Avocado tree in Yanonge DRC
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CHAPTER 2

Pathways to achieving sustainable development goals through tree commodities in Africa

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Key highlights

- Tree commodities constitute an essential part of African economies by providing livelihoods for millions of people
- The use of tree commodities in pathways to prosperity and development therefore is essential for these people and economies
- Tree commodity-based pathways to sustainable development include agronomic pathways, value-addition pathways and governance pathways
- Plausible, effective and efficient opportunities for such pathways can be supported with case study examples within Africa
- Enabling conditions for these pathways include finance and investments, availability of knowledge and technical know-how, market reform and policies and incentives.

1. Introduction

Tree commodities are tree crops grown largely for commercial purposes, such as cocoa, coffee, timber, oil palm, and rubber. The category also includes fruits, raisins, gums, oils, nuts, leaves and other products harvested from trees in the wild or in early stages of domestication. In sub-Saharan Africa, tree commodities occupy more than 100 million ha of arable land. They are also a large part of land management dynamics as they interact with food and nutrition systems. In total more than 250 million people are directly involved in these activities, while over 600 million are indirectly impacted by the value chains and supply systems. Tree commodities make up between 15 and 20% of the GDP in SSA, with more than 35 countries involved. Tree commodities are also key export crops and therefore key in determining the balance of payments. As a result, tree commodities are an important part of livelihoods, agro-ecosystems,

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sociological and economic systems. Consequently, they play an important role in potentially determining how Africa will, or will only partially, achieve the Sustainable Development Goals.

Timber and other agricultural commodities (including cocoa, coffee and other tree commodities) feature prominently in the Africa Commodities Strategy. The African Commodities Strategy is an important component of the Agenda 2063 ('The Africa We Want'), which aims at propelling sustainable development on the continent. The Africa Commodities Strategy and the Agenda 2063 share the global aspirations of the 17 SDGs. The African Commodity Strategy aims to identify, formulate and drive the implementation of policies and programmes that will enable African countries to add value, extract higher rents from their commodities, integrate into global value chains, and promote vertical and horizontal diversification anchored in value addition and local content development. It targets a number of issues, including identifying opportunities and how to identify existing challenges in various sectors, commodity price volatility, driving commodity-based industrialization as a launch pad for future diversification and better integration into local, continental and global trade (AU 2021).

It is expected that this approach will contribute to meeting the SDGs in Africa, such as a reduction in poverty (SDG 1) and hunger (SDG 2), improved health care services (SDG 3), access to quality education (SDG 4), clean water (SDG 5), affordable energy (SDG 7), decent working conditions (SDG 8), interlinked industrial development and stability of livelihoods (SDG 9) (van Noordwijk et al 2018). Through the advancement of tree crop commodities, countries can – so is the ambition -- achieve prosperity and sustainable development particularly for the millions of farmers, forest communities and poor people in degraded landscapes. However, the evidence of achievements so far is mixed.

This chapter explores the potential of selected tree commodities in Africa to contribute to the SDG Agenda. Therefore, we look at three related questions:

1. Which pathways can Africa use in a tree-commodity orientation to support SDG attainment?
2. What practices are required within the pathways to attain the SDGs?
3. What conditions can be established and/or improved to support a tree-commodity based development pathway?

2. The Pathways

To discuss the intended achievement of sustainable development in Africa, we identify three groups of pathways through which tree commodities can contribute to SDGs. These include agronomic pathways, value-addition pathways and governance pathways. Each pathway group includes a number of sub-pathways.

Agronomic pathways represent actions at farm level. They focus on increasing productivity of multiple products on farm through a portfolio of management practices as the main route to achieving SDGs. Sub-pathways will include sustainable intensification of production systems, sustainable diversification of production systems, and rejuvenation of old plantations. Here we are talking about sustainable agriculture that embraces agroecological principles.

Value-Addition pathways represent actions for improving benefits from tree commodities through the value chain. These could include, increased domestic processing, domestic demand, improved domestic markets and marketing, bioenergy generation as bye-products and improved eco-certification as sub-pathways.

Governance pathways consist of actions and options for enabling contributions to SDGs by enhancing how tree commodities are governed. Examples of sub-pathways include improved measures to ensure deforestation free commodities, land and tree tenure (Alden Wily 2021), reduced child labour and fairer pricing of tree commodities.

Figure 2.1 illustrates the various pathways to achieving five clusters of crucial SDGs are directly connected and indirectly influenced by the pathways. Each pathway leads to a core SDG that is ultimately connected to the achievement of associated SDGs, e.g., the reduction of poverty (SDG 1) is associated with an increase in economic growth (SDG 8). The pathways are also interconnected as various aspects of each pathway contribute to others, despite their distinct features. Even further, we also highlight the enabling conditions possible for the achievement of the five pathways within the topics: policy/regulatory frameworks, certifications, organisations within communities, financial incentives/support and technical support. Each of these pathways is discussed in the subsequent sections to further elaborate on the role and capability of achieving sustainable development in Africa through tree commodities. It is important to note that we separate the pathways here for practical presentation and easy understanding only. In reality, these pathways are highly interconnected and complementary in many ways, and in other instances, they can be conflicting.

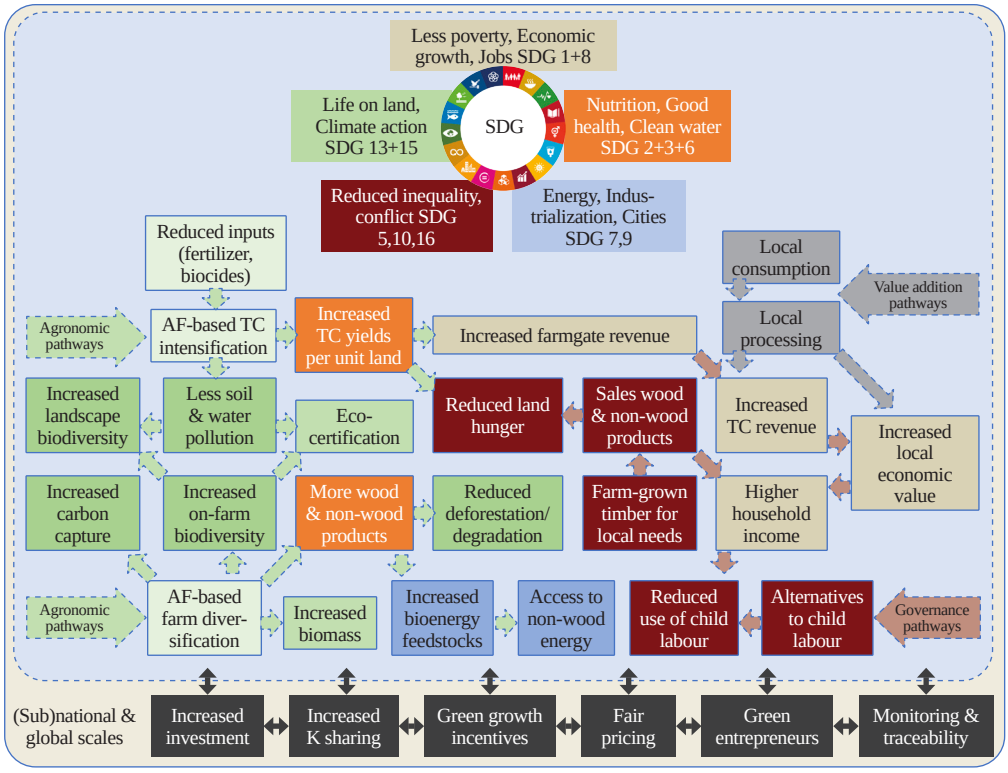

Figure 2.1: *Tree commodity pathways to the achievement of sustainable development goals in Africa*

2.1. Agronomic pathways

2.1.1. Sustainable Intensification

Sustainable intensification was originally described as the goal raising agricultural yields while ensuring environmental and economic benefits (Pretty 1997). The original concept envisioned the use of local knowledge within local conditions to benefit poor farmers; but the term evolved into a focus on efficiency enhancement (Loos et al 2014, van Noordwijk and Brussaard 2014). The sustainable intensification pathway as interpreted now is primarily for achieving reduced poverty (SDG 1) among African communities through efficient and appropriate use of inputs, providing access while avoiding excess (van Noordwijk and Cadisch 2002). Achieving a higher income among these families will enable greater access to basic amenities such as food (SDG 2), health goods and services (SDG 3), education (SDG 4) and energy (SDG 7). The majority of smallholders have low incomes, thus they are unable to meet basic needs such as food, education and health services. For example, in Ethiopia, poverty rate is around 48% (Rapsomanikis 2015).

Inputs such as fertilisers and pesticides, water harvesting and conservation are important examples in improving production while maintaining the environment. In Uganda, the intensification of coffee farms is fuelled by higher inorganic fertiliser application rates, genotype variety of coffee grown and intensification systems such as land management in relation to altitude (Sebatta et al 2019). Integrated pest management is one of the critical methods utilising a combination of targeted compounds with agronomic and biological techniques to control crop pests without yield penalties. Despite Africa using less pesticides and insecticides in comparison to other continents for agricultural production, more countries are rapidly increasing their use. For example, in Kenya, the amount of pesticides used increased from 6,400 to 15,600 tonnes from 2015-2018 (Sakar et al 2021). Synthetic pesticides endanger human and ecosystem health; thus, reduction in their use decreases pollution to both ground and surface water and allows access to clean water and sanitation on and around the farms (SDG 6). Achieving cleaner water access will also reduce the cases of water-borne disease contractions, thus, supporting better health (SDG 3).

Additionally, to harness the benefits of ecosystem services such as improving soil health conditions and ultimately increasing yields, agroforestry is used as an input method to increase production (Kuyah et al 2021). Asaah et al (2011) and Ajayi et al (2011) identify the use of agroforestry in Malawi, Tanzania, Mozambique, Zambia and Cameroon where the adoption of 'fertilizer trees' with nitrogen fixation has improved the soil and consequently increased the production of maize by about 3 tonnes over five years. Furthermore, agroforestry is a viable option for farmers with limited capital in acquiring inputs to provide supportive functions such as soil improvement and water recycling that benefit their yields (Mbow et al 2014).

2.1.2. Sustainable diversification

Sustainable diversification is an essential pathway to achieve food security (SDG 2) through the combination of food and tree farming, as well as increasing the income of farmers from their sale of diverse crops. It is worth noting that sustainable intensification and diversification are often intertwined depending on the activities practiced, such as agroforestry, to achieve a desired outcome. However, we discuss them separately to highlight the pathways to the achievement of reduced poverty from sustainable intensification and reduced hunger from sustainable diversification. The fluctuating prices of commodities such as coffee and cocoa jeopardize the livelihoods of numerous actors within the sectors. Therefore, diversification offers an opportunity for alternative sources of income. Furthermore, cocoa farmers with the cultivation of vegetables in cocoa farms provide a high chance of improving the nutrition within their households through the intake of the diverse vegetables needed for a balanced diet (Djokoto et al 2017), and improve the health of the people (SDG 3). Bymolt et al (2018) highlights the practice of diversification in cocoa farms during replanting seasons where

crops such as plantain are used to provide shade for young cocoa trees and simultaneously increase household income and food security (SDG 2). As climate change continues to affect production, food insecurity is expected to rise and affect millions of people. Therefore, encouraging diversification of the commodities' cropping systems projects as a risk strategy in adapting to climate change (Masters et al 2010). In Africa, we highlight two examples of diversification in cropping systems – intercropping and agroforestry.

Intercropping as a diversification method using marketable annuals is most suitable with early yields and returns while slightly improving environmental impacts. Benefits of intercropping coffee and other crops are much realised in smallholder systems when the type of crops required are selected based on the socio-ecological conditions (Rahn et al 2018). Typically, when cash crops are introduced, food crops are often displaced, leaving cash crops to harm the availability of food. This is evident in Guinea Bissau in 2006, where rice production decreased as farmers resolved to increase the production of cashew because of its high market value. As a result, the country was forced to import rice to feed the citizens from the annual rice deficit of 70,000 tons (The New Humanitarian n.d., Catarino et al 2015).

Agroforestry is continuously being adopted across crop landscapes in Africa due to the input in soil health conditions and consequently increased yield that it offers. In the diversification pathway, agroforestry is an approach that can provide produce for increased income and food consumption through fruit trees (van Noordwijk et al 2021). The current systems of agroforestry in Africa are wide in variety and are similarly described to have massive commonality with woody perennials (Mbow et al 2014). In Southern Ethiopia, the coffee home gardens have been combined with the plantation of the perennial *Ensete ventricosum*, which is a staple food for about 15 million people in this region (Abebe 2013). Furthermore, African countries have been noted to diversify their dietary choices and nutrients from fruits, nuts and leafy vegetables acquired from agroforestry systems (Mbow et al 2014). Even further, in between crop harvests and in cases of cop failure or drought, trees such as *Moringa stenopetala*, *Vitellaria paradoxa* and *Sclerocarya birrea* have been used as a source of food across several parts of Africa (Forch 2003, Jamnadass et al 2013).

2.1.3. Rejuvenation of old plantations

Somariba et al (2021) and Wessel and Wessel (2015) established that aged tree plantations represent one of the main limitations of production and productivity in many developing countries, including in Africa. The high cost of rejuvenation in terms of inputs and time often limits rehabilitation of such old plantations. The old plantations still generate some revenue, but where money has not been set aside and saved during the most productive stage, external support is needed to make the investments in rejuvenation. In many parts of Africa, governments have set out to implement large scale plantation renewal programmes by distributing tree seedlings

and providing extension support (Wessel and Wessel 2015). The main approach is to clear and replant old plantations. This is largely done by large scale plantations. Smallscale farmers who practice complete replanting often phase it to avoid long periods of little or no income. Often these replacements are done with improved germplasm with a view to improving productivity. In some parts of Africa, faster and improved practices such as grafting are increasingly being deployed. Farmers graft improved shoots onto existing stems and thus rejuvenate them faster, with yields potentially doubling within 2 years compared to 4-5 years in the case of complete replanting. This allows very little loss of income and avoids the environmental pitfalls of clear-felling. While the grafting approaches are not widely practiced, they hold great potential as reported in Asia and other experiences in chapter 26 (van Noordwijk et al 2021).

2.2. Value addition

The value addition pathway is characterised by the achievement of industrialisation in Africa (further discussed in Piabuo et al 2021, *chapter* 17) through the increase of economic value captured by producing countries. In this pathway we discuss the role of developing and enhancing domestic processing of tree commodities and domestic consumption in boosting the economic value received by both the farmers and countries. Currently, majority of the tree commodities are exported in their raw state to Europe and North America, where they are processed and sold to majority of the consumers. Therefore, for commodity products, value addition majorly occurs within the consuming regions.

2.2.1. Domestic processing

The Global Trade Review (GTR) reports that in 2019, 26% of cocoa from Africa was exported as cocoa products, while 74% was in form of raw cocoa beans. Additionally, the cashew sector only exported 5% of processed nuts and 95% of raw cashews. The addition of value in cocoa is seen in Cote d'Ivoire (2nd) and Ghana (6th) featuring among the top ten grinders in the world at 12.3% and 6.4%, respectively, in 2018/2019. In Côte d'Ivoire, the multinational companies Cargill, Barry Callebaut, Olam and Cemoi have established grinding facilities, grinding about 45,000 to 49,000 tonnes of beans per month. Additionally, local entrepreneurs have also made an effort to produce chocolate in Ghana and Cote d'Ivoire. However, in Ghana, they have been challenged by the lack of sufficient milk supply, leading to importation of milk, excessive prices of electricity and high temperatures that require a lot of refrigeration of the products.

The current activities in value addition through local processing of commodities in Africa are majorly practiced within smallscale facilities and businesses. In Nigeria, Lawal et al (2010) show that in Nigeria the value addition of cashew can be done through the grading, heat treatment, shelled roasting and packaging of kernels, and crushing and processing of apples into juice. This addition was estimated to contribute $USD 180 per farmer above the net income

gained without value addition. In Mali, only 4% of the produced nuts are processed within the country for self-consumption and local sales (European Commission 2020). Additionally, in Ghana and Uganda, the processing of shea beyond the raw nuts and kernels is locally practiced by farmers. Traditionally, the processing of shea nuts by artisanal women processors to crude butter involves curing and extraction. Small-scale machinery has been introduced to reduce the drudgery of manual work; these include roasters, milling machines and boilers. On a larger scale, the industrial processing of shea is done through extraction and refinery. Despite showing the present forms of commodity processing, practiced across the continent, the performance is still basic in comparison to the global standards practiced in importing countries. Therefore, to compete with multinational organisations and companies, it is imperative that the standard of processing is highly elevated.

2.2.2. Domestic marketing

Consumption of coffee has historically been low in Africa, with Ethiopia as an exception, due to a higher tea-drinking culture, e.g., in Kenya and Uganda. The consumption of coffee has also been significantly lower than in other regions such as Europe and America. For example, the average per capita consumption in Africa is highest in Ethiopia at 2.27kg, while in Brazil it is 6kg and nearly 9kg in the European Union. However, the tables seem to be turning with the increased consumption of coffee among the middle-class, thus increasing the prevalence of local coffee shops such as Java House and Art Caffe in Kenya, Café Neo in Nigeria and Kaldis in Ethiopia (Reuters). The success of these local businesses has encouraged the processing and consumption of coffee within the countries. Additionally, other platforms such as coffee training schools have been established to serve the increased consumption, such as Dormans' 'The Nairobi School of Coffee', in Kenya.

Comparing African countries to the top producers and exporters, consumption of the commodities within the producer countries is key. Brazil, for example, is the largest producer and exporter of coffee in the world. This success is majorly attributed to the high production and consumption rates of coffee within the country. The local consumption increase in the country was affected by the growth in coffee product quality through certifications, growth in the demand for premium coffee, placement of the coffee products as a health-boosting product and macroeconomic growth within the country. In the 2019/2020 season, Brazil produced 58.2 million 60-kg bags of coffee (Statista). Of this, the local consumption consisted of 23.5 million 60-kg bags (Statista). This accounts for 40.4% of local consumption from the total amount of coffee produced.

2.2.3. Bioenergy

The total energy demand of Africa as reported by the International Energy Agency (IEA) in 2018 was 830 million tonnes of oil (Mtoe), while the sub-Saharan average consumption per person was 0.4 toe/capita. The energy sources are dominated by oil, coal, gas and bioenergy. Specifically, bioenergy is the major source of energy in sub-Saharan Africa for cooking among households and industrial consumption (Cozzi et al 2019). Energy consumption in Africa is focused on biomass sources, specifically firewood and charcoal, with 90% of wood consumed in Africa used as wood fuel and charcoal. In 2012, the charcoal production was estimated at 30.6 million tons, which accounts for about USD 6.1-24.5 billion in annual sales (Grid Arendal 2013). With the increase in population and growth in urbanization, exploration of alternative sources of energy to supplement the current sources and increase the production quantity are of great necessity.

Agroforestry provides for fuel through firewood that is used in cooking and boiling drinking water, thus, ensuring sanitation and preventing diseases (Jemal et al 2021). Additionally, biomass waste from the production and consumption of food crops can be utilised in energy generation. The post-harvest losses from food crop farming can be used by farmers as wood fuel. Eco Africa, documents the variety of wood fuel sourced around Africa to replace conventional firewood and charcoal for cooking and heating homes. Key examples show the invention of coal briquettes generated from banana skins (Cameroon), maize (Uganda) and sugarcane (Kenya) to replace charcoal (Melanie 2018). Additionally, a review by Mohlala et al 2016 shows corn and sugarcane, rated among the highest produced food crops in South Africa and Nigeria, have significant high potential in biofuel generation.

Biomass use in waste generation also provides for a shift into more modern biomass use within the continent while providing waste management practices through using crop residues such as coffee, cocoa, cashew and oil palm in Africa, among other crops (Mensah et al 2021). Woldesenbet et al (2016) indicate the possibility of the use of coffee waste (pulp and mucilage) to produce ethanol, therefore, providing an alternative and reducing dependence on oil and petroleum. It also reduces environmental pollution and provides energy solutions for small-scale farmers. Beyond this, the joint production of biogas and bioethanol can also be explored.

2.2.4. Eco-certification

Certification is the most widely used proxy of adherence to the zero-deforestation pledges, with four out of five pledges relying on certification. The majority of the companies for a long time have used a range of voluntary certification schemes for the associated forest-risk commodities. To monitor actions conducive to the pledges; however, companies must rely on their positions within the supply chains. For companies as producers, processors or vertically

integrated, which control production, they can verify compliance themselves without reliance on certification. Companies at the consumer level, however, are too far from the production systems and seldom have access to much information on the upstream suppliers. Therefore, to ensure compliance with the pledges, we must rely on certification (FAO 2018). Some cocoa farmers in West Africa, through the support of the Rainforest Alliance, were able to obtain sustainability certifications where a minimum of five trees must be left per hectare for certification (Carodenuto 2019). Companies at production and processing levels, as well as vertically integrated companies, can monitor compliance and control production easily as they are in direct contact with the producers. Contrarily, companies working at the consumer end of the chain must rely on certification and procurement (FAO 2018).

Efforts have been made through various projects, such as the partnership of Olam and Rainforest Alliance with the 'Climate Cocoa Partnership for REDD+ Preparation' project that aims to break links between cocoa production and deforestation, and inculcate more climate-resilient cocoa (Hans et al 2015). Support and incentives for smallholders are crucial in the fight against deforestation and enhancing the broader social and environmental sustainability of supply chains. Significant shares of the commodities linked to deforestation are produced by smallholder farmers, often due to the inability to make changes in practices because of a lack of knowledge and capital.

2.3. Governance

The governance commodity pathway seeks to establish the place of tree commodities in reducing deforestation, reducing child labour and improving fair pricing to bring out peace, justice and strong institutions (SDG 16), reduce inequalities (SDG 10) and develop partnerships (SDG 17).

2.3.1. Deforestation-free commodities

The deforestation-free commodity pathways seek deforestation-free supply chains of commodities to reduce deforestation and biodiversity loss to conserve life on land (SDG 15) and act against climate change (SDG 13). Deforestation and forest degradation are driven by many factors, one of which is agricultural expansion. With the demand for agricultural products expected to grow, pressure on natural ecosystems such as forests is likely to increase. The loss of forest area in the last 25 years accounts for about 30.7 per cent of the total land area (FAO 2018). Furthermore, deforestation significantly contributes to greenhouse gas (GHG) emissions, estimated at 4 to 14 per cent globally. A balance is therefore required between consumer demands and the necessity of forest and ecosystem maintenance to achieve a positive impact of agriculture on the natural ecosystems (Hans et al 2015, Minang et al 2014).

Deforestation from agricultural expansion fundamentally affects the wellbeing of an ecosystem by disrupting the original ecological balance. The biodiversity of plants and wildlife decreases due to the loss or alteration of habitat conditions such as temperature change, moisture content, soil composition and foliage loss (Varcho n.d.). Commercial agriculture accounts for about a third of the deforestation as well as subsistence agriculture in Africa (Kissinger et al 2012). The expansion of commodities such as palm oil, sugar and cocoa production in West Africa is resulting in an upward trend of deforestation and degradation (Ordway et al 2017). Social conflicts such as inequality, unclear and disputed tenure and access rights are considerably associated with the expanding production of commodities, especially with weak governance. Smallholder farmers are integral in the production of commodities with responsibility as high as 90 per cent in cocoa production, yet they are primarily overlooked in initiatives aimed at reducing deforestation (Fairtrade Foundation 2011).

The dynamics and multiple causes of deforestation and forest degradation are highly complex. Addressing them requires innovative, integrated solutions, including the development of improved technologies and policies that promote more ecologically efficient food production while optimising land allocation for conservation and agriculture. Various public-private partnerships, such as the Tropical Forest Alliance (TFA) 2020, have committed to reducing tropical deforestation associated with essential global commodities.

2.3.2. Land and tree tenure

Land and tree tenure are critical for enabling effective, efficient and equitable tree commodities. Access to land is much harder for youth and women, therefore impeding their engagement and benefits from tree commodity systems. Trees take time to grow, so disadvantaged or migrant workers renting land cannot invest in tree commodities or trees. On the positive side, we have seen pressure on land encouraging intensification and diversification of tree commodities in countries like CDI and Ghana. On the impact side, the quest for land by multinationals for developing tree commodities in Africa has led to conflicts. Cases include DRC, Liberia, Cameroon, and others.

Furthermore, a key challenge across the world in commodity landscapes, with particular evidence in Africa, is the grabbing of land. For example, across west to central Africa, multinational companies are colluding with development banks and local elites to grab land from communities for oil palm plantations. From 2000-2015, it was found that over 4.7 million hectares in Africa were signed off in 65 large-scale land deals for oil palm plantations. However, in the last couple of years, communities in these countries have contested the invasion of these companies into their communal land and resisted the projects. Large-scale oil palm projects in Angola, Cameroon, Congo-Brazaville, DRC, Ethiopia, Ghana, Guinea, Mozambique, Nigeria, Sierra Leone and Tanzania have failed or been abandoned, while others have been scaled down

(GRAIN 2019). Establishment of national standards that align with international standards such as the VGGT - Voluntary Guidelines on the Responsible Governance of Tenure would be helpful in directing land investments.

Like land tenure, tree tenure is an extremely important component of green tree commodities. Without clear ownership, farmers will not plant trees. Actually, timber trees and other NTFPs are not grown when farmers do not own or have access to the products. In many countries, the long and costly permit process for harvesting, transporting and selling trees is a hindrance to the integration of trees into tree commodity farms. Recent laws allowing tree ownership on farms in Cote d'Ivoire and Ghana have made a big difference in tree planting and integration in cocoa. Thus, directly impacting biodiversity in farm areas next to protected areas and potentially enhances carbon sequestration.

2.3.2. Child labour

Africa has the highest regional prevalence of child labour; with 19.6%, 72 million children in child labour (ILO 2017). A strong correlation is noticed between child labour and situations of conflict and disaster, with the African region being among the most affected by this, thus, at a heightened risk of child labour. The nature of child labour is majorly characterised by children working as a contribution to family needs as labourers and not as employees (ILO 2018). Child labour has dramatically depended on the low income and livelihoods of the parents, and therefore, an improvement of the two is highly significant. Through associations and cooperatives, the workers receive access to support inputs and better pricing on outputs. In Rwanda, these cooperatives play a crucial role, revealing that among farm households actively in agricultural cooperatives, child labour is one third lower than in other farm households (UCW 2010). Furthermore, securing wages for vulnerable workers reduces the levels of child labour. In Egypt, an increase of 10% in the market wages for illiterate males decreased the probability of child labour among boys and girls by about 22% and 13% for boys and girls, respectively (Wahba 2000). The provision of inclusive and equitable education for all (SDG 4) and the reduction of child labour are inseparable. To ensure that schooling is beneficial in comparison to child labour, policy approaches that address early childhood development, care and pre-primary education, reduce direct and indirect schooling costs, extend school access and improve school quality (ILO 2018).

A study by Akoyi et al (2018) in South-Western Ethiopia and Eastern Uganda indicates that prohibition alone is not enough in the fight against child labour. In the comparison of two certifications, Rainforest Alliance (RA) and Fairtrade (FT), it was observed that participation by smallholder farmers in FT specifically impacted society through an increase in children's schooling eight years after the certification's introduction. Contrarily, participation in RA had no

impact on child schooling despite an increase in household income. The difference in impact is attributed to awareness-raising and investment within the regions by the certification. Beyond the prohibition of child labour by both certifications, FT requires the payment of a premium by buyers to producer cooperatives or plantation workers that aids in the local development of society (Fairtrade International 2017). Further, FT states that 'If there are no schools available in the area where children live, all effort should be made to work with national authorities and other relevant partners to build schools' (Fairtrade International 2011). Appropriate policy choices are significantly highlighted as a successful approach in reducing the levels of child labour in various countries. Brazil and Mexico, for example, present the importance of policy support where a study utilising econometric methods shows that despite the significance of long-term structural changes in the population and economy in reducing child labour, the highest declines were attributed to policy-related factors (ILO 2018).

2.3.3. Fair-pricing

In the West African cocoa farms, farmers were paid below the market prices and lacked the bargaining power due to lack of access to the updated information and scales to weigh their produce. Beyond the poverty in these societies, the low income from their produce pushes farmers to use children to work on their farms to reduce labour expenses (Athreya 2011). Price volatility is gravely harming the livelihoods of farmers due to the inability to plan their production process as they are unaware of the market pricing during the harvest time. Coffee prices exhibit this characteristic due to the vulnerability of production to temperature, precipitation and diseases, causing a wide variance in production each year, hence a peak in the prices (Brown et al 2001).

Different price mechanisms are now in use within the cocoa sector to address the extreme price volatility issues and low income of the farmers in the sector. Certifications such as Fairtrade provide a minimum price for farmers depending on their regional location due to the differences in production and living costs. The prices guarantee coverage of sustainable production and standard living costs required by the producers, and in rare cases where the international prices exceed Fairtrade prices, they receive the market price (Slob and Osterhaus 2006). Encouragement of small-scale producer organisation in the processing of coffee beans can increase the value of their product.

To facilitate fair pricing for the farmers, UAP insurance and the Syngenta Foundation for sustainable agriculture partnered to offer an affordable and straightforward weather insurance product 'Kilimo Salama' in Kenya. Smallholders buying inputs from local agrodealers are linked to the insurance program via a mobile phone application. When buying a product, the farmer scans the affixed barcode to set up a contract with UAP. The farmer then pays for half

the price of the product and the insurance product partners pay the other half. During climate extremes, the farmers are immediately compensated for the yield losses through mobile money transfers (Syngenta).

3. Enabling conditions

In order to realise these pathways, a number of conditions have to be met. These conditions will enable action along the pathways for adoption to occur and for the scale of action necessary to move towards achieving sustainable development goals. We outline and highlight the enabling conditions necessary for all pathways. Generic enabling conditions for all pathways include, adequate financing and investments; knowledge, technical know-how and extension support; market infrastructure; and policies.

Adequate financing and investments are necessary for the achievement of all tree commodity pathways to sustainable development. Investments are required to acquire improved and climate-smart germplasm and labour for agronomic pathways, as well as in infrastructure for processing and marketing and or certification processes in the case of value-addition. Governments will need to invest in subsidising inputs, providing guarantees on loans for smallholder farmers and in market infrastructure investments. Actors could look to climate finance mechanisms and biodiversity finance or mechanisms such as green bonds to help support climate related components of tree commodity value chains. Such investments are enabling, but increased domestic financing is required across Africa to put in place mechanisms to ensure education and compliance with deforestation-free, child labour-free and quality produce regulations.

Knowledge, technical know-how and extension services are required to enable all tree commodity pathways to sustainable development. Tree commodities are knowledge intensive and highly technical, especially in terms of innovations. Therefore, not only is knowledge required, but technical support is also needed on the ground. Additional challenges in terms of knowledge involve management of significant pests and diseases such as the cocoa swollen shoot virus and or coffee blights and others. New areas of value addition such as bioenergy generation require novel technologies and a business ecosystem requiring deliberate investments.

Market infrastructure and reforms are needed to enable especially the value-addition and governance pathways. Tremendous potential exists in local markets, but these need to be encouraged and developed. The pathways that reduce 'externalities' of social and environmental impacts of main-stream commodity production can be at odds with the 'free market' philosophy that underpins the rules of the World Trade Organization (WTO). Any type of 'subsidy' tends to be seen as a market distortion, rather than a legitimate correction to the values that markets tend to ignore. Where powerful importing countries have domestic

production streams, that competes with what can be imported from elsewhere. However, their efforts to secure socially and environmentally responsible production can lead to a view that the destruction of natural and social capital in unregulated agricultural production is a form of subsidy that distorts markets. Therefore, continued review and reform of existing institutions (including markets) is needed.

Policies and incentives are needed to enable tree commodity pathways. Policy instruments covering institutions, rules, regulations, incentive packages, disincentives and others are necessary to ensure tree commodity contributions to sustainable development. These will be best addressed on a case-by-case basis. Depending on contexts, a number of instruments would together yield the desired pathway, provided they consider the trade-offs and synergies across pathways and commodities. However, clear policy instruments will also be based on both domestic and international considerations and given that it is in Africa, these commodities are largely destined for export.

Cross-sectoral engagement: Success in both individual and multiple pathways will largely depend on joint and coordinated action between agriculture, forestry, research, finance departments, social welfare (on issues of child labour) and trade. Any strategy to enhance the contributions of tree commodities to SDGs would need to embrace and enhance the effectiveness and efficiency with which these departments work together.

4. Conclusion

This chapter set out to explore pathways through which tree commodities can contribute to SDGs. We conclude that tree commodities have the potential to achieve SDGs across Africa, through agronomic, value-addition and governance pathways. Table 2.1 below shows the specific SDGs that can be achieved using tree commodities.

Classification of pathways	Pathways	SDGs
Agronomic	Sustainable Intensification	1,4,5,6,8
	Sustainable Diversification	2,3
	Rejuvenation of old plantations	12
Value-Addition	Domestic processing	9,11,12
	Domestic Marketing	9,11,12
	Bioenergy	7,9,11
	Eco-certification	12,15
Governance	Deforestation-free commodities	13,14,15
	Child labour	10,16,17
	Fair pricing	1,8,10,16

While these pathways are plausible and potentially impactful from a strategic perspective, we also highlight a number of key conditions that have to be met to enable sustainable development. These include financing and investments, knowledge and technical know-how, market reforms and policies, incentives and cross-sectoral engagement. It is important to note that the pathways identified herein interact in reality. Often, complementarity and synergies between pathways could result in higher and better quality SDG outcomes. Sometimes, pathways and conditions can also be conflicting. Therefore, decision-making, strategies and tactics aimed at enhancing the contribution of tree commodities to sustainable development, have to be evidence-based and consider synergies and trade-offs between various pathways and conditions from a systems perspective.

From the foregoing, we recommend and encourage countries to consider two options in the pursuit of enhancement of tree commodity contributions to SDGs.

a. For short-to-medium term, cost effective and low investment options that can build on current extension and market systems as well as work with minimum policy changes, to:

    i. Focus on agronomic pathways, including sustainable intensification and diversification and especially the renewal of old plantations through innovative techniques like grafting.

    ii. Encourage and support domestic marketing and value chains such as fruit trees that deliver jobs, revenues, food security and nutritional benefits.

    iii. Effect tree tenure changes that deregulate and enable tree ownership and benefits for farmers in the way Ghana and Cote d'Ivoire have recently done with great impact.

    iv. Encourage cross-sectoral information exchange, actions and engagement

b. Develop and implement longer term strategies and measures that draw on pathways that require extensive reforms, investments and infrastructure in a progressive manner. Including,

    i. Policy reforms around enterprise, diverse incentive options and land tenure.

    ii. Domestic public investments and public private partnerships and capacity building that catalyse value addition, industrialisation and trade.

    iii. Development of systems for monitoring, traceability and certification as well as effective forest protection against encroachment in the context of zero deforestation.

Such a phased multiple pathways approach could enable progressive transformative green tree commodity systems that contribute to the achievement of sustainable development goals in Africa.

References

Abebe T. 2013. Determinants of crop diversity and composition in Enset-coffee agroforestry home gardens of Southern Ethiopia. *J. Agric. Rural Dev. Trop. Subtrop.* 114:29–38.

Ajayi OC, Place F, Akinnifesi FK, Sileshi GW. 2011. Fertilizer tree systems in Southern Africa (Malawi, Tanzania, Mozambique, Zambia and Zimbabwe). *International Journal of Agricultural Sustainability* 9(1):129–136

Akoyi KT, Mitiku F, Maertens M. 2018. *Is prohibiting child labour enough? Coffee certification and child schooling in Ethiopia and Uganda* (No. 2058-2018-5270).

Asaah EK, Tchoundjeu Z, Leakey RRB, Takousting B, Njong J, Edang I. 2011. Trees, agroforestry and multifunctional agriculture in Cameroon. *International Journal of Agricultural Sustainability* 9(1):110–119.

Athreya B. 2011. White man's "Burden" and the new colonialism in West African cocoa production. *Race/Ethnicity: Multidisciplinary Global Contexts* 5(1):51-59.

[AU] African Union. 2021. *Africa's commodities strategy; value addition for global competitiveness.* Directorate of Information and Communication, Addis Ababa, Ethiopia. 2nd September 2021. https://au.int/sites/default/files/pressreleases/40770-pr-COMMODITY_STRATEGY_PRESS_RELEASE.pdf

Brown O, Charveriat C, Eagleton D. 2001. *The coffee market–a background study*. Oxfam: London.

Bymolt R, Laven A, Tyszler M. 2018. *Demystifying the cocoa sector in Ghana and Côte d'Ivoire. Chapter 5, Crop choice and diversification*. Amsterdam, The Netherlands: The Royal Tropical Institute (KIT), pp.71-90.

Carodenuto S. 2019. *Governance of zero deforestation cocoa in West Africa: new forms of public–private interaction. Environmental Policy and Governance* 29(1):55–66.

Catarino L, Menezes Y, Sardinha R. 2015. Cashew cultivation in Guinea-Bissau–risks and challenges of the success of a cash crop. *Scientia Agricola* 72(5):459–467.

Cozzi L, Bouckaert S, Kim T, McNamara K. 2019. *Africa energy outlook 2019*. International Energy Agency (IEA). World Energy Outlook (WEO).

Djokoto JG, Afari-Sefa V, Addo-Quaye A. 2017. Vegetable diversification in cocoa-based farming systems Ghana. *Agriculture & Food Security* 6(1):6.

European commission. 2020. *Cashew value chain analysis in Mali.* September 2020. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjy1ue5yf76AhVo_7sIHW2tBk4QFnoECAwQAQ&url=https%3A%2F%2Feuropa.eu%2Fcapacity4dev%2Ffile%2F111487%2Fdownload%3Ftoken%3D5t_MT4uk&usg=AOvVaw0LY4-FkbqxvUo2qDhhDPo8

Fairtrade Foundation. *Cocoa farmers.* https://www.fairtrade.org.uk/Farmers-and-Workers/Cocoa/. (Accessed on 9th June 2022).

Fairtrade International. 2011. *Fairtrade standard for small producer organizations* [Online]. Fairtrade International: Bonn, Germany. http://www.fairtrade.net/fileadmin/user_upload/content/2011-12-27_SPO_EN_FINAL.pdf (Accessed 23 January 2017).

Fairtrade International. 2017. *What is Fairtrade?* https://www.fairtrade.org.uk/what-is-fairtrade/

[FAO] Food and Agriculture Organization. 2018. *Zero-deforestation committments - a new avenue towards enhanced forest governance?* Rome: Food and Agriculture Organization of the United Nations.

GRAIN. 2019. *Communities in Africa fight back against the land grab for palm oil.* https://grain.org/en/article/6324-communities-in-africa-fight-back-against-the-land-grab-for-palm-oil. Accessed on 5th September 2022.

Grid Arendal. 2013. *The charcoal supply chain.* https://www.grida.no/resources/7505. Accessed on 13-04-2022.

Hans S, Richard M, Arianne G. 2015. *Implementing deforestation-free supply chains - certification and beyond.* Smart Development Works.

[ILO] International Labour Organization. 2018. *Ending child labour: a review of policies and programmes.* Geneva: International Labour Organization. https://cocoainitiative.org/wp-content/uploads/2018/12/wcms_653987.pdf

[ILO] International Labour Organization. 2017. *Global estimates of child labour: results and trends, 2012-2016.* Geneva: International Labour Organization.

Jamnadass R, Place F, Torquebiau E, Malezieux E, Iiyama M, Sileshi GW, Kehlenbeck K, Masters E, McMullin S, Weber JC, Dawson IK. 2013. *Agroforestry, food and nutritional security.* ICRAF Working Paper No. 170. Nairobi: World Agroforestry Centre.

Jemal OM, Callo-Concha D, van Noordwijk M. 2021. Coffee agroforestry and the food and nutrition security of small farmers of south-western Ethiopia. *Frontiers in Sustainable Food Systems* 5:24. https://doi.org/10.3389/fsufs.2021.608868

Kissinger GM, Herold M, De Sy V. 2012. *Drivers of deforestation and forest degradation: a synthesis report for REDD+ policymakers.* Vancouver, Canada: Lexeme Consulting.

Kuyah S, Sileshi GW, Nkurunziza L, Chirinda N, Ndayisaba PC, Dimobe K, Öborn I. 2021. Innovative agronomic practices for sustainable intensification in sub-Saharan Africa. A review. *Agronomy for Sustainable Development* 41(2):1–21.

Lawal JO, Oduwole OO, Shittu TR, Muyiwa AA. 2011. Profitability of value addition to cashew farming households in Nigeria. *African crop science journal* 19(1).

Loos J, Abson DJ, Chappell MJ, Hanspach J, Mikulcak F, Tichit M, Fischer J. 2014. Putting meaning back into "sustainable intensification". *Frontiers in Ecology and the Environment* 12(6):356–361.

Masters G, Baker P, Flood J. 2010. *Climate change and agricultural commodities.* CABI Work Pap, 2, pp.1-38.

Mbow C, van Noordwijk M, Luedeling E, Neufeldt H, Minang PA, Kowero G. 2014. Agroforestry solutions to address food security and climate change challenges in Africa. *Current Opinion in Environmental Sustainability* 6:61-67.

Mensah TNO, Oyewo AS, Breyer C. 2021. The role of biomass in sub-Saharan Africa's fully renewable power sector–The case of Ghana. *Renewable Energy* 173:297–317.

Melanie H. 2018. *Top five greener alternatives to charcoal.* https://www.dw.com/en/top-5-greener-alternatives-to-charcoal/a-43268826. (Accessed on 25-03-2022).

Minang PA, Duguma LA, Bernard F, Mertz O, van Noordwijk M. 2014. Prospects for agroforestry in REDD+ landscapes in Africa. *Current opinion in environmental sustainability* 6:78–82.

Mohlala LM, Bodunrin MO, Awosusi AA, Daramola MO, Cele NP, Olubambi PA. 2016. Beneficiation of corncob and sugarcane bagasse for energy generation and materials development in Nigeria and South Africa: a short overview. *Alexandria Engineering Journal* 55(3):3025–3036.

Ordway EM, Asner GP, Lambin EF. 2017. Deforestation risk due to commodity crop expansion in sub-Saharan Africa. *Environmental Research Letters* 12(4):044015.

Oxfam. 2015. *The Right to Resilience adaptation finance in the post 2020 Paris agreement.* https://www.oxfam.org/sites/www.oxfam.org/files/file_attachments/right_to_resilience_- _adaptation_finance_in_the_post-2020_paris_agreement.pdf

Piabuo SM, Tieguhong JC, Minang PA, Foundjem D, Duguma LA. 2021. Industrializing Africa through tree commodities. In: Minang PA, Duguma LA, van Noordwijk M, eds. 2021. *Tree commodities and resilient green economies in Africa.* Nairobi, Kenya: World Agroforestry (ICRAF).

Pretty JN. 1997. The sustainable intensification of agriculture. *Natural resources forum* 21(4):247–256.

Rahn E, Liebig T, Ghazoul J, van Asten P, Läderach P, Vaast P, Jassogne L. 2018. Opportunities for sustainable intensification of coffee agro ecosystems along an altitudinal gradient on Mt. Elgon, Uganda. *Agriculture, ecosystems & environment* 263:31–40.

Rapsomanikis G. 2015. *The economic lives of smallholder farmers: an analysis based on household data from nine countries*. Food and Agriculture Organization of the United Nations, pp.1-39.

Sarkar S, Gil JDB, Keeley J, Jansen K. 2021. *The use of pesticides in developing countries and their impact on health and the right to food*. European Union.

Sebatta C, Mugisha J, Bagamba F, Nuppenau EA, Domptail SE, Kowalski B, Hoeher M, Ijala AR, Karungi J. 2019. Pathways to sustainable intensification of the coffee-banana agroecosystems in the Mt. Elgon region. *Cogent Food & Agriculture 5*(1):1611051.

Slob B, Osterhaus A. 2006. A fair share for coffee producers. *Business unusual: successes and challenges of fair trade*. Brussels: Fair Trade Advocacy Office.

Somarriba E, Peguero F, Cerda R, Orozco-Aguilar L, López-Sampson A, Leandro-Muñoz ME, Jagoret P, Sinclair FL. 2021. Rehabilitation and renovation of cocoa (Theobroma cacao L.) agroforestry systems. A review. *Agronomy for Sustainable Development* 41(5):1–19.

Syngenta. *Agricultural insurance – Kenya.* https://www.syngentafoundation.org/agricultural-insurance-kenya. (Accessed on 9th June 2022).

The New Humanitarian. 2022. *Diversification from cashew nuts essentials.* https://www.thenewhumanitarian.org/feature/2006/06/15/diversification-cashew-nuts-essential. (Accessed on 14-03-2022).

[UCW] Understanding Children's Work Project. 2010. *Farm cooperatives, household vulnerability and agricultural child labour in Rwanda.* Policy Appraisal. UCW Working Paper, Rome, July 2016.

Wahba J. 2000. *Do market wages influence child labour and child schooling?* December 2000. Available at SSRN: https://ssrn.com/abstract=265209 or http://dx.doi.org/10.2139/ssrn.265209.

van Noordwijk M, Cadisch G. 2002. Access and excess problems in plant nutrition. *Plant and Soil* 247:25-49.

van Noordwijk M, Brussaard L. 2014. Minimizing the ecological footprint of food: closing yield and efficiency gaps simultaneously? *Current Opinion in Environmental Sustainability 8*:62–70.

van Noordwijk M, Duguma LA, Dewi S, Leimona B, Catacutan DC, Lusiana B, Öborn I, Hairiah K, Minang PA. 2018. SDG synergy between agriculture and forestry in the food, energy, water and income nexus: reinventing agroforestry? *Current opinion in environmental sustainability 34*:33–42.

van Noordwijk M, Martini E, Gusli S, Roshetko JM, Leimona B, Nguyen MP. 2021. Cocoa and coffee in Asia: contrasts and similarities in production and value addition. In: Minang PA, Duguma LA, van Noordwijk M, eds. 2021. *Tree commodities and resilient green economies in Africa*. Nairobi, Kenya: World Agroforestry (ICRAF).

Varcho LA. n.d. *A bitter brew - coffee production, deforestation, soil erosion and water contamination.* https://ohiostate.pressbooks.pub/sciencebites/chapter/a-bitter-brew-coffee-production-deforestation-soil-erosion-and-water-contamination/. (Accessed on 13-04-2022).

Wessel M, Quist-Wessel PF. 2015. Cocoa production in West Africa, a review and analysis of recent developments. *NJAS: Wageningen Journal of Life Sciences* 74(1):1–7.

Woldesenbet AG, Woldeyes B, Chandravanshi BS. 2016. Bio-ethanol production from wet coffee processing waste in Ethiopia. *SpringerPlus* 5(1):1903.