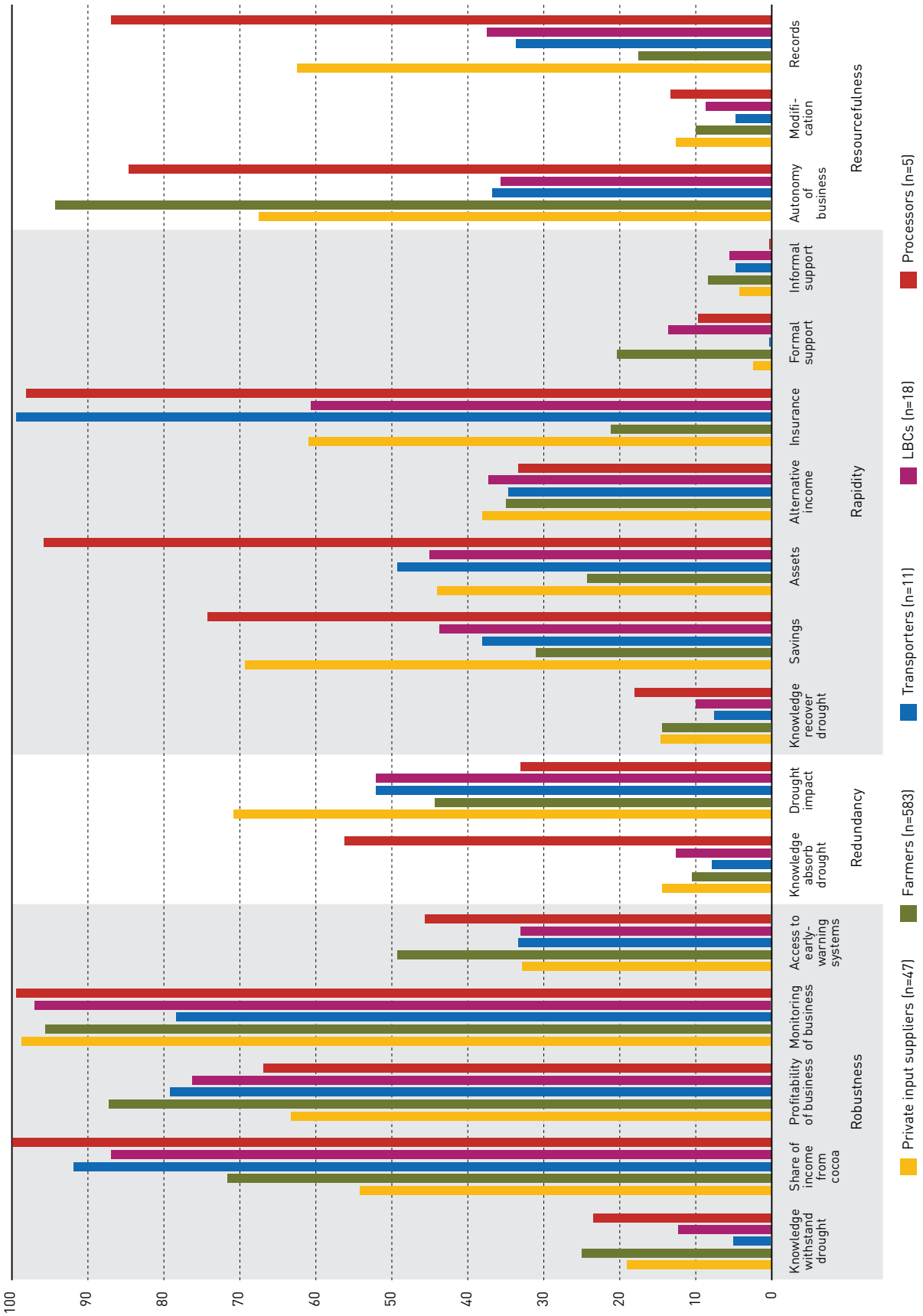


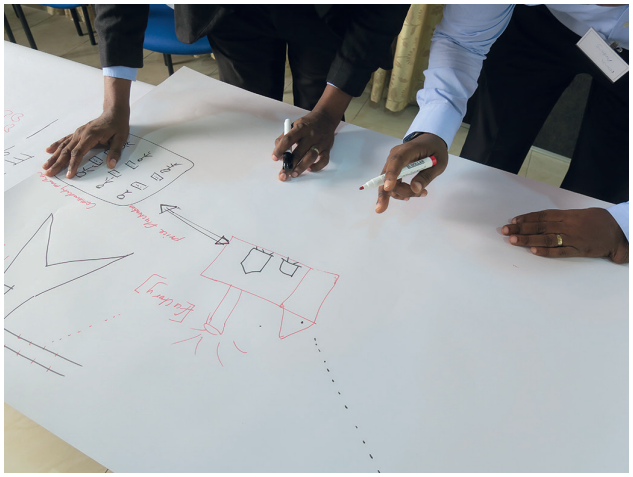
Figure 7
Overall resilience of stakeholders of the cocoa value chain in Ghana to drought; 0 (not available) to 100 (fully available)

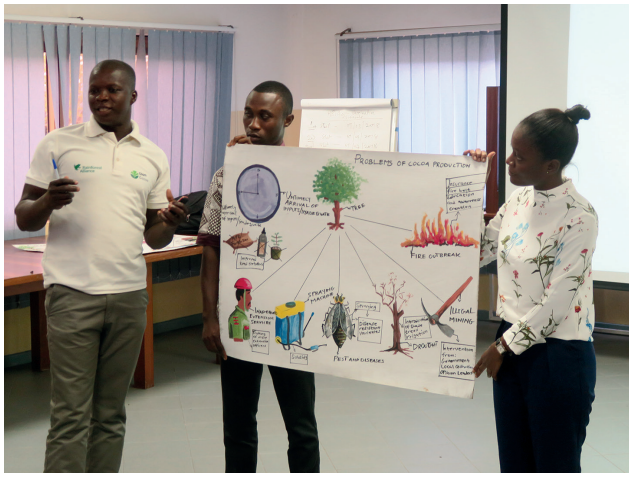
Resourcefulness

The resourcefulness reveals whether stakeholders are more or less likely to learn and transform their activity based on the experience of a shock, in this case drought. The results show that cocoa processors keep records (score of 87) and have autonomy (score of 85) to change processes in their business activities. Farmers also have autonomy (score of 94) over their farming activities, but do not keep much records (score of 18). Input suppliers have a certain autonomy (score of 67) and also keep records (score of 63) from previous drought events which impacted their business. In terms of modification of business activities, all stakeholders have changed little (scores range from 5 for transporters to 13 for cocoa processors) within their business activities after experiencing drought events in the past.

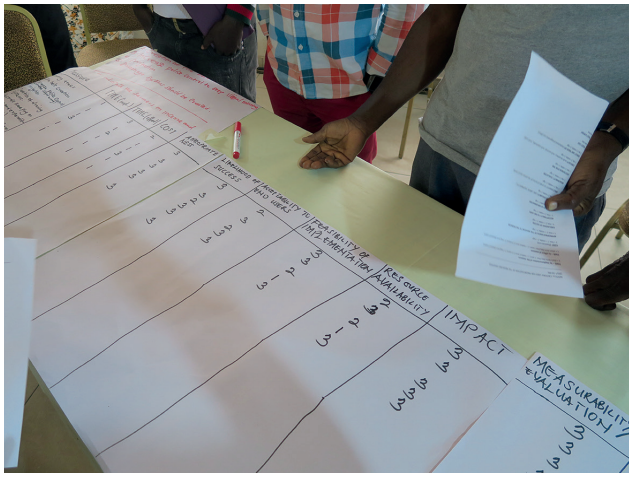
Overall resilience of the cocoa value chain

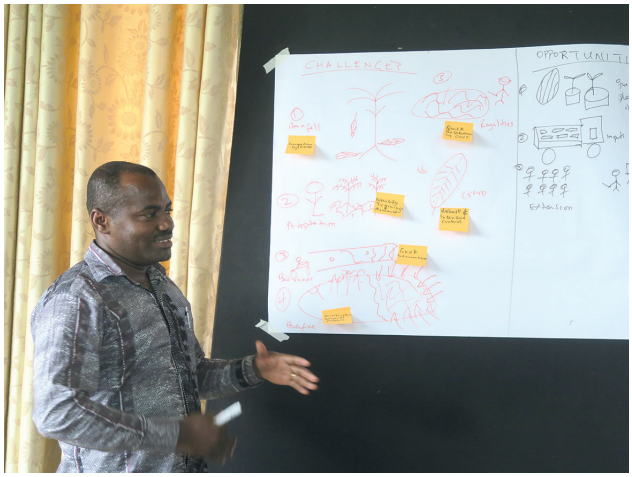
Overall, stakeholders which have more financial capacities and get support from domestic and international investors are more resilient to drought, such as cocoa processors and input suppliers which have diversified networks. A resilience thinking in terms of establishing shock resistance is not yet well established among all actors, as knowledge levels are low across the different resilience elements. The assessed resilience factors focus largely on economic strength which makes cocoa processors most resilient. However, despite the limited financial capacity of farmers, they are to some extent resilient to drought as their household income does not only come from cocoa farming, but also the production of other crops as well as different sources of alternative income, such as working for transport and construction companies. LBCs and transporters are highly dependent on the amount of cocoa produced and will adjust their business activities accordingly. Stakeholders who are diversified and cocoa-independent are more resilient.




PROBLEMS OF COCOA PRODUCTION
FIRE OUTBREAK
ILLEGAL MINING
DROUGHT
PEST AND DISEASES


NOTE BOOK
ISSUE STRATEGIES
KEY RESPO


IMPACT
MEASURABILITY/ EVALUATION


CHALLENGES

Private Input Suppliers

In Ghana the provision of cocoa seedlings, fertilizers, herbicides, fungicides, insecticides, etc. is to a large extent provided by subsidiaries and units of COCOBOD. Except fertilizers, cocoa farmers are expected to receive those inputs for free from the Seed Production Division (SPD) and Cocoa Health and Extension Division (CHED). However, cocoa farmers usually do not get the recommended amounts (e.g. two times herbicides spraying instead of recommended six times) for production from COCOBOD (Monastyrnaya et al. 2016). Thus, private input suppliers play a complementary role and provide those inputs as well as planting tools and other equipment. Fertilizers are provided at subsidised rates as of 2017. The products offered by private input suppliers are usually too expensive for cocoa farmers because they are not subsidised and often originate from non-Ghanaian production. Major providers of inputs are large companies located in countries in the North, China, Russia and India. Around 3,500 private input suppliers exist across Ghana. These private input suppliers are largely located in the vicinity of urban centres.

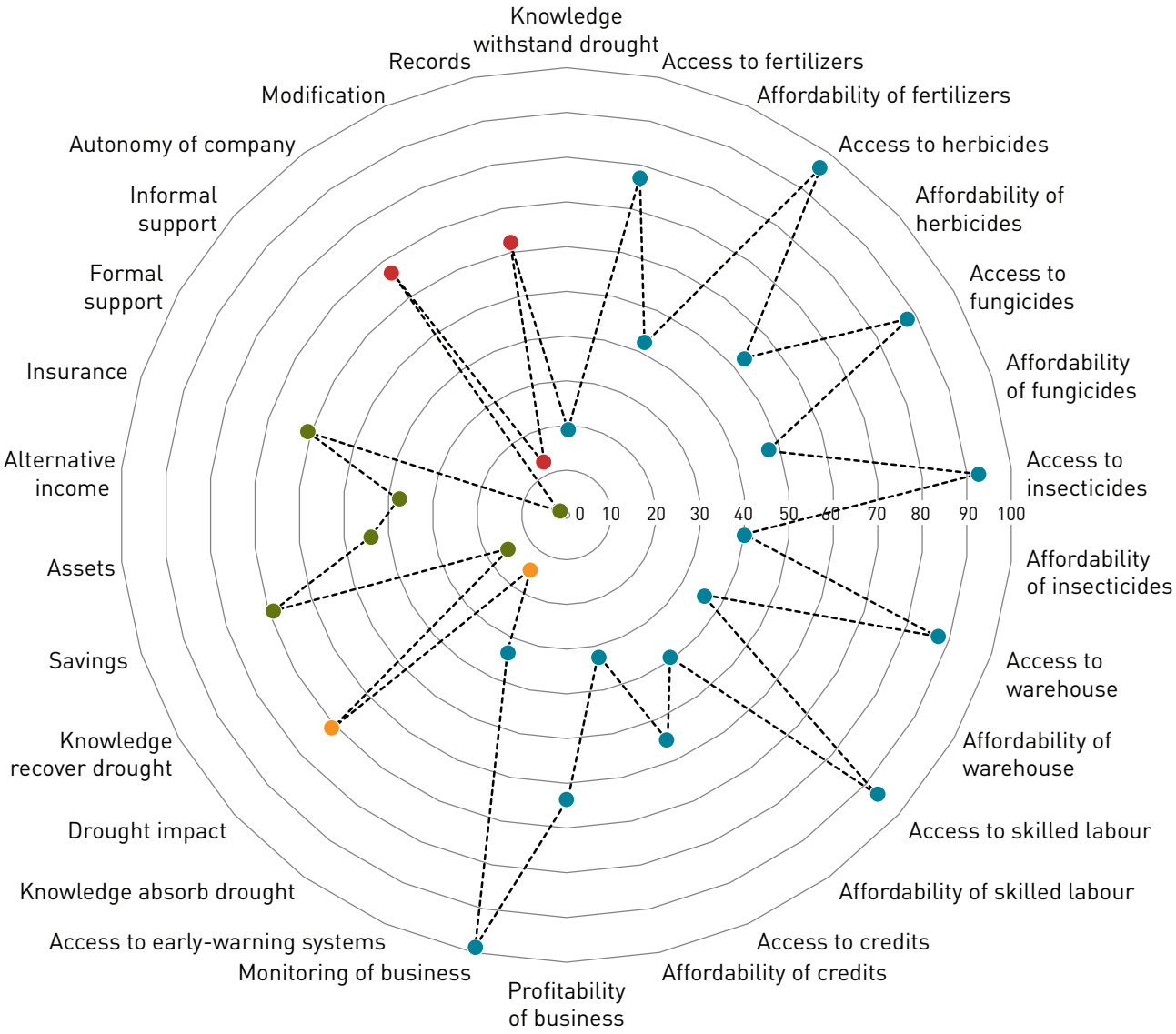


Figure 8
Resilience of input suppliers against drought; 0 (not available) to 100 (fully available). Blue indicators are for robustness, yellow for redundancy, green for rapidity, and red for resourcefulness

For this study, we surveyed a sample of 47 private input suppliers located in Kumasi and Ejisu in the Ashanti Region and the centres of Juaboso and Wiawso in the Western Region.

Robustness

Overall, the robustness of private input suppliers is characterised by high access to input products, but constrained by low affordability to procure these inputs.

Figure 8 shows that private input suppliers have little problem to get access to inputs for cocoa farmers, such as fertilizers, herbicides, fungicides and insecticides. However, all of these products are expensive to procure. Accordingly, the proper storage of these products as well as skilled staff is constrained by additional high costs. These challenges coupled with expensive interest rates for obtaining credits, make the business of selling cocoa-related input products to cocoa farmers not very profitable (score of 63). Moreover, private input suppliers are vulnerable to drought shocks due to low availability of early-warning information (score of 32).

Redundancy

The redundancy of private input suppliers (Figure 9) is characterised by low knowledge to deal with drought impacts (score of 14). From an input suppliers' perspective, knowledge to absorb a drought is something that has hardly been prioritised in their business strategies. This is despite the significant impacts of drought on their business outcome. During a drought, private input suppliers will hardly be able to have business because cocoa farmers will not demand any of their products. The financial risks related to the occurrence of a drought largely explain why the impact of a drought is perceived as rather high (score of 71).

Rapidity

The rapidity of private input suppliers to recover from a drought event is explained by limited knowledge (score of 15) and external formal support (score of 2). Private input suppliers as independent companies rely entirely on available savings and insurance solutions to sustain and recovery from a drought. Those private input suppliers which belong to an international company, have better financial recovery capacities compared to individual and small private input ones. Since a drought affects the production of all agricultural commodities, the opportunities to generate alternative income from selling inputs to other producers than cocoa is limited.

Resourcefulness

The resourcefulness of private input suppliers is characterised by rather high autonomy (score of 67) and them moderately keeping records from past drought events (score of 62). As some private input suppliers are subsidiaries of larger international companies, the autonomy of some input suppliers is slightly constrained. Efforts to modify business activities after the experience of past droughts is low (score of 13). This is problematic as it means private input suppliers hardly adapt to drought risk.

Overall resilience of private input suppliers

Overall, the resilience of private input suppliers to drought is characterised by high access to inputs and low knowledge and high financial risks related to dealing with drought shocks. The affordability of inputs is a challenge before and during a drought. As private input suppliers are individual independent companies, external formal support is inexistent and therefore, they rely on savings and insurance products to recover from a drought event. Private input suppliers that are subsidiaries of larger international companies can better absorb and recover from a drought than other private input suppliers.

Figure 9
Inside a shop of a private input supplier in Kumasi, Ashanti Region

Farmers

In Ghana, the estimated number of cocoa farmers is around 800,000. Most of them are smallholders producing cocoa within a surface area of 2–5 hectares. Within the cocoa plantations, shade trees and intercropping are common. In our sampling, we selected a proportional number of cocoa farmers from the Ashanti and Western regions. Among these regions, we stratified the sampling and randomly selected 583 cocoa farmers from Offinso and Ejisu districts in the Ashanti Region and Juaboso and Wiawso districts in the Western Region. During the time of conducting the survey in February and March 2017, the average age of the cocoa trees was 19 years and the average cocoa farm size was 3.6 hectares. The average yield in the 2015/16 season was 0.27 t ha^{-1}. The total average farm size was 4.7 hectares and therefore, more than 23% of the farm land of a cocoa farmers is used for other crops (e.g. plantains, palm oil, sugar cane, etc.) than cocoa. As per the policies of COCOBOD, cocoa farmers receive a certain amount of inputs for free (except fertilizers), as well as seedlings for planting cocoa trees and hand pollination services when they rejuvenate their cocoa plantations. Furthermore, cocoa farmers receive a fixed producer price (see Figure 2) for selling their cocoa. These prices were GHC 425 per bag of 64kg during the 2015/16 season and 475 GHC during the 2016/17 season.

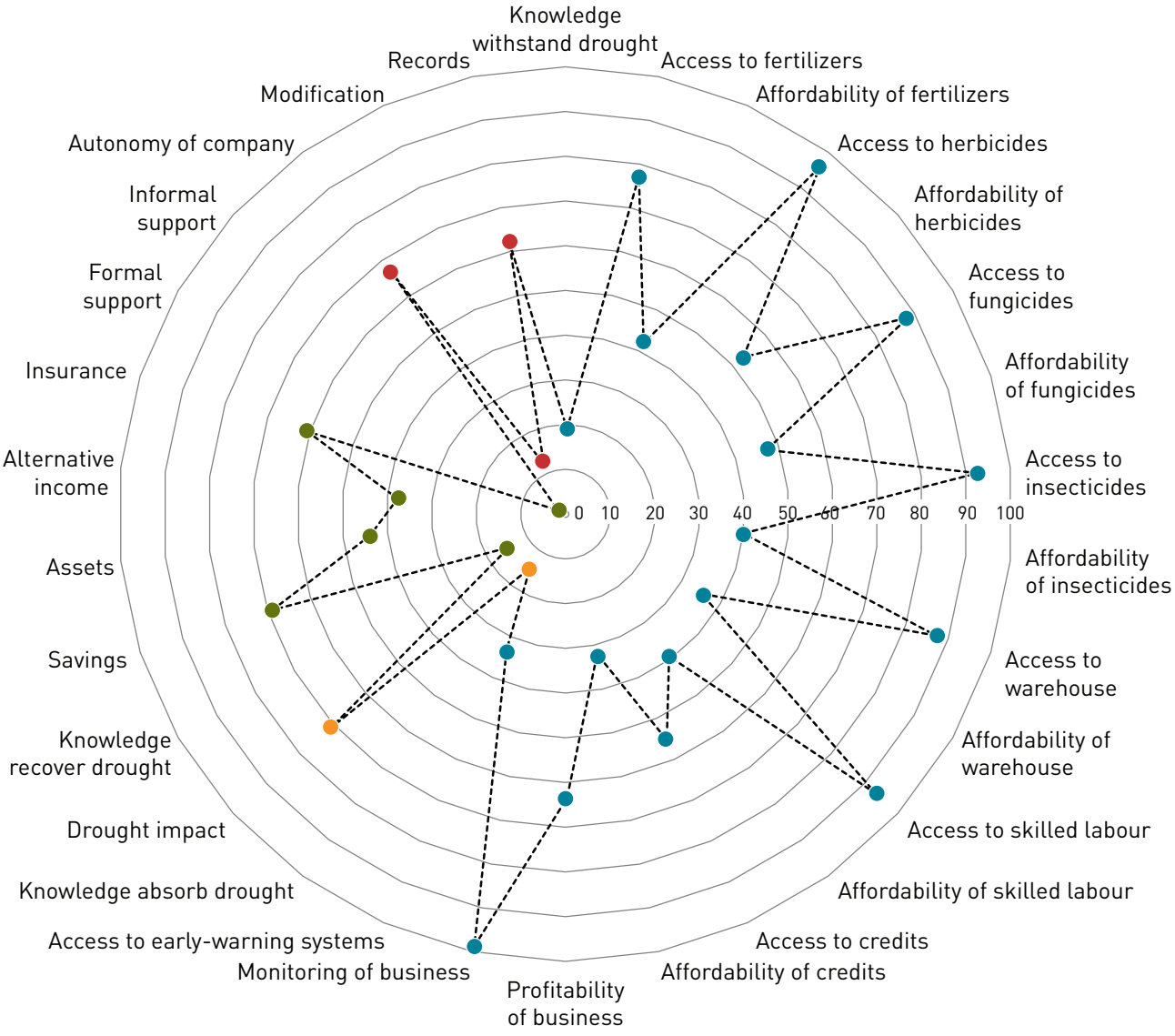


Figure 10
Resilience of cocoa farmers against drought; 0 (not available) to 100 (fully available). Blue indicators are for robustness, yellow for redundancy, green for rapidity, and red for resourcefulness

Robustness

Overall, the robustness (Figure 10) of cocoa farmers is characterised by high access to input products, but constrained by low affordability of fertilizers (score of 16), skilled labour (score of 14) and credits (score of 9). Although, the perceived knowledge of farmers to withstand a drought is low (score of 10), they moderately practice the planting of shade trees (score of 63), building of fire belts (score of 49) and mulching (score of 50). These practices help to reduce the impacts of an extended period of high temperatures coupled with no precipitation and low humidity. The application of drought tolerant varieties is hardly practiced (score of 2) by cocoa farmers because it is directly related to the availability of financial capital. Cocoa farmers perceive the profitability of cocoa farming as high (score of 87) and monitor (e.g. pruning, weeding, etc.) their plantations (score of 96) to ensure the well-being (Figure 11) of their cocoa farms. Access to early-warning information (score of 49) about drought is to some extent informally available.

Redundancy

Surprisingly, cocoa farmers consider the impacts of drought to be only moderate (score of 44). This is remarkable since cocoa farmers are directly affected by this shock. However, this perception is confirmed by the limited yield losses during the severe drought in 2016 in Ghana. During the 2015/16 cocoa season the average yield of cocoa farms reduced by only 10% 0.27t ha^{-1} instead of 0.30t ha^{-1} in the 2014/15 cocoa season). Cocoa farmers perceive their availability of water as moderate (score of 34) and think that their cocoa trees are in an acceptable condition (score of 58).

Rapidity

The ability of cocoa farmers to recover from a drought is rather limited. Despite the fact that the production of cocoa is profitable (score of 87), farmers find it difficult to build savings (score of 31) and create wealth. Although, some cocoa farmers find work in other business sectors (e.g. construction, transport) during times of low farm activity (score of 35). Insurance solutions exist in Ghana, but are hardly purchased by cocoa farmers (score of 21). Formal (government) (score of 20) and informal (community) (score of 8) support are very limited and cannot be relied upon in the aftermath of a drought.

Resourcefulness

The resourcefulness of cocoa farmers is characterised by high autonomy in taking decisions about the farm management (score of 94), but low efforts to modify farm management practices after the experience of past droughts (score of 10). However, in our survey, 96% of the farmers were fully owning their farm and only 4% were farming cocoa based on a sharecropping agreement, such as abunu and abusa. These sharecropping agreements allow external farmers to farm on someone else's land, but will have to share substantial amounts of their production to the legal owner of the farm. The abunu and abusa sharecrooping arrangements are seen as problematic by our stakeholders in making farms more resilient to drought shocks.

Overall resilience of cocoa farmers

Overall, cocoa farmers are rather capable to deal with drought shocks. Although, droughts do have an impact on the yield, these losses are not as high as expected (at least during the 2016 drought). Cocoa farmers practice to some extent sustainable farm management practices, including intercropping, planting of shade trees, fire belts, mulching, etc., which result in acceptable conditions of soils. The key challenge for farmers to deal with droughts is to absorb the financial losses and recover from them. Whether it is during normal or shock times, cocoa farmers have limited financial capacities to run their farm with sufficient supply of inputs as well as transferring drought risk by purchasing insurance solutions. Moreover, external support is limited as well as the farmers' knowledge to pro-actively take measures to protect (e.g. shade trees) their cocoa farms against future drought shocks.

Figure 11
Well-managed cocoa farm in Ejisu, Ashanti Region, January 2017

Transporters

Transporters carry the cocoa beans on behalf of the Licensed Buying Companies (LBCs) from the farmers to LBCs and Cocoa Marketing Company (CMC) storage warehouses. The total number of transporters is estimated to be more than 10,000 in Ghana. Many of them are informal businesses and are usually located in the peri-urban areas of cities and towns. Transporters are difficult to approach and to survey due to their reluctance to speak about their informal business. In our study with 11 responses, we only approached transporters that are recognised and belong to the formal sector. The surveyed transporters are located in Kumasi, Accra and Tema.

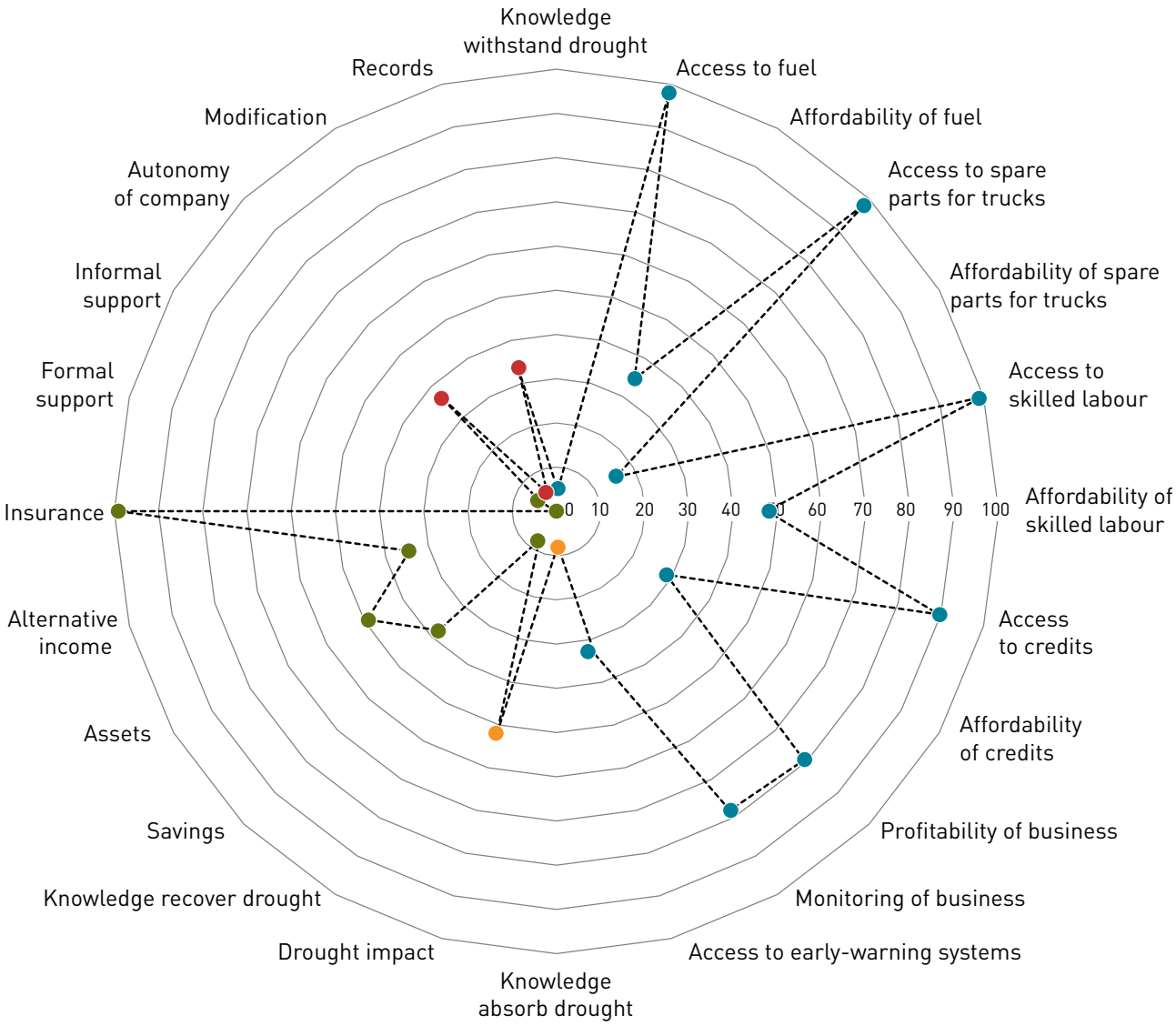


Figure 12
Resilience of transporters against drought; 0 (not available) to 100 (fully available). Blue indicators are for robustness, yellow for redundancy, green for rapidity, and red for resourcefulness

Robustness

The robustness of transporters (Figure 12) is characterised by high access to resources, but moderate ability to afford fuel (score of 35) and low affordability to purchase spare parts for trucks (score of 16) and get credits (score of 28). The business of transporting cocoa is in general profitable (score of 79). However, transporters are competing with other transporters which has implications on the fees that they can get from their clients. Early-warning systems against droughts only exist informally (score of 34). The knowledge of transporters to withstand a drought is low (score of 5) which is because transporters are only indirectly affected by droughts.

Redundancy

Transporters perceive the impact of drought as moderate (score of 52). Essentially, transporters are capable to shift their transport activities to carry different types of goods and commodities. Therefore, the impact of a drought can be absorbed by shifting to other businesses. The impact of a drought is only related to the lack of transport opportunities and does not affect any other parts of their transport business. The knowledge of transporters to absorb a drought (score of 8) is perceived to be irrelevant because transporters think that they cannot actively reduce the impacts of a drought.

Rapidity

Transporters can make use of some of their assets (score of 49) to be converted into money to recover from a drought in order to pay for business expenses. As defined by law, transporters need to insure their trucks against any accidents. However, insurance solutions do not include the compensation of business losses due to drought. External support from the government as well as local communities is not available for transporters. Thus, the ability for transporters to recover from less transport opportunities caused by a drought is to be flexible in finding alternative transport jobs. This means that those transporters that are more competitive will also more quickly recover from a drought shock.

Resourcefulness

The resourcefulness of transporters is limited. Some of the surveyed transporters are either partially or fully owned by LBCs. This enables the development of a passive attitude in terms of initiating and implementing measures to make their business more resilient to future droughts. Transporters keep to some extent records (score of 34) from previous drought, but hardly implement related measures (score of 5).

Overall resilience of transporters

Overall, the resilience of transporters to drought shocks is mixed. On the one hand, transporters are in general challenged by a competitive business environment and unfavourable ownership status. Thus, the financial situation of many transporters is not very good which reduces their ability to invest and afford needed resources to build resilience against drought. On the other hand, a drought shock has only indirect impacts on transporters in form of reduced transport opportunities. In the case of drought, transporters reported that they are capable to switch to other business opportunities.

Licensed Buying Companies (LBCs)

LBCs play an intermediary role between the cocoa farmers and the Cocoa Marketing Company (CMC). LBCs receive licenses once a year that define the minimum amount of how much cocoa beans a LBC needs to deliver to the CMC. The volume of cocoa beans as well as the delivery price are negotiated during the licensing process. LBCs have a genuine interest to maximise the amount of cocoa delivered to the CMC. LBCs usually have designated farmers that supply them with cocoa. This means that the LBCs can provide supplementary benefits to cocoa farmers if they achieve certain targets (e.g. quality, size, amount, etc.). Schemes to incentivise cocoa farmers are popular among international cocoa processors which can add an additional premium to cocoa that is produced, for example, under sustainable conditions. As a result, LBCs and international cocoa processors often collaborate closely in the sourcing

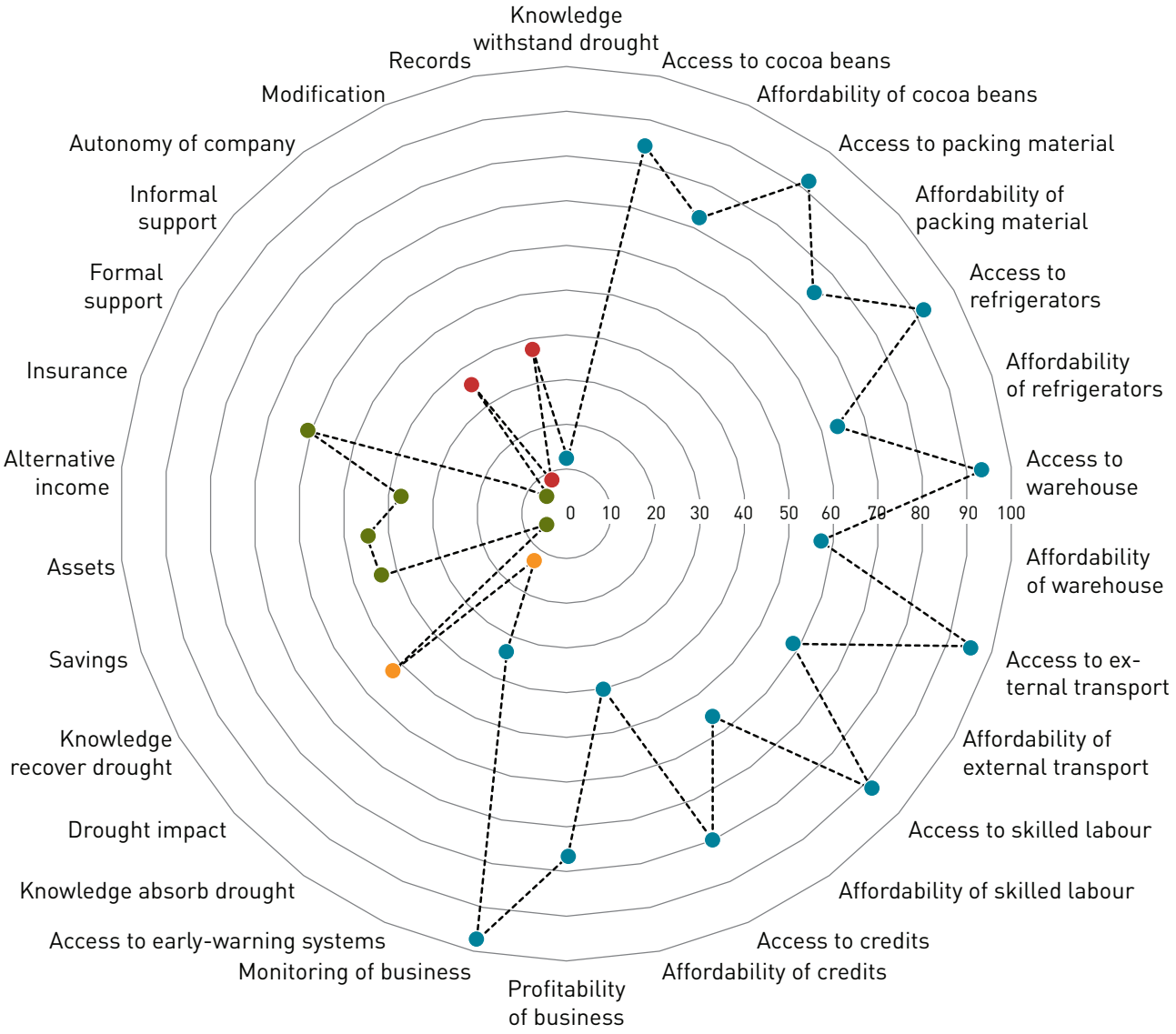


Figure 13
Resilience of LBCs against drought; 0 (not available) to 100 (fully available). Blue indicators are for robustness, yellow for redundancy, green for rapidity, and red for resourcefulness

of cocoa beans. These collaborations have in many cases the objective to ensure the traceability and quality of cocoa production through certification. At the time of conducting the survey between February and April 2017, 38 LBCs were identified to be existing in Ghana. All these LBCs were approached and 18 of them responded to our survey.

Robustness

The robustness of LBCs (Figure 13) is defined by high access and moderate to high affordability of resources. LBCs in general are in good financial condition as COCOBOD allows them operate in a controlled market where LBCs play the role of distributing cocoa from producers to Cocoa Marketing Company (CMC). Despite this, LBCs are competing with each other which results in low margins that make the trading of cocoa beans not as profitable (score of 76) as expected. LBCs have the same challenges like other stakeholders in the cocoa value chain. For example, the affordability of credits is moderate (score of 40) for LBCs because interest rates of credits are often too high and the seed funds provided by COCOBOD are not enough to purchase the desired amount of cocoa beans from their farmers. LBCs do not consider that they can actively avoid the impacts of a drought since they are only indirectly affected by such a shock. Thus, there is low awareness on how to withstand a drought and prepare against it (score of 12).

Redundancy

LBCs are impacted by drought (score of 52) through reduced supply of cocoa beans from their farmers. The impacts are limited to only delivering lower volumes to CMC. The conditions will not change for LBCs during a drought. LBCs will do little to actively reduce the impact of a drought due to lack of knowledge (score of 12) and alternative opportunities. LBCs usually only do business related to the trading of cocoa beans and no other crop.

Rapidity

The strong dependency on trading cocoa beans also means that the ability of LBCs to recover from a drought is linked to how cocoa producers recover from a shock. The fact that LBCs only serve as internal traders of cocoa beans within Ghana through a licensing system also has impacts on how they run their business. For example, savings are only moderately available (score of 44) to deal with a drought. Insurance products are purchased by some LBCs to support the transport of cocoa beans. LBCs do usually not receive support from the national government during a time of drought and since they belong to the private sector neither from local governments.

Resourcefulness

Many LBCs are usually owned by large international cocoa processing or trading companies. Thus, they serve as implementers of foreign interests and have little room for autonomous decision-making power. The consequence is that LBCs are somehow passive in dealing with drought risk and do not adapt actively to it.

Overall resilience of LBCs

Overall, the resilience of LBCs to drought is characterised by high robustness and limited redundancy, rapidity and resourcefulness. Due to the nature of LBCs to play an intermediary role between cocoa farmers, CMC and international cocoa traders and processors, LBCs find it difficult to build resilience in their business structure. LBCs largely benefit from a controlled internal marketing system of cocoa which, however, in return makes them highly dependent on the production outcomes of cocoa farmers. LBCs usually do not trade any other crop than cocoa and rely on seed fund provided by COCOBOD as well as financial support from international partners, which seems to be insufficient to deal with drought shocks. This results in LBCs being not well prepared to dealing with a drought shock.

Processors

In Ghana, only very few cocoa processors exist. The reason is manifold, but can be limited to some key ones:

- The Ghanaian government controls the internal marketing of cocoa with COCOBOD's subsidiary the Cocoa Marketing Company (CMC). This results in cocoa beans being provided by only one provider.
- The main cocoa processing product, chocolate, has no tradition in the Ghanaian diet. Ghanaian people primarily enjoy chocolate during major festivities, such as Christmas, Valentine's Day, etc. The result is that only one Ghanaian chocolate brand exists.
- Chocolate producers often prefer to process cocoa beans close to their consumers to ensure quality and local taste is met. Moreover, big international companies want to maintain their control over the chocolate making which provides the highest added value in the cocoa value chain.

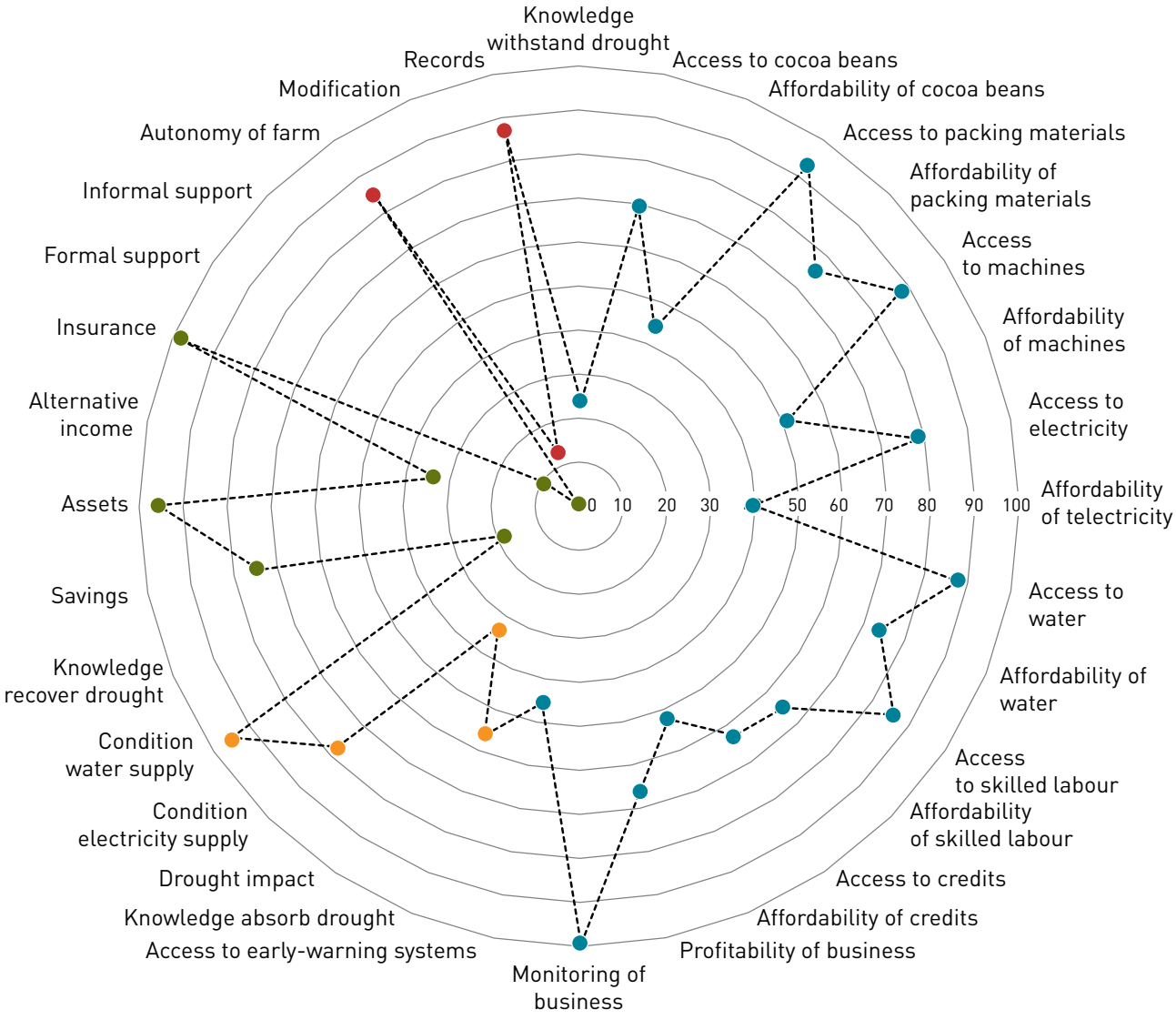


Figure 14
Resilience of cocoa processors against drought; 0 (not available) to 100 (fully available). Blue indicators are for robustness, yellow for redundancy, green for rapidity, and red for resourcefulness

The consequences of these reasons are that we identified only ten processors in Ghana. Among those ten processors, most of them are controlled by international companies and investors which serve chocolate producers in industrialised countries with semi-finished cocoa products, such as cocoa liquor (mass), cocoa powder and cocoa butter. In our study, five processors responded to our survey. All of them are located in urban areas close to major cocoa beans transfer sites, such as Tema, Takoradi and Kumasi.

Robustness

The robustness of cocoa processors (Figure 14) is characterised by high access to resources, but limited ability to afford cocoa beans, machines, electricity and credits. The profitability of cocoa processors (score of 66) is only moderate because they do not provide cocoa products which can create high added value, such as chocolate. Cocoa liquor, cocoa powder and cocoa butter can easily be produced by any processor, provided they have state of the art machines and tools. The moderate score to afford cocoa beans (score of 44) has to do with the perception of cocoa processors that cocoa beans from Ghana are expensive. The import of cocoa beans to Ghana is not practised by those processors that participated in our study.

Redundancy

Cocoa processors perceive the impacts of a drought as rather low (score of 33). This is because the international demand for cocoa products remains stable despite volatile prices of cocoa beans on the international markets (see Figure 2). Moreover, domestic prices of purchasing cocoa are more or less fix. As a result, cocoa processors in Ghana will run their business pretty much regardless of the world market price for purchasing cocoa beans. Cocoa processors do have some knowledge (score of 56) on how to absorb a drought and their facilities are prepared in form of back-ups to provide water and electricity in case there is an interruption of supply.

Rapidity

Cocoa processors have a lot of assets (score of 96) that could be converted into money as well as savings (score of 74) in case of need. Since the cocoa processors serve international clients, it requires them to practice international management standards and have their facilities insured against damages and failures. However, cocoa processors are very dependent on keeping sufficient clients as they do not generate much income from other sources than selling semi-finished cocoa products. Formal and informal (community) support is not expected by cocoa processors to recover from a drought.

Resourcefulness

The resourcefulness of cocoa processors is characterised by high autonomy (score of 85) and keeping records about drought shocks (score of 87). However, little efforts are made to adjust management practices after experiencing a drought (score of 13). Essentially, the strong dependency of cocoa processors on international clients do not give them incentives to run their business independently and introduce innovative practices unless they are instructed to do so by their owners.

Overall resilience of cocoa processors

Overall, the resilience of cocoa processors to drought is rather high. Cocoa processors benefit financially from their international orientation in terms of ownership and clients. Accordingly, they can rely at all times from financial support which will reduce the impact of drought on their business activities. However, this international orientation also makes cocoa processors dependent to a small network and results in their business activities to exclusively produce semi-finished cocoa products. Furthermore, they may not change business practices after experiencing a drought unless they are told by their owners. From a resilience perspective, the sole focus on international clients and processing only one commodity bears considerable risks. Changes in international market conditions and ownership may have direct impacts on their business.

Retailers

In Ghana, retailers exist in various forms: supermarkets, small retailers, table-tops, street sellers, etc. The estimated number of those sellers is several thousand and hard to accurately estimate. The range of cocoa products varies for each retailer. Supermarkets usually provide chocolate-based products from Ghana and abroad. However, their focus is usually on offering non-Ghanaian chocolate products due to consumers' preferences.

The occurrence of shocks, such as drought, is not yet perceived by retailers to be affecting their business. Therefore, we reduced the number of survey samples to only a handful (10 samples) and focused on assessing their general condition. In our sampling, we only included supermarkets and no other types of retailers.

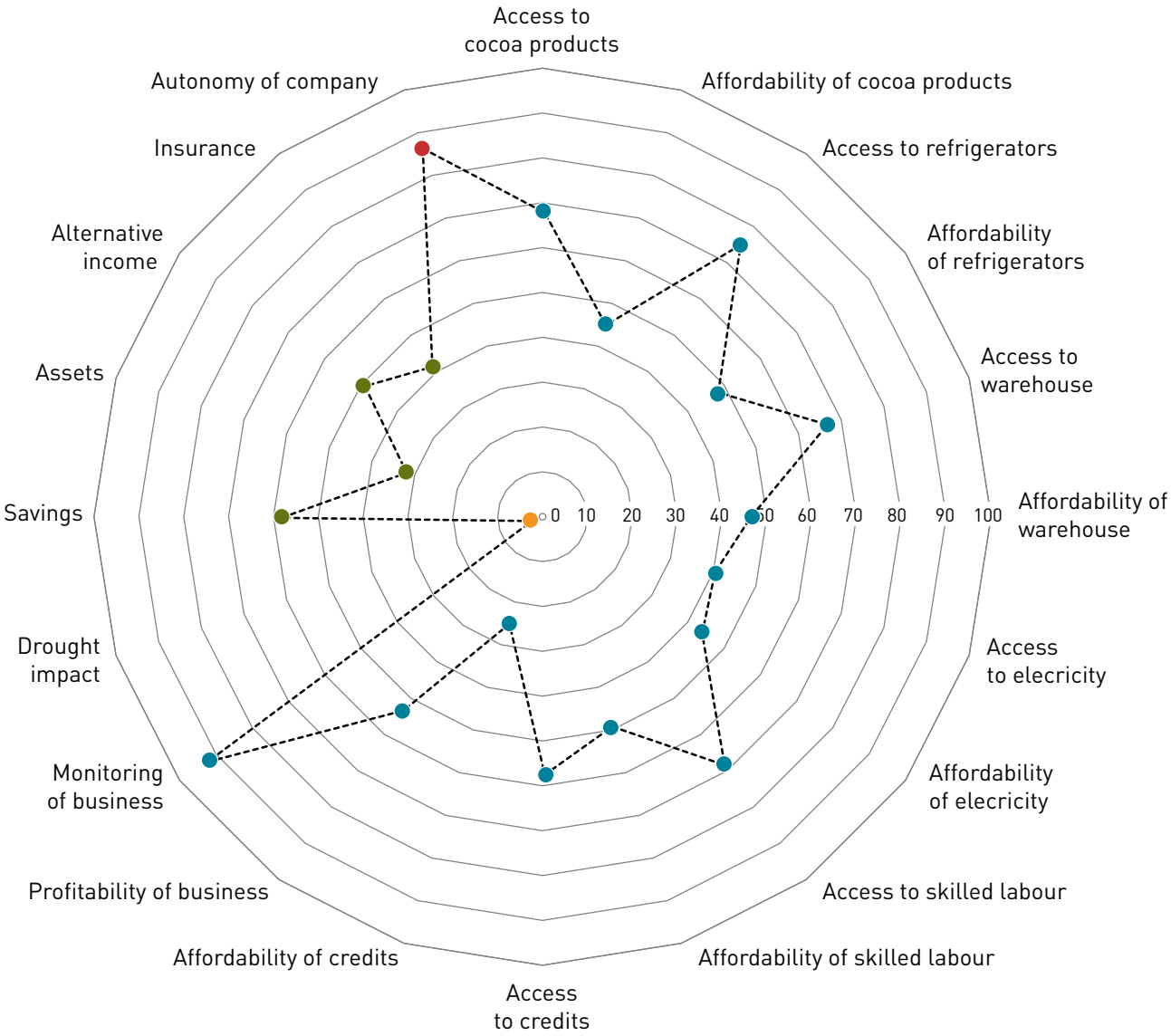


Figure 15
Resilience of supermarkets against drought; 0 (not available) to 100 (fully available). Blue indicators are for robustness, yellow for redundancy, green for rapidity, and red for resourcefulness

Robustness

The robustness of supermarkets (Figure 15) is characterised by higher access to resources compared to the ability to afford them. Cocoa products, refrigerators, warehouses, electricity, skilled labour and credits are all resources that are available, but are expensive. The profitability from selling cocoa-based products is not very high (score of 54) because the demand is moderate and the margins are small. Various chocolate brands compete with similar products.

Redundancy

The impacts of drought shocks are perceived to be negligible for supermarkets (score of 3). Supermarkets benefit from a wide range of products that allow them to compensate potential losses related to only marginally more expensive chocolate products.

Rapidity

Supermarkets are vulnerable to sudden unexpected changes induced by external events, such as drought. Moreover, supermarkets operate in a very competitive environment which has implications on their ability to impose high margins on their products. As a result, their availability of savings, convertible assets, alternative income and insurance protection is limited.

Resourcefulness

Supermarkets are privately owned companies and therefore, their ability to take decisions autonomously is very high (score of 87). This high autonomy of supermarkets coupled with a high interest to protect their business against external shocks, gives significant value to their adaptive capacity.

Overall resilience of supermarkets

Overall, the resilience of supermarkets to droughts is very high because such shocks have very little impact on their business. However, if other external shocks would occur, the availability of key resources that are likely needed in such a case would only moderately be available. Supermarkets operate in a fierce environment with little room for building resource that enhance their resilience against shocks.

Building Resilience in the Cocoa Value Chain

In this study, one of our goals was to translate results from a resilience assessment into the development of action plans that build and enhance the resilience of the stakeholders of the cocoa value chain in Ghana. We found it imperative that in a first step stakeholders' strengths and weaknesses in dealing with drought risk were assessed and then, in a second step, got recognised in the process of developing adequate and feasible action plans.

Design Thinking technique

In order to include and properly reflect the complexity of different activities of the cocoa value chain (system), we used available Design Thinking techniques (e.g. Brown [2008]; Brown [2009]; Buchanan [1992]). The objective of our design thinking model (Figure 16) was to allow stakeholders to come-up with action measures through an iterative, creative and step-wise thinking process:

1. Stakeholders analysed and validated the survey results (resilience assessment) → identified *insights* about what kind of challenges and problems (e.g. resources are mostly accessible, but not affordable) they face in their particular activity.

2. Stakeholders discussed and attached *basic needs* (e.g. more money to afford resources) to address these *insights* → prioritised a set of *underlying goals*.

3. Stakeholders isolated the specific underlying goals (e.g. sustainable business management) → identified *specific problems* (e.g. lack of knowledge, etc.) that would need to be resolved for achieving a specific underlying goal.

4. Stakeholders attached concrete measures (e.g. more extension officers for farmers) to each problem.

5. Stakeholders evaluated (Figure 17) all the measures based on a list of 13 evaluation criteria.

6. Stakeholders split all the measures into three categories with equal number of actions. The three categories prioritised the measures into *urgent*, *important* and *nice to have* in terms of implementation.

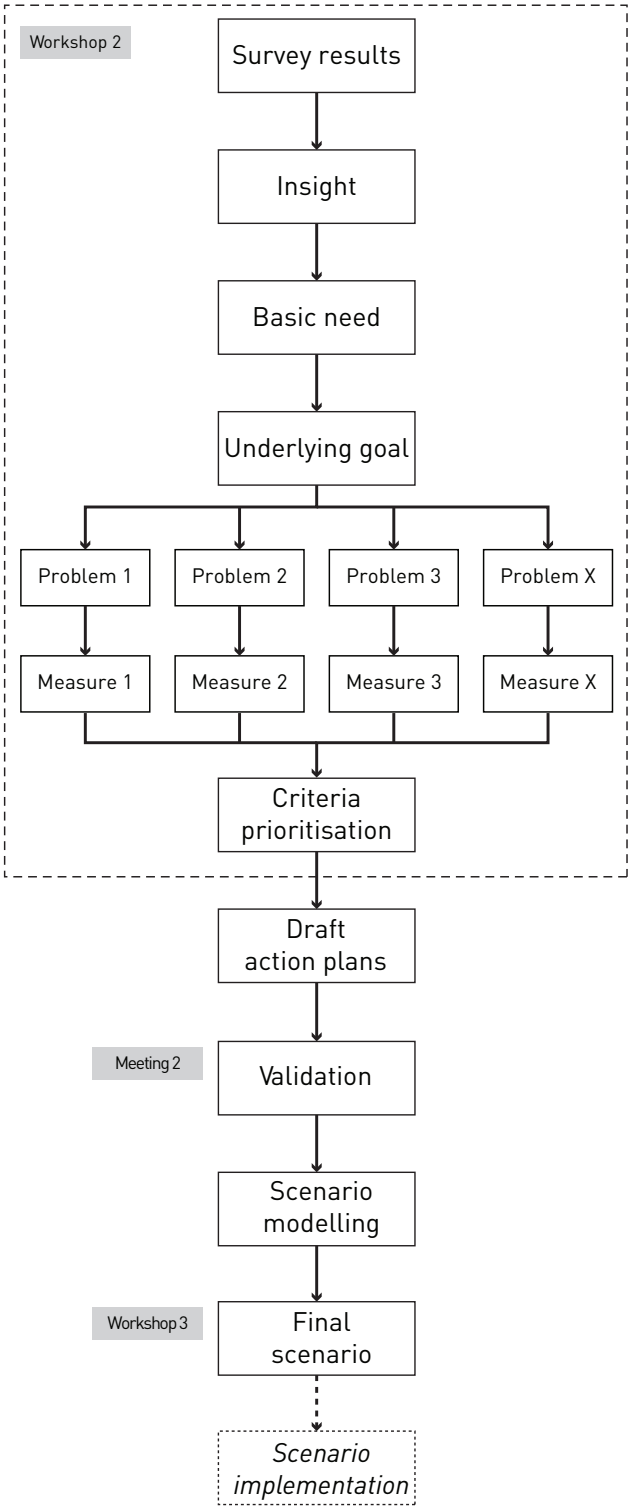


Figure 16
Using Design Thinking to generate action plans

Draft action plan validation by peers

After developing the draft action plans, our stakeholders got them validated by their peers and added or changed proposed action measures. The validation occurred in form of direct talks as well as meetings and mini-workshops. For example, our cocoa farmers organised village meetings where they first explained our study and then presented to them the proposed action measures (Figure 18). After that their colleagues provided critique and added or changed action measures.

This validation process enabled to verify whether the proposed actions would be supported by stakeholders beyond those who participated in our project workshops.

SystemQ analysis – scenario modelling

In a final step, we analysed the proposed action measures by using Vester's (2012) impact matrix (using the software *SystemQ*) to identify the influence of the proposed measures to each other. Concretely, we compared each action measure to another measure to identify whether they directly influence each other (indirect influences were not considered). For example, if measure A has high influence on measure B, measure A is an *active* measure in the system of all measures. If measure B is highly influenced by measure A and perhaps also by measures C and D, it becomes a *passive* measure. By comparing 1-by-^{1} each measure to another measure, we identified the key action measures among the draft action plans. The outcome of this impact matrix analysis is that action measures get allocated into different boxes that show whether a particular action measure is *active* or *passive* in influencing other measures. If it has high active and passive values at the same time it becomes an *ambivalent* measure, and its behaviour in the system of all measures is difficult to predict. If it has little influence on other measure and does not get influenced strongly, it is a *buffer* measure which means it has stabilizing function in the overall system of the measures.

Final scenario

The outcome of this impact matrix analysis of action measures is to directly support the formulation of scenarios (strategies) on how to build resilience in the cocoa value chain. In the final workshop in June 2018, stakeholders formed mixed groups to identify strategies on how to implement some of the key action measures.

Figure 17
Farmers discussing action plan during second workshop

Figure 18
Validation of action plan in farmer's village

Action Plan: Cocoa Production

In our study, cocoa farmers and input suppliers focused together on identifying action measures for enhancing the resilience of cocoa producers. In total, they identified 25 action measures (Figure 19) that may build resilience against drought risk.

Urgent action measures for implementation

Among the action measures that need to be *urgently* implemented and which are active in influencing other measures is only the *Increase of governmental subsidies on cocoa inputs*. Our cocoa farmers see COCOBOD in a primary role to enhance their resilience against drought risk by improving the provision of inputs and resources (e.g. fertilizer, seedlings, water, etc.) through subsidies. An improved provision of those inputs and resources would help farmers to adequately manage their farms in terms of soil and plant management as well as ensure that sufficient shade trees are planted to protect cocoa trees against drought risk. A greater involvement of COCOBOD would also result in financing irrigation technologies as well as support the construction of drainage systems to retain water for periods of no rain.

Important action measures for implementation

Among the action measures that are *important* and active in influencing other measures are *Recruitment of more extension officers*, *Improvement of road networks and Strengthening of border patrols against smuggling*. More recruitment officers would help to advance the knowledge of farmers on how to build fire belts, plant shade trees, apply irrigation technologies and in general adopt good farm management practices to manage future drought events. Improved road networks in Ghana would have a positive influence on the provision of inputs and resources as well as the internal marketing of cocoa beans. The strengthening of border patrols would not only reduce smuggling activities between Ghana and Ivory Coast, but also reduce illegal mining activities in Ghana.

Nice to have action measures for implementation

There is only one action measures that is *nice to have* and which is also active: *Building of dams for irrigation purposes*. This action measure would directly support the provision of water for irrigation purposes as well as the provision of potable water.

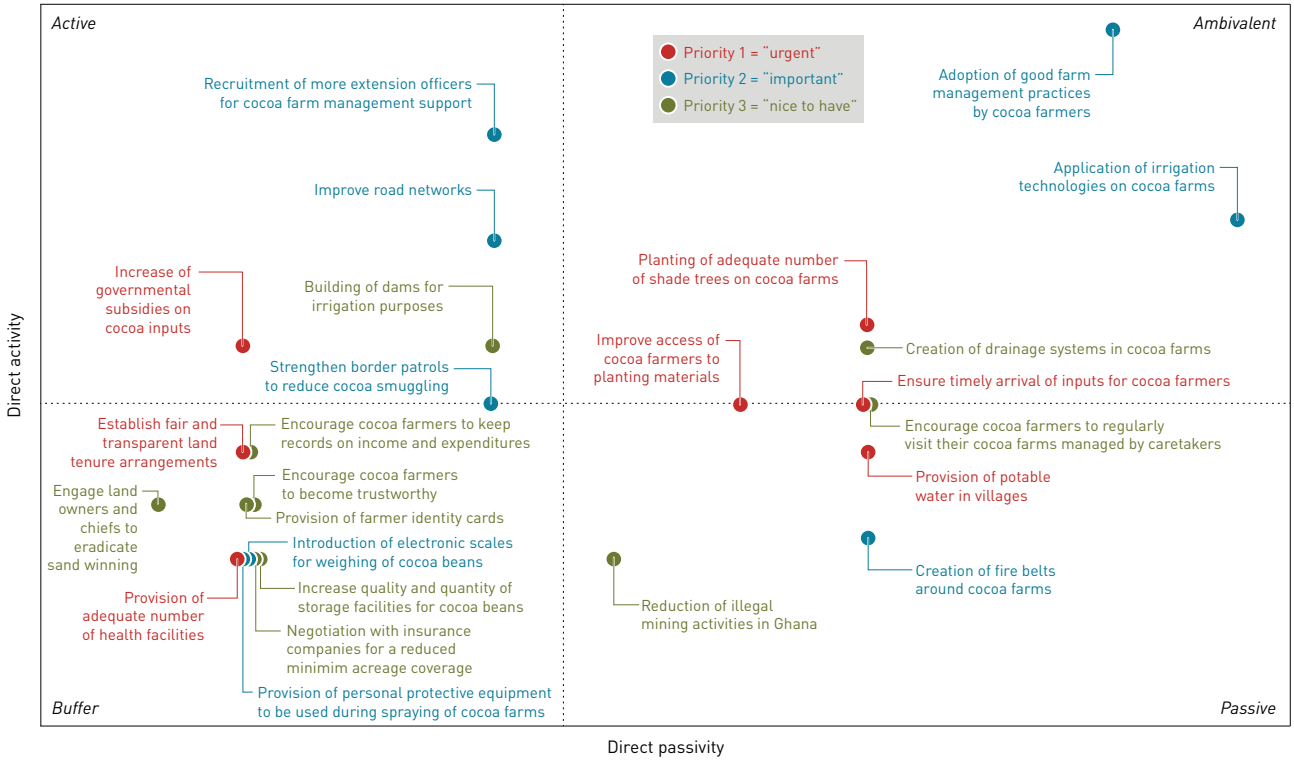


Figure 19
Action plan for cocoa production analysed with SystemQ software. Dotted lines indicate mean activity and passivity of all measures and separate the four boxes

Linkage of action measures to resilience assessment

Among the identified active measures (focus) are those that improve the availability of inputs, resources and knowledge. In addition, most of them require COCOBOD and other ministries of the Ghanaian government to take the lead in the implementation process. Linking action measures to the results from the resilience assessment of cocoa farmers (Figure 10), there is great correspondence with the identified deficits. A lack of affordability of inputs and resources has been mentioned to be a key challenge as well as knowledge on how to sustainably manage cocoa farms and protect against drought risk. All active measures would address those deficits and therefore, the proposed action measures are meaningful in the process of building resilience in the cocoa production in Ghana. However, since most of the proposed action measures require governmental bodies (especially COCOBOD) to take the lead, it makes cocoa farmers rather dependent on external decisions and powers.

Implementation strategies for key action measures

As shown in Table 1, the stakeholders consider that an "Increase of governmental subsidies" is required to provide farmers with lower input costs for the production of cocoa. Potential strategies to support and complement the implementation of this action measure include a reduction of taxes on agricultural inputs and machinery, local production of inputs and timely delivery of fertilizers through LBCs. Apart from COCOBOD and other branches of the government to provide more inputs/subsidies, the stakeholders believe that Public-Private-Partnerships (PPP) could help to alleviate the lack of sufficient and affordable inputs.

The second key action measure is to "Establish fair and transparent land tenure arrangements". To implement this action measure, intense discussions and meetings are required between chiefs, farmers, governmental representatives and landlords. A joint understanding about problems (e.g. land rights) could be facilitated through the adoption of a transdisciplinary approach.

The third key action measure is "Planting of adequate shade trees". The strategies to implement this measure is to educate farmers about the importance of having shade trees on their farm and overall to improve the supply of the adequate number and types of shade trees. The Seed Production Division (SPD) is the leading unit within COCOBOD who may take the lead and work together with the Forestry Commission, LBCs and the Council for Scientific and Industrial Research (CSIR) of Ghana to deliver adequate and sufficient numbers of shade trees to farmers.

Our stakeholders, consider that all action measures could be fairly quickly (short-term) implemented if the relevant actors would agree on working together to implement these action measures, and if there is the will to initiate and lead this process by major stakeholders.

Table 1
Implementation strategies proposed by stakeholders for cocoa production

Action measure	Strategies	Key responsibilities	Timeline
Increase of governmental subsidies	1. Encourage government to reduce taxes on agricultural inputs and machinery 2. Encourage local production of inputs 3. Timely delivery of fertilizers to farmers through LBCs	Farmer groups, LBCs and Government → PPP between private sector and COCOBOD	Short-term
Establish fair and transparent land tenure arrangements	Discussion and meetings between chiefs, farmers, governmental administrators and landlords	Chiefs, landlords, farmers	Short-term
Planting of adequate shade trees	1. Educate farmers about importance of shade trees 2. Supply more adequate trees to farmers	SPD, Forestry Commission, LBCs, CSIR	Short-term

Outlook for building resilience in the production activity of the cocoa value chain in Ghana

As COCOBOD has shifted in early 2017 from the Ministry of Finance to the Ministry of Food and Agriculture, one may expect that in the future aspects of sustainability (environmental protection, diversification of activities, etc.) will be prioritised more over short-term financial gains from selling cocoa beans. Accordingly, more funding would be available for providing subsidised inputs (e.g. fertilizers, shade trees, etc.) (Figure 19 and Table 1) to cocoa farmers. However, considering the volatile cocoa beans market (Figure 2) where the Ghanaian government recently suffered from heavy cuts of export earnings from selling cocoa beans, it may be difficult for COCOBOD and other branches of the government to finance all of the proposed action measures without changes in spending priorities of the Ghanaian government. Moreover, the recent reduction of producer prices in Ivory Coast (Figure 2) has triggered an increase in smuggling activities of cocoa beans between Ivory Coast and Ghana, which makes it even more difficult to substantially increase producer prices. However, discussions are currently ongoing about aligning producer prices between Ghana and the Ivory Coast to halt smuggling activities and improve the income of farmers in the long-term.

In such a situation, credits may offer a viable alternative to finance the need of inputs and resources, but would create dependency and financial burdens to cocoa farmers due to high interest rates. An alternative option would be to develop more collaborations between cocoa farmers and other stakeholders of the cocoa value chain in Ghana and abroad which could provide knowledge and other resources to farmers. The volatile market conditions, changing consumer sensitivity towards greater recognition of aspects of sustainability and interest among stakeholders within the cocoa value chain in Ghana offer a 'window of opportunity' to establish and intensify collaborations that help to build resilience.

Action Plan: Post-Production Activities

In our study, we aggregated the stakeholders from the post-production activities into a single group to define action measures that would enhance their resilience. This resulted in representatives from LBCs, cocoa processing and retailing to work together. In total, they identified 19 action measures (Figure 20) that would enhance their resilience. No stakeholder in this group perceived that it could directly reduce drought risk. Instead, they focused on proposing measures that can help to develop a stable supply of cocoa beans at all times.

Urgent action measures for implementation

Among the action measures that need to be *urgently* implemented and which are active in influencing other measures are a *Timely release of seed fund for LBC*s as well as an *Adequate provision of seed fund*. Both of these action measures would strengthen the financial capacity of LBCs to purchase and sell cocoa beans. Our stakeholders think that an improved internal marketing of cocoa beans would positively influence the availability of cocoa beans for cocoa processors and therefore, allow them to ensure a stable production of semi-finished cocoa products.

Important action measures for implementation

Among the action measures that are important and active in influencing other measures are *Improvement of access of market platforms and market partnerships*. These measures would help to enhance the information flow between different stakeholders of the cocoa value chain in Ghana. Improving the information flow between stakeholders would subsequently help LBCs and cocoa processors to purchase cocoa beans during periods of low prices. It would also advance the knowledge between stakeholders on quality and supply of cocoa beans. Advancing the knowledge of stakeholders in the post-production activities would have a positive impact on securing the supply of cocoa beans and products at all times.

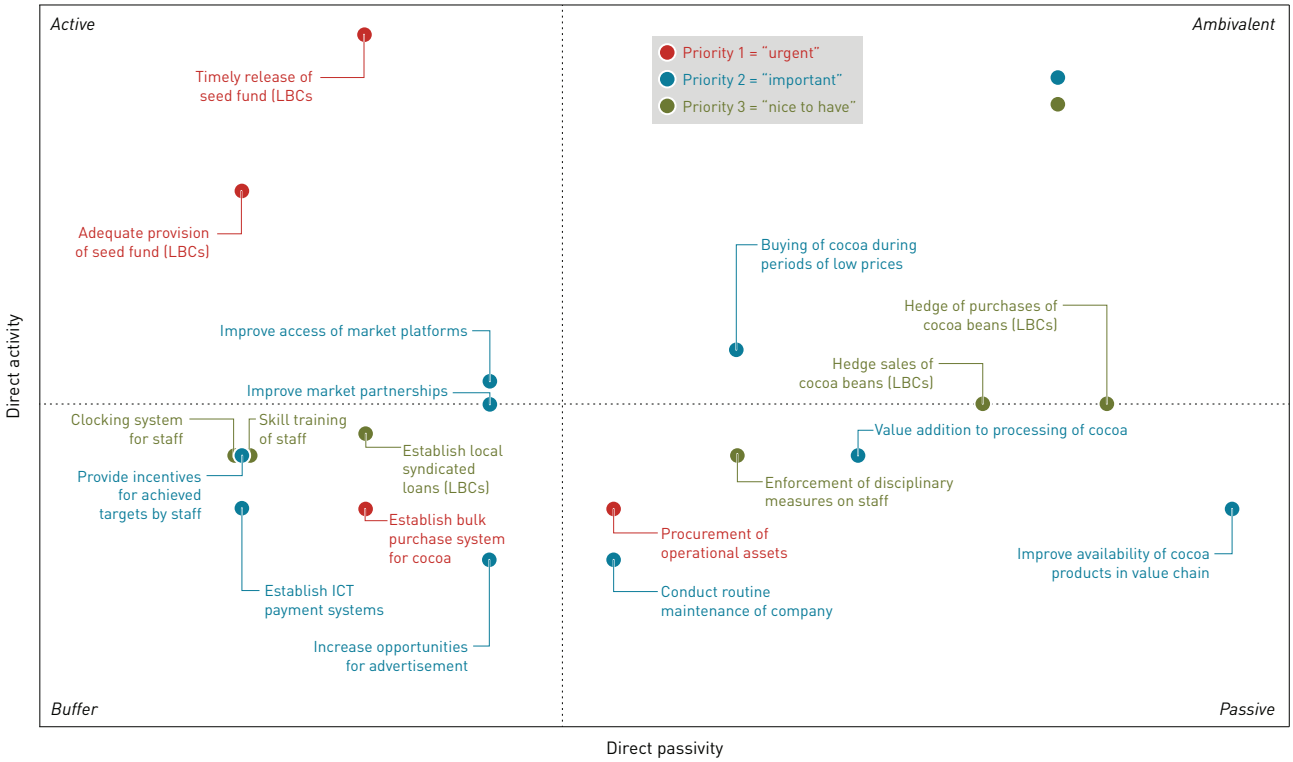


Figure 20
Action plan for post-production stakeholders analysed with SystemQ software. Dotted lines indicate mean activity and passivity of all measures and separate the four boxes

Linkage of action measures to resilience assessment

Among the identified active measures are those that improve the availability of cocoa beans and products at all times. The stakeholders themselves can implement some of these measures (e.g. market platforms and partnerships), but other measures (timely and adequate provision of seed funds) require the involvement and leadership of COCOBOD.

In terms of linkage to the resilience assessments of LBCs, cocoa processors and retailers, the proposed action measures focus largely on improving the robustness of their activities. This means that our stakeholders prioritise on the aspect of avoiding any impacts from an unexpected interruption of supply of cocoa beans. The aspects of absorbing and recovering from an interrupted supply of cocoa beans is difficult for the stakeholders to improve in a joint effort and therefore, has not been given much attention in the identification of action measures. Stakeholders believe that those aspects need to be individually improved. In terms of resourcefulness, our stakeholders see a potential in improving the information flow between the post-production activities through the establishment of market platforms and partnerships. Enhancing the information flow would ultimately improve the knowledge of stakeholders on the current market conditions of cocoa.

Implementation strategies for key action measures

Table 2 shows that our stakeholders see the *timely release of seed funds to LBCs* as a key action measure that would help the internal marketing of cocoa beans in Ghana. The strategies for implementing this measure go beyond improved release of funds by COCOBOD, but also require LBCs to identify alternative funding sources from the capital market. LBCs should also more timely process their application for seed funding and propose realistic targets of cocoa beans provisions.

The second key action measure is *procurement of operational assets*. To implement this measure, one option is to lease warehouses, trucks and equipment. Another strategy could be to set-up PPPs to finance the procurement of those assets. A third option could be to improve the distribution of those assets through better management before the start of the harvesting season.

The third key action measure is to *establish bulk purchase systems for cocoa*. This measure targets primarily processors and requires them to hedge the purchase of cocoa beans.

Our stakeholders think that all action measures could rather quickly be implemented if the relevant actors work together on it and if major stakeholders are willing to initiate and lead implementation activities. By 2020, these action measures could be implemented if from today these measures are tackled.

Outlook for building resilience in the post-production activities of the cocoa value chain in Ghana

The stakeholders in the post-production activities of the cocoa value chain in Ghana seem already today to be quite resilient to avoid negative effects from shocks, such as drought. Due to their international clients and owners, they have access to financial, information and technological resources. However, despite the availability of resources, the higher up (until cocoa processors) in the cocoa value chain, the more the income of stakeholders depends on doing business with cocoa beans/products (see Figure 21). In contrast, the higher up in the value chain, the less stakeholders think that a drought would affect them.

The current role of stakeholders in post-production activities (excluding retailers) to serve international clients has therefore direct implications on the identification and prioritisation of action measures. All proposed action measures focus on improving business processes and none of them suggests ways to reduce the dependency from doing business with cocoa. From a stakeholder perspective, this is understandable, but from a resilience perspective, this is problematic. Unless the formal import (not through smuggling) of foreign cocoa beans becomes a viable opportunity, post-production activities remain susceptible to impacts of droughts in Ghana.

LBCs' dependency on COCOBOD to receive a licenses and seed funds make them directly dependent on decisions made by COCOBOD. Similarly, the few number of cocoa processors in Ghana as well as their subsidiary role to serve in the interests of international companies make them very dependent on a stable and safe (high quality) supply of cocoa beans from Ghana. Retailers operate freely, but since cocoa-based products are not enrooted in the Ghanaian food and beauty culture, they are less dependent on selling cocoa products that are produced in Ghana.

Table 2
Implementation strategies proposed by stakeholders for post-production activities of cocoa

Action measure	Strategies	Key responsibilities	Timeline
Timely release of seed funds LBCs	1. Other source of funding (LBCs) 2. Prompt release of seed funds (COCOBOD) 3. LBCs should start timely processing of application for seed fund and not set over ambitious targets 4. Money from capital markets	LBCs, banks, COCOBOD, Finance Ministry, stock exchange	2019–2020
Procurement of operational assets	1. Leasing of warehouses, trucks and equipment 2. PPP to finance warehouses trucks, and equipment 3. Adequate distribution of assets before harvest season starts	LBCs, Processors, Transporters, banks and insurance companies	2020
Establish bulk purchase systems for cocoa	Hedging	Processors	2020

Key Lessons Learned

In this transdisciplinary study, we learned the following key lessons:

- Drought resilience: Overall, stakeholders across the cocoa value chain in Ghana have higher robustness against drought compared to redundancy, rapidity and resourcefulness. Stakeholders primarily focus on avoiding a drought and have so far limited abilities to absorb, recover and learn from such a shock. Stakeholders higher up in the cocoa value chain and with more connection to international clients are overall more resilient than others based on our model.

- Cocoa dependency and drought impact: The higher up in the value chain (until cocoa processors), the more stakeholders are dependent on income from doing business with cocoa (Figure 21). In contrast, the higher up in the value chain, the less are drought impacts perceived to be constraining the business with cocoa. As a result, the perceived impact of drought correlates negatively with the dependency on doing business with cocoa.

- Factors determining the resilience of stakeholders: Knowledge and finance are crucial factors to determine the resilience of stakeholders in the cocoa value chain in Ghana. For example, the access to inputs is available, but stakeholders find it difficult to afford them. Knowledge needs to be properly analysed: for example, when cocoa farmers are asked about their level of drought knowledge, they know very little, but when asking them about whether they conduct specific practices against drought, they reveal that they are well aware of drought risks, as they plant to a large extent shade trees, create fire belts, etc.

- Interactions among stakeholders in the cocoa value chain: Stakeholders from a particular activity in the cocoa value chain do not yet interact much with stakeholders from other activities. However, they show great interest to learn and enhance their resilience together with different stakeholders.

- Building resilience: Stakeholders know well their weaknesses and proposed action measures to tackle them. They are convinced that they are key players in the process of building resilience and thus, should take the lead in the initiation and implementation of relevant action measures. However, support from COCOBOD, the private sector, academia and NGOs is needed in this process.

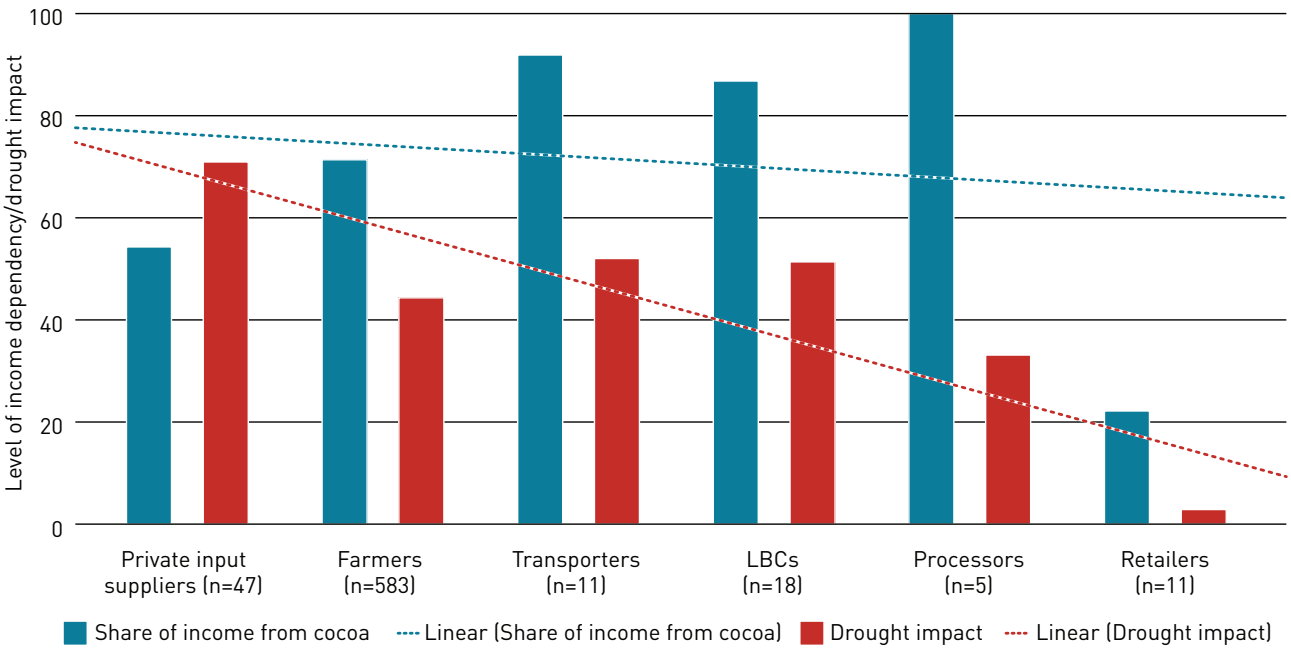


Figure 21
Share of income from cocoa versus drought impacts for stakeholders

Stakeholder Feedbacks

Overall, our stakeholders were very positive about the adopted transdisciplinary process. They felt that they were involved throughout the project and could shape the course and direction of the project. The below statements highlight some of the feedbacks of our stakeholders:

"Project tried to properly address the different contexts → surveys for the resilience assessments were applicable"

"Transdisciplinary approach is crucial to address the multiple known problems in the cocoa value chain in Ghana. COCOBOD can be the main beneficiary."

"Pictures generate more impact than written posters/documents"

"Project gave insights and opportunities to all stakeholders of value chain on how to reduce and tackle risk (e.g. drought) → stakeholders could come-out to think on how to jointly tackle a specific problem."

"Project has helped to increase the understanding about challenges of other stakeholders in value chain → synergies were identified."

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Way Forward

Based on our study, we propose the following way forward:

- **Roundtable:** To enhance the resilience of stakeholders in the cocoa value chain and to prepare them better against upcoming unexpected shocks, such as drought and also world market price fluctuations, it is crucial to bring stakeholders from all activities together to discuss potential pathways for transforming the cocoa value chain in Ghana and make it more resilient against shocks. For this, COCOBOD with its different units and subsidiaries needs to be involved, like the players from the other sectors, from the beginning into a dialog of transformation. Changes in the cocoa sector will require a thorough debate and analysis about potential trade-offs in transforming the current export-oriented cocoa value chain of Ghana. These debates should be structured and accompanied by a *neutral* player to balance potential power asymmetries and to avoid deadlocks. Science may play a role here in structuring the process, providing appropriate communication techniques, and feed in evidences needed to support a fruitful process. However, initial activities to establish a round table must come from one or several key stakeholders and not from *external* actors.

- **Ghana Cocoa Platform:** Our study adds to a large number of strategies that advocate for a more sustainable cocoa sector in Ghana. The Ghana Cocoa Platform is recognised by COCOBOD to be a viable body for collecting and disseminating knowledge that serve stakeholders in the cocoa value chain in Ghana. This body as well as other international associations could serve as facilitators to build resilience in the cocoa value chain.

- **Partnerships:** Stakeholders in our study have appreciated to be involved throughout the project period. We learn from this that building project collaborations with local stakeholders requires a full recognition of all involved project partners. Project decisions need to be taken jointly and through consensus. In light of international interests to become active in Ghana, potential long-term partnerships need to pay particular attention to the needs of local stakeholders.

- **Further research:** We propose to look in detail about how stakeholders of the cocoa value chain in Ghana can effectively transform in order to become resilient against shocks. Resilience aspects, such as diversification, ownership, flexibility, etc. could serve as potential determinants of transformation. In addition to these determinants, it would also require the identification of barriers that prevent transformation and building of resilience against potential shocks. In the context of transformation, we are currently comparing the resilience of different production systems: conventional, label and organic. Moreover, we analyse the feasibility of implementing action measures to build resilience among cocoa farmers.