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Smallholders in agro-industrial production: Lessons for rural development from a comparative analysis of Ghana's and Indonesia's oil palm sectors

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ABSTRACT

By successfully including smallholders, the oil palm boom in Southeast Asia has contributed significantly to rural economic development and poverty alleviation, notwithstanding its huge environmental costs. Oil palm production in other world regions is currently picking up, including in Africa. Yet it is uncertain whether the positive socioeconomic impacts from Southeast Asia can be replicated elsewhere. Little development gain may thus accompany severe environmental harm if oil palm expansion leads to deforestation. To shed light on the (prospective) role of oil palm for rural development we perform a systematic comparison of Ghana's and Indonesia's oil palm sectors at the macro and micro level, focusing on smallholder inclusion and using a mixed-methods approach. We identify substantial differences in structural conditions and policy foci that have led to two very different oil palm sectors. While the Indonesian experience clearly highlights the development opportunities coming with smallholder inclusion in agro-industrial production, our analysis shows that transferability to the West African context is limited due to regional specificities.

1. Introduction

The increase in worldwide vegetable oil demand has led to a transformation of land use and substantial changes in the global agricultural landscape. One prominent manifestation of this transformation is the expansion of the Southeast Asian oil palm sector and its accompanying socioeconomic and ecological effects, which have been analyzed extensively by now. Overall, the oil palm boom has contributed to economic growth, rural development, and poverty alleviation, in particular in Indonesia and Malaysia—the two biggest palm oil producers in the world (Basiron, 2007; Edwards, 2019a; Kubitza et al., 2018; Rist et al., 2010). These economic benefits have come with very severe environmental impacts as oil palm plantations are established on previously biodiversity-rich tropical rainforests and peatlands (Dislich et al., 2017), resulting in substantial ecological loss (Meijaard et al., 2020; Vijay et al., 2016).

The resulting concerns have slowed down the rate of expansion in Indonesia and Malaysia (Austin et al., 2019; Gaveau et al., 2018).[1] The rural-development effects of the oil palm expansion in Indonesia have been both extensive and relatively inclusive, with the successful cooperation between large-company plantations, processing facilities, and farmers through contract farming schemes as key factor here (Ali et al., 2019, 2014). Thus, oil palm in Indonesia can be considered an exemplary case of a rural-development pattern driven by agro-industries but successfully including smallholders and nonfarm households. This makes it a very relevant case to current debates in rural development policy on the role of smallholders in agri-food chains (Hall et al., 2017; FAO, 2020; Lay et. al, 2021; Meemken and Bellemare, 2020) and it

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[1] However the expansion continues in selected frontier regions. For example on the Indonesian islands of Borneo and Papua, as well as in other countries of the region, such as Thailand (Indonesian Bureau of Statistics, 2021; Saswattecha et al., 2016).

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remains an open question whether the successes of Indonesia's oil palm boom can be replicated in other developing countries, possibly without also replicating its severe adverse environmental impacts.

In recent years, oil palm production in other world regions, including in Africa, is picking up pace. Oil palm originates in West Africa and is an integral part of the agricultural landscape, but the sector has not (yet) seen a boom comparable to Southeast Asia's. However large-scale investment projects have been initiated in selected countries of the region with—so far—rather limited and localized socioeconomic as well as environmental impacts. In Liberia and Sierra Leone, land concessions for new plantations in excess of 400,000 ha in size have been granted in each of the two countries.[2] As the development of the large-scale commercial oil palm sector continues in West Africa its potential contribution to rural development as well as suitable support policies there remain unclear and require investigation.

Current oil palm promoting policies are not so different from the ones that have proven successful in the Southeast Asian context, such as the promotion of large-scale plantations and nucleus estates. We argue that while some lessons can be learned from the Southeast Asian experience, differences in structural conditions and context limit the transferability of insights. For example, oil palm production in West Africa, including in Ghana, is predominantly smallholder-based with only a handful of large estates in the sector, which hardly cooperate with or successfully involve smallholders. Moreover, recent evidence from sub-Saharan Africa suggests that the local economic gains of large-scale agricultural projects in terms of (quality of) employment and income may be limited (Lay et al., 2021) and the welfare impacts of contract farming on smallholders ambiguous and context-specific (Bellemare and Bloem, 2018). Thus, the sector's potential for rural development in West Africa and the transferability of promotion strategies from the Southeast Asian experience require differentiated analysis.

This paper systematically compares the Indonesian and Ghanaian oil palm sectors at the macro- and micro-level, considering the sectors' structural similarities and differences. We identify which (structural) conditions, policies, and institutional features were or will be conducive or harmful to the positive contribution of the oil palm sector to rural development, focusing on smallholders' livelihoods and their integration in the agro-industry. We compare the Indonesian experience with Ghana's, where more than 40,000 ha of new concessions for oil palm have been added since the year 2000. Oil palm has not (yet) been associated with contract farming at scale nor with large-scale deforestation in the region (Okoro et al., 2016). We use a mixed-methods approach, combining comparative macro analyses of the respective sectors' historical and prospective performances as well as associated institutional and policy developments. Subsequently we compare micro-level data on smallholder production as a snapshot of the systematic challenges and differences within and across the two countries. Specifically, we also compare contract farmers integrated in the agro-industry to artisanal farmers in Ghana. We also discuss the rural-development effects of oil palm cultivation. We review previous evidence from both countries and present poverty trends among Ghanaian oil palm-producing and other smallholder households over time, using nationally representative data.

To the best of our knowledge, no such comparison has been done. Our analysis identifies substantial differences in the structural conditions and policy foci that have led to two diverging oil palm sectors today. We argue that the Ghanaian oil palm sector holds considerable potential to contribute to rural development. However, related strategies to foster rural development need to differ from the Indonesian approach and account for the context specificities, in particular the presence of an important artisanal oil palm sector as well as the scarcity of suitable (non-forest) land in Ghana.

The paper is structured as follows: Section 2 discusses the development of both oil palm sectors from a historical policy perspective. Section 3 provides information on the different value chains involved, while Section 4 discusses their production methods and associated challenges using micro-level survey data. Section 5 evaluates the relationship between oil palm and rural development using previous evidence and descriptive analyses based on household-survey data. Finally, Section 6 discusses the findings and concludes.

2. History, policy, and the development of the oil palm sector

Both Ghana and Indonesia have suitable agroecological conditions for oil palm cultivation. In Ghana, optimal conditions are found in a relatively small area in the southwest of the country (Rhebergen et al., 2016) where agricultural activity is dependent on highly seasonal rainfall. Indonesia has a vast area of suitable land, across all islands, a large share of which is (formally) owned by the government (Ministry of Agriculture Indonesia, 2019) and ideal climatic conditions.

Oil palm originates in West Africa, as an essential part of the local culture, cuisine, and economy (Khatun et al., 2020; Robins, 2021). Traditionally the production system is dominated by small-scale farmers and small mills. In Ghana, the production system remained smallholder-based also under colonialization, with only one large estate. The colonial government feared that the expropriation of smallholder land for plantation establishment would lead to social unrest and disrupt the existing export production system, which was also considered more economically resilient (Byerlee et al., 2017; Fold and Whitfield, 2012). This smallholder-based system was the leading foreign-exchange earner in Ghana (Carrere, 2013) until the early twentieth century, when palm oil exports nearly disappeared due to low world-market prices. At that time, the increasing demand for chocolate in Europe incentivized farmers to adopt cocoa cultivation (Fold and Whitfield, 2012). The colonial government unsuccessfully countered this decline, inter alia, through subsidies for larger mills and the establishment of oil palm service centers in agroecologically favorable areas. Notwithstanding these efforts, cocoa surpassed palm oil as the major export product in Ghana and the latter sector transitioned from being export-oriented to domestically oriented instead (Asante, 2021). The oil palm sector thereby became of only minor importance, receiving little attention from policymakers at the time.

In Ghana, oil palm production remains mainly smallholder-based, as neither the colonial nor postindependence governments acquired or appropriated large tracts of land for the establishment of plantations (Daddieh, 1994). Smallholders (generally less than two ha) produce on land held under customary tenure (an estimated 80% of agricultural land), which is governed by traditional rulers, including local and paramount chiefs (Lambrecht and Asare, 2015; Asante, 2021).

In Indonesia, oil palm production began in the mid-nineteenth century when the Dutch colonizers brought seeds from Africa (Robins, 2021). During the colonial era, the oil palm sector played a minor economic role (Gatto et al., 2015), but large-scale plantations were developed on Java and Sumatra in the late nineteenth century (Baudoin et al., 2017). An important precondition for the development of large estates was the Agrarian Acts of 1870. They decreed that all land not under constant cultivation—that is, all fallow land, peatland, and forests—would become the "free" domain of the state, thereby creating the legal basis for officially disregarding customary land tenure (McWilliam, 2006). Under Indonesia's first postcolonial government the oil palm sector stagnated (Baudoin et al., 2017) until the "New Order" government, in 1968, integrated former Dutch plantations into 28 state-run companies as the first step toward sector development post-independence (Larson, 1996).

In both countries, postindependence governmental efforts marked an era of high state involvement and control, with a strong focus on the establishment of state-owned and state-operated oil palm plantations

[2] All figures are authors' own calculations, using data on land acquisitions for oil palm plantations from the Land Matrix Initiative (2021); the latter collects data on large-scale land transactions in the Global South.

(Huddleston and Tonts, 2007; Larson, 1996). From the 1960 s onward, the Ghanaian government exclusively focused on the establishment of large-scale plantations and processing facilities, either under partial or full government control, resulting in a sixfold increase in cultivated areas by 1990 (Ministry of Food and Agriculture Ghana, MoFA, 2011)—albeit starting from a low base. During this expansion, the state-operated estates did not (successfully) establish market linkages to oil palm-producing smallholders (Carrere, 2013).

Indonesia's policy portfolio was more diversified. Initially, starting in the late 1960 s, state-run companies were established in Sumatra (Larson, 1996) and later in Borneo and Papua (Obidzinski et al., 2014). They were complemented by semipublic companies that were supported through World Bank loans (Baudoin et al., 2017). From the late 1970 s onward, the Indonesian government actively involved and supported smallholders (Baudoin et al., 2017; Gatto et al., 2017), linking oil palm cultivation to its transmigration programs. These programs were implemented to reallocate people from the overpopulated islands of Bali and Java to scarcely populated ones such as Sumatra. The so-called transmigrants were given approximately two ha of land for settlement, rubber and oil palm production, as setup monocultures (McCarthy and Zen, 2016).

In the mid-1980 s a new policy enabled large private companies and foreign investors to convert forest areas, formally owned by the government, into oil palm plantations, further encouraged through easy access to credit for plantation and processing-facility establishment. Smallholders were integrated in the oil palm sector through the Nucleus Estate and Smallholder (NES) schemes. Nucleus estates ("inti") provided land (usually two ha), credit, village infrastructure, agricultural inputs, and training to so-called plasma farmers (McCarthy and Zen, 2016; Rist et al., 2010), and employed farmers as plantation laborers to bypass the initial years of unproductive oil palm cultivation (Gatto et al., 2017). These "inti-plasma schemes" were again linked to transmigration programs.

The 1990 s and 2000 s saw (partial) decentralization and economic liberalization in both countries. In Ghana, the state-owned plantations had proven economically unviable due to capital constraints, poor planning, and management. Consequently some plantations were abandoned or sold, followed by attempts to vitalize the sector under decentralized control (Byerlee et al., 2017; Dzanku et al., 2020). Previously state-owned plantations were privatized,[3] which led to a substantial increase in cultivated area (see Fig. A1 in the Appendix). Despite extensive political efforts, attracting further foreign investment largely failed and the Ghanaian oil palm sector stagnated once more (Byerlee et al., 2017).

At the same time, the Indonesian government cut back its involvement in plantation establishment and management—particularly in areas with a well-established sector (e.g. Sumatra). The transmigration program was also stopped in those regions. From 1995 onwards private companies led direct negotiations with local farmers, including over land, which required the establishment of cooperatives to increase the latter's bargaining power (Gatto et al., 2015; Larson, 1996; Zen et al., 2016). Nevertheless many negotiations were unsuccessful without the government taking an active role in them. Recently, outgrower contracts between farmers and companies have expired, giving rise to a rising number of independent oil palm farmers (Qaim et al., 2020). Knowledge about oil palm cultivation disseminated and credits, planting materials, and inputs were easily accessible as the market developed with liberalization. Thus, the adoption of oil palm became self-sustaining and shifted from a government-led to a market-oriented phase (Gatto et al., 2017). In regions where oil palm was more recently introduced (e.g. Borneo and Papua) the government has persisted with the NES and transmigration program to expand oil palm production even further (Obidzinski et al., 2014). Under recent NES companies are still obliged to establish smallholder plantations on at least 20% of their total cultivated land area.

Indonesia overtook Malaysia as the world's largest palm oil producer in the 2000 s, and palm oil remains the country's number one export product to this day (FAO, 2020). The expansion of cultivated areas has continued since, slowing down only in the past three years. Today, oil palm is cultivated on more than 14 million ha of land, of which approximately 40% is cultivated by some 2.7 million smallholders. Additionally 4.2 million wage laborers work on oil palm plantations (Ministry of Agriculture Indonesia, 2019), one-quarter of Indonesia's total agricultural wage-labor force (Indonesian Bureau of Statistics, 2016). However the economically successful expansion of the sector has come at huge environmental and social costs (more below), which triggered international calls for more sustainability (Hidayat et al., 2018). The private sector responded by establishing the Roundtable on Sustainable Palm Oil (RSPO) and a corresponding certification scheme. It requires producers to implement globally accepted sustainability and best management practices on their plantations, mills, and associated smallholder farms. Whether RSPO certification contributes to (significantly) more sustainable production is not yet sufficiently understood (Cattau et al., 2016; Ruysschaert and Salles, 2014). Yet the Indonesian government argues that RSPO is overly strict, discouraging oil palm production (Brandi et al., 2015; Choiruzzad, 2019). Consequently it issued its own "watered down" version of certification in 2011, Indonesian Sustainable Palm Oil (ISPO), without much success in establishing it as a credible and internationally recognized alternative.

In comparison the Ghanaian oil palm sector has only experienced moderate yet steady growth, with higher growth rates since the early 2000 s. As the second-most important industrial crop, oil palm is a crucial contributor to agricultural development (Asante, 2021). Currently over 300,000 ha of land are cultivated with oil palm, with 80% of it managed by smallholders (Ofosu-Budu and Sarpong, 2013). Ghana produces approximately 2.6 million tons of fresh fruit bunches (FFBs) annually, equivalent to around 2% of Indonesia's yearly production of over 115 million tons. However, despite moderate growth rates (see Fig. A2 in the Appendix), Ghanaian palm oil exports have increased rapidly—almost tenfold since 2008 (see Fig. A3 in the Appendix). Future expansions of the sector are expected, but progress is slower than some anticipated when foreign investors acquired land in a number of West African countries in the wake of the commodity-price hikes. Since 2000, (at least) 34 new large-scale land concessions have been approved for the establishment of oil palm estates in West Africa (according to data from the Land Matrix).[4] This constitutes a transfer of 1.5 million ha of land, mainly to transnational companies. Several of these land deals have only started to operate, and have established production only on a small fraction of the concession area (Lay et al., 2021).

The only modest growth of the oil palm sector in Ghana has transpired despite deliberate government efforts to foster agricultural growth and productivity in general and to boost this sector specifically. In 2002, the Ghanaian government promoted improved seeds and the expansion of artisanal processing capacity across all agricultural sectors. Subsequent development plans specifically for oil palm sought to develop a large-scale agro-processing industry for exports, by establishing nucleus estates with contract farming schemes and by upgrading existing bigger mills to strengthen their ties to smallholders. To support the distribution of production inputs, the government provided GHS 37 million (approximately USD 5.8 million) to existing contract farming schemes in 2010. In 2011, it aimed at providing agricultural finance (in the form of medium- and long-term loans) via contract-farming arrangements to selected commercially viable value chains, including

[3] Including the four-largest Ghanaian estates: Benso Oil Palm Plantation (BOPP), Ghana Oil Palm Development Corporation (GOPDC), Twifo Oil Palm Plantation (TOPP), and the National Oil Palm Limited (NOPL) plantation.

[4] See Table A1 in the appendix for a detailed overview.

palm oil (MoFA, 2017; Ofosu-Budu and Sarpong, 2013).

These policy plans for the most part focused on the development of a large-scale agro-industry that cultivates oil palm on nucleus plantations with outgrower schemes, in a sense trying to replicate the conventional "Indonesian model." The establishment of contract-farming schemes has proven challenging beyond the discussed land constraints because contracts have failed to sufficiently overcome the structural challenges faced by smallholders. Further, the few existing schemes hold monopsony power within their catchment areas and set contract conditions and prices. This may enable them to tilt contract conditions in their favor. Attempts to strengthen the artisanal value chain and its actors, who faced increasing competition from the new plantations and processors, were limited (Asante, 2021).

Although oil palm sector development has been stated a policy priority, cocoa remains Ghana's primary industrial crop. To put the importance of the sector into perspective: The annual production value of oil palm is estimated at GHS 133 million, produced by an estimated 120,000 smallholders (Asante, 2021), compared to GHS 2.5 billion for cocoa (Ghana Statistical Service, 2019), produced by about 800,000 smallholders (Hütz-Adams et al., 2016). Cocoa is the country's most important export crop, accounting for 13% of exports in 2017 (gold and oil exports are far more important). The enduring importance of cocoa as Ghana's main cash crop is for multiple reasons, including path dependencies and the fact that the first steps of cocoa processing (fermentation and drying) could and still do take place in the cocoa farmers' villages.

The lack of diversification into oil palm (or other crops) reflects the prevailing structural conditions, for example land constraints, the lack of adequate infrastructure, and a shortage of accessible mills, which can be partly explained as resulting from failed or ineffective policies. Of course, global demand and the prices for agricultural commodities—in particular cocoa, rubber, and palm oil—also influence farmers'—large-scale farms' as well as smallholders'—crop choice and land-use decisions. Further, as we will explain in the following, the variance in structural conditions has caused very different oil palm sectors to emerge in the two countries.

3. Business models and marketing channels

Different supply chain models coexist in Ghana, ranging from integrated agro-industries procuring from company plantations and contracted farmers to small- and medium-scale producers who sell fruits to artisanal processors or manually processed palm oil to local consumers. The integrated industrial supply chain comprises privatized large-scale plantations with processing facilities and small-, medium- and large-scale farms linked to the plantations through various forms of contractual agreements. Contracted smallholders produce on their own lands or company lands; some without, but many with financial or in-kind assistance as part of newly established nucleus estate and smallholder schemes. To the best of our knowledge, only two large nucleus schemes exist (at this time) that contract artisanal oil palm producers with established plantations through simple procurement contracts. The industrial supply chain is well-coordinated, produces the improved oil palm variety tenera, and processes crude palm oil (CPO) for the export market at 20–30 tons per hour per facility (Asante, 2021; Huddleston and Tonts, 2007; Ruml and Qaim, 2021).

The artisanal supply chain comprises small- and medium-scale farms and artisanal millers. Artisanal small-and medium-scale farms continue to produce 75% of the annual Ghanaian supply of FFBs (Byerlee et al., 2017). They either sell their harvested fruits directly to consumers at the local market, manually process red palm oil (for local dishes) or sell oil palm fruits to smaller mills or traders (Ruml et al., 2021). The artisanal mills use manual or semi-mechanized processing techniques, have a processing capacity of up to 1 ton of CPO per hour and are of crucial economic importance, because they process 60% of the country's palm oil (Byerlee et al., 2017; Osei-Amponsah et al., 2012). The milling is dominated by women (Dzanku et al., 2020; Etuah et al., 2020), who oversee the post-harvest handling, particularly the manual picking and processing of the fruits and the marketing (Awusabo-Asare and Tanle, 2008). The mills have very low rates of mechanization, due to credit market constraints and a lack of off-farm income sources. The processed palm oil is sold to market women and traders for sale in Ghana, Nigeria or Togo. Both value chains are separated yet interlinked through the farmers and traders/ aggregators. Contracted farmers can and do sell palm fruits to artisanal outlets if production exceeds the contract quantity. Yet, it is more common that artisanal farmers sell FFBs, if possible and dependent on the season, to aggregators for industrial processing. Thus, the share of artisanal FFB production (75%) is higher than the artisanal share of palm oil production (60%), also in parts due to the low oil extraction rates of artisanal milling (Asante, 2021).

In Indonesia, no artisanal supply chain exists, and the supply chain can be considered exclusively industrial. Market transactions are well coordinated among farmers, private national and international, and public or semi-public companies. These companies typically run nucleus plantations and operate mills. Independent farmers that no longer have formal contracts may sell to different mills implying an increasing role for local traders (Gatto et al., 2015). Although the independent farmers have no formal contracts with the companies, they have fluid relationships with the local traders and in some cases continue to receive support from government and companies (Bakhtary et al., 2021). These farmers also sell to stand-alone mills without plantations, which have emerged more recently (Jelsma et al., 2017).

4. Production methods and productivity gaps

The Ghanaian and Indonesian oil palm sectors exhibit productivity gaps and closing these gaps can contribute to meeting the rising global demand for palm oil without further area expansion and deforestation. In Indonesia, this gap refers to productivity differences between smallholders (14 tons of FFBs/ha per year) and large-scale plantations (17–18 tons of FFBs/ha per year). The Ghanaian productivity gap, meanwhile, refers to overall modest performance compared to international competitors. Average national land productivity in Ghana (West Africa) is substantially lower than in Indonesia (Southeast Asia), with 3–6 tons versus 17 tons of FFBs per ha per year respectively (see also, Fig. A4 in the Appendix). In this section, we provide descriptive micro evidence on the production of different types of smallholders in the two countries, comparing artisanal and industrial smallholders in Ghana to Indonesian smallholders. Descriptive insights on farms and management practices shed some light on the reasons behind the substantial productivity gaps.

4.1. Data

Presented is 2018 survey data for 463 Ghanaian and 243 Indonesian oil palm-producing households, as collected for preceding research projects. The Ghanaian data comprise 106 artisanal producers (Ashanti Region) and 357 industrial producers with contract-farming arrangements (Central and Western Region). Contracted farmers produce on their own land, supply FFBs to the contracting company at fixed annual prices, and in part receive production inputs and assistance in the form of in-kind credits. Here, a two-stage sampling procedure was applied. First, 22 villages participating in contract-farming schemes were sampled based on contractor lists (Wilmar International and Unilever) and nine artisanal villages based on lists provided by the MoFA. Second, 75% of the oil palm-producing households within each village were randomly sampled and interviewed. All three selected regions are comparable in terms of their agroecological and socioeconomic indicators (Ruml and Qaim, 2021).

The Indonesian data were collected in Jambi Province in Sumatra, one of the oil palm-expansion hotspots—making up over 7% of related national land use. Approximately 65% of the area is cultivated by small- and medium-sized family farms, which is among the highest shares in

Table 1
Yields and profitability.

	Ghana		Indonesia
	Artisanal supply chain	Modern supply chain	
	n = 82	*n = 318*	*n = 243*
Yields per ha of oil palm (in tons)	6.69	8.44	14.27
	(4.06)	(4.36)	(11.42)
Revenues per ha of oil palm	1607.16	1590.85	3631.73
	(1316.88)	(1046.07)	(5477.88)
Profits per ha of oil palm	628.00	1010.7	3038.35
	(1982.60)	(1216.32)	(5651.30)
Production costs per ha of oil palm	979.16	580.15	593.38
	(1870.95)	(792.76)	(1628.05)
Price per ton of oil palm fruits	184.74	170.06	229.97
	(77.44)	(12.66)	(116.38)

Notes: All values presented in Table 1 are in GK$ for direct comparability. The purchasing power parity for Ghana and Indonesia are 1.899 and 4762.637 LCU per GK$ respectively in 2018. This value is derived from the World Bank Database, see: https://data.worldbank.org/indicator/PA.NUS.PPP?locations=ID-GH. Standard deviations in parentheses.

Indonesia. Jambi's smallholders are known to exhibit a productivity gap that is more pronounced than the average national gap (Ministry of Agriculture Indonesia, 2019). Within Jambi, a multistage sampling procedure was applied. Five regencies were purposely selected (Batanghari, Bungo, Jambi, Muaro, Sarolangun and Tebo) and four districts within each were randomly sampled. Within the 20 districts, 45 villages were sampled leading to the surveying of 701 households, out of which 243 cultivated oil palms. These households produce without current formal contracts to the companies and on their own land.

4.2. Descriptive statistics

Table 1 presents average yields and returns per ha of oil palm plantation across value chains. Our data confirm that average yields are substantially lower in Ghana, with 6.7 tons in the artisanal and 8.4 tons in the industrial value chain, compared to 14 tons in Indonesia. The relative gaps are even larger when it comes to revenues and profits. While Ghanaian smallholder yields are about 50% of Indonesian equivalents, their revenue is only about 40% (slightly higher for the artisanal supply chain). Profits are lowest in the Ghanaian artisanal supply chain, with only 628 international dollars compared to about GK $ 1000 in the modern supply chain. Yet, Indonesia's smallholders earn profits (per ha) that are three times higher than those of counterparts in Ghana. This is because average production costs (without plantation establishment) are highest in the artisanal value chain, and comparable between "modern" producers in Ghana and Indonesia.

Modest Ghanaian profits are not only due to low yields and relatively high production costs (for the low yield levels), but also due to depressed average prices. Ghana's average price per ton of palm fruits is between GK$ 45 and 60 (almost 30%) lower than in Indonesia, partly due to high transport costs. Further, market structures may depress prices. A handful of large processors hold monopsony power within the regions and set prices accordingly. Moreover, the price strongly fluctuates across seasons: In the peak season (February to May), local FFB supply exceeds national processing capacity, which leads to a sharp decline in FFB prices and product waste. During the lean season (July to December), oil palm fruits are extremely scarce and prices generally high (Adjei-Nsiah et al., 2012). These fluctuations mostly affect independent producers without fixed quantity and price agreements. Contract farmers accept a lower fixed price throughout the year, in exchange for the guaranteed purchase of their produce—possibly in larger quantities in one go (Ruml et al., 2021).

Table 2
Farm- and plot-level descriptive.

	Ghana		Indonesia
	Artisanal marketing channel	Modern marketing channel	
Farm-level	*n = 106*	*n = 357*	*n = 243*
Farm size (in ha)	5.67	6.44	6.72
	(6.02)	(6.13)	(7.97)
Area under oil palm cultivation (in ha)	2.13	2.63	3.67
	(2.24)	(2.83)	(4.50)
Number of cash crops produced	2.74	2.24	1.61
	(1.23)	(0.84)	(0.51)
Plot-level	*n = 122*	*n = 430*	*n = 336*
Plot size (in ha)	0.52	0.50	1.85
	(0.26)	(0.27)	(2.22)
Tenera (dummy)	0.98	0.98	not available
	(0.15)	(0.13)	
Number of palms per ha	150.86	149.08	132.13
	(11.94)	(16,20)	(95.06)
Plot use prior to oil palm plantation			
Pasture (dummy)	0.48	0.47	0.26
	(0.50)	(0.50)	(0.44)
Forest (dummy)	0.41	0.17	0.14
	(0.49)	(0.38)	(0.34)
Other crop cultivation (dummy)	0.11	0.35	0.22
	(0.31)	(0.48)	(0.42)
Purchased as oil palm cultivation (dummy)			0.25
			(0.43)
Received from government (dummy)			0.12
			(0.33)
Production inputs			
Chemical fertilizer use (dummy)	0.03	0.13	0.61
	(0.18)	(0.34)	(0.49)
Herbicide use (dummy)	0.50	0.54	0.60
	(0.50)	(0.50)	(0.49)
Labor days per ha per year	195.16	77.93	52.22
	(197.53)	(74.08)	(88.36)
(of which) Hired labor days per ha per year	46.62	40.67	15.20
	(100.31)	(63.41)	(25.21)

Notes: Labor days are standardized to five hours per day for all sectors. Production values captured here are for the entire 12 months prior to the survey. Standard deviations in parentheses.

Ghanaian farmers face a myriad of production challenges that limit their productivity. Due to the low degree of coordination between sellers and buyers, farmers face the risk of not selling their highly perishable produce in time and are uncertain about future market prices. This risk constrains productive investments, especially in the artisanal value chain (MoFA, 2011; Rhebergen et al., 2016). Most farmers do not have a steady income stream or collateral (e.g. formal land titles) to obtain formal financing for plantation establishment or expansion (Adeleye et al., 2020; Herrmann et al., 2018). These constraints lead to smaller plantations and less specialized farmers with more diversified crop portfolios of approximately two to three cash crops on average. Moreover, oil palm is a capital-intensive crop that yields positive returns only after four to five years. Farmers with insecure land tenure thus rather invest in crops with faster returns and lower capital requirements.

In the Indonesian context, some of these constraints also affect smallholders, but often to a lesser extent. For example, Indonesian farmers tend to cultivate oil palm on land with more secure tenure, in particular on that with a formal title from the central government. Since land conflicts occasionally occur, farmers who do not hold any formal

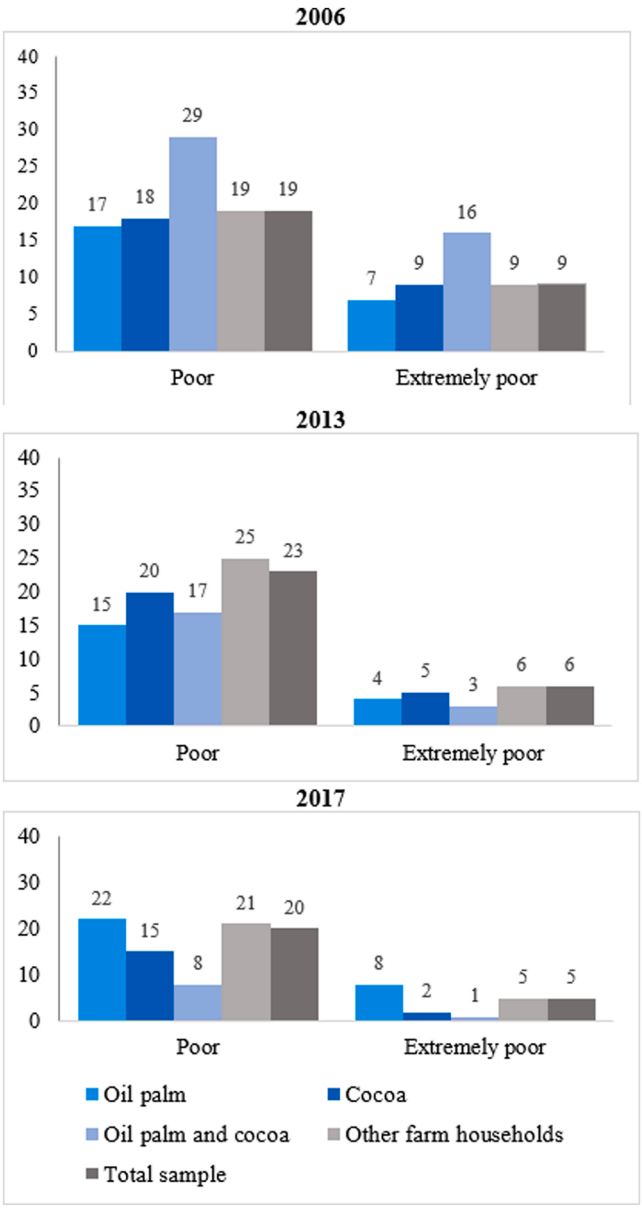

Fig. 1. Poverty headcount ratios (in % of households), by type of producer (based on GLSS data).

land titles or only have land titles issued by the village authorities usually resist establishing oil palm plantations. Table 2 illustrates this and shows that while differences in average farm sizes (land availability) are minor across sectors and value chains, Indonesian farmers have substantially larger oil palm plantations—mostly monocultures. This is in part also because forest and fallow lands are still widely available for purchase or can be illegally appropriated in Jambi (Krishna et al., 2017). In contrast to Ghana, credit markets are relatively well developed, resulting in accessible capital for farm expansion (Gatto et al., 2017). We also observe that Indonesian farmers are more specialized in oil palm, with low cash crop diversity. As expected, Ghanaian contract farmers (modern marketing channel) are somewhat more specialized than artisanal farmers, but still very different from their Indonesian counterparts (see also, Ruml and Qaim, 2020a).

In Ghana, 89% of the plots on artisanal farms were originally pastured or forest lands. In the modern marketing channel, farmers transformed pasture lands and other cash crop plantations, which indicates a substitution of cash crops (mostly cocoa, rubber, and citrus) in the modern marketing channel rather than agricultural lands now expanding into forest areas. This is similar in Indonesia, with the exception that 37% of the plots were purchased by or given to the households as setup oil palm plantations by the government. It is reasonable to assume that these plot shares were pasture or forest lands prior to plantation establishment. In Ghana, the artisanal and industrial plots are almost exclusively cultivated with the improved tenera variety, which has a higher oil content compared to the indigenous dura variety. This is the result of much increased adoption of the tenera variety among farmers in Ghana (Manley and Leynseele, 2019). The average number of palms per ha is slightly higher for the Ghanaian plots in our sample than for the Indonesian ones and on the upper end of the optimal plant density of 120–150 palms per ha (Woittiez et al., 2017).

Oil palm is capital-intensive and production inputs are costly. This explains why relatively poor and credit-constrained farmers underutilize agrochemical inputs as well as use inferior planting materials and low-yielding varieties. Low agrochemical-input use is illustrated in Table 2, with only 3% and 13% of the plots in Ghana being treated with chemical fertilizer respectively. The share is higher in the industrial supply chain, due to easier access to (superior) production inputs via the contracting companies (Asante, 2021).

Table A2
GLSS sample information.

	2006	2013	2017
Number of observations	1987	4177	1732
Oil palm producers	179	222	112
Cocoa producers	369	1295	299
Oil palm and cocoa producers	63	275	96
Other farms	1376	2385	1225
Household shares			
Oil palm producers	9.0%	5.3%	6.4%
Cocoa producers	18.6%	31.0%	17.3%
Oil palm and cocoa producers	3.2%	6.6%	5.5%
Other farms	69.3%	57.1%	70.7%

Table A1
Oil palm land concessions in West Africa since 2000.

	Domestic		Transnational		Total	
	# Deals	Size (ha)	# Deals	Size (ha)	# Deals	Size (ha)
Benin	1	5000	0	–	1	5000
Cote d'Ivoire	0	–	3	129,000	3	129,000
The Gambia	0		1	200,000	1	200,000
Ghana	3	unknown	11	39,539	14	39,539
Guinea	0	–	1	5000	1	5000
Liberia	1	220,000	3	241,018	2	461,018
Nigeria	8	193,309	8	152,962	16	346,271
Sierra Leone	1	32,441	7	277,570	8	310,011
West Africa	14	450,750	34	1.045,089	46	1.495,839
Africa	21	637,026	72	2.234,667	93	2.871,693
Global	167	2.778,215	289	9.134,900	456	11.913,115

Note: All figures are authors' own calculations, using data from the Land Matrix (2021).

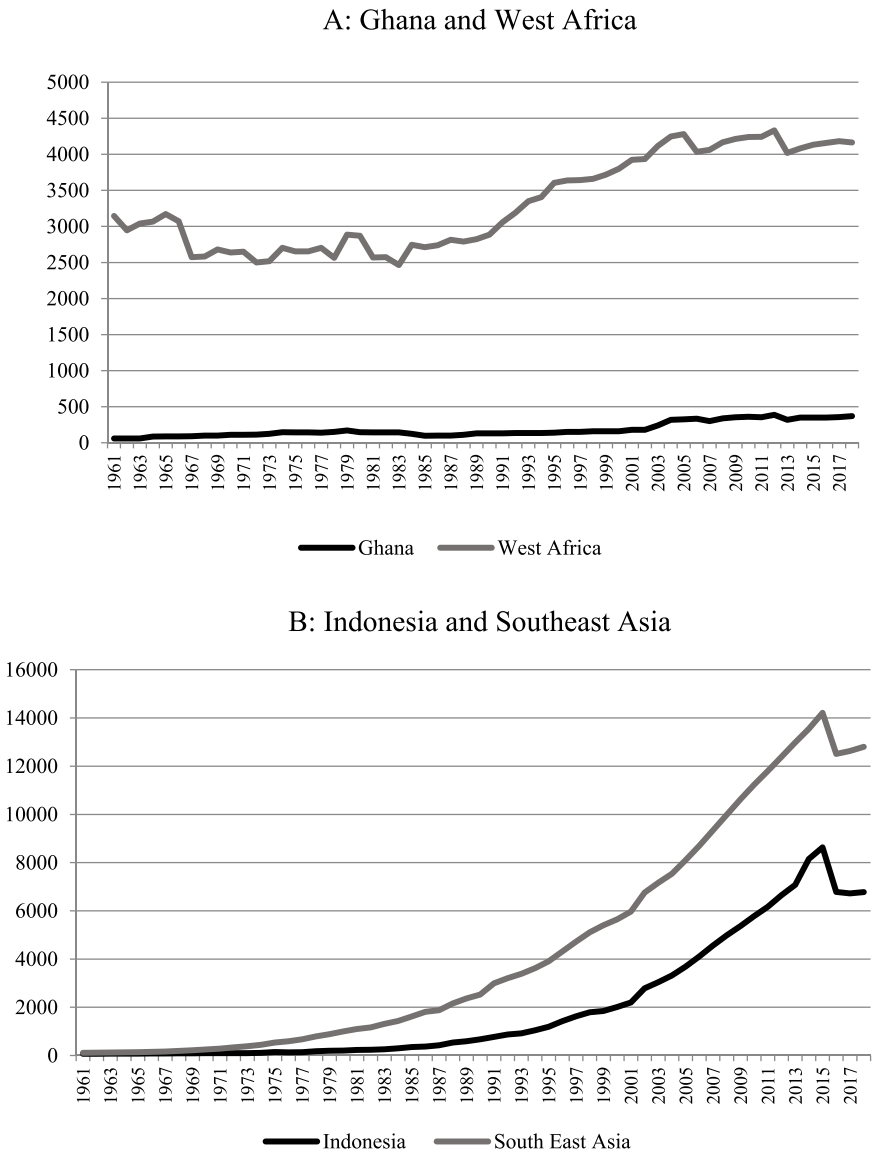

Fig. A1. Area harvested 1961–2018 (in 1000 ha).
Source: Authors' own illustration, based on data from Food and Agriculture Organization (2020).

On the contrary, 61% of the plots in Indonesia are treated with chemical fertilizer, where such production inputs are subsidized and input markets are well-established. In Ghana, various fertilizer subsidy programs have been in place since 2008 (Asante, 2021). They initially excluded cash crop producers (CIKOD, 2018), but cocoa farmers have also received subsidized fertilizer since 2014. This partly explains why fertilizer use in the Ghanaian oil palm sector remains low despite countrywide progress in recent years. Moreover, unsatisfactory palm nutrition, incomplete crop recovery, inappropriate fertilization, and poor canopy management all limit yields (Byerlee et al., 2017; MoFA, 2011; Rhebergen et al., 2018, 2020). In contrast, herbicide use is relatively high among all three groups of producers (between 50% and 60%)—indicating that it is not access to agrochemicals that explains the low use of fertilizer in the sector.

Table 2 illustrates substantial differences in agricultural-labor requirements across value chains. In Indonesia, 52 labor days (per annum and ha) are required, including 15 days of hired labor on average. Contract Ghanaian farmers require 78 days, including 41 hired labor days. Artisanal oil palm production is very labor intensive, with approximately 195 labor days, including 47 hired labor days. The main reason for this high labor requirement is that artisanal farmers typically do not sell FFBs, but fruits. The latter are manually picked and sold for manual processing (or processed by the farmer themself). In contrast, produce sold through modern supply chains is picked up in the form of FFBs without any postharvest handling, which leads to substantial labor savings. However if the harvest exceeds the pre-agreed quantity, contract farmers may apply postharvest handling methods to sell in the artisanal value chain, which partly explains the labor differences between the Ghanaian and Indonesian modern marketing channels. Moreover, Ghanaian farmers generally have less efficient plot setups and fewer monoculture plantations.

Traditional processing technologies are also labor-intensive. Artisanal mills with low levels of mechanization thus generate employment, in particular for women, but they are associated with low oil-extraction rates and poor CPO quality (Byerlee et al., 2017), which exacerbates the low productivity of the sector. On average, an artisanal processor employs 22 laborers a day, with approximately 75% of them being women (Asante, 2021).

5. Rural development and poverty impacts

Indonesia's oil palm boom has had ambiguous development impacts.

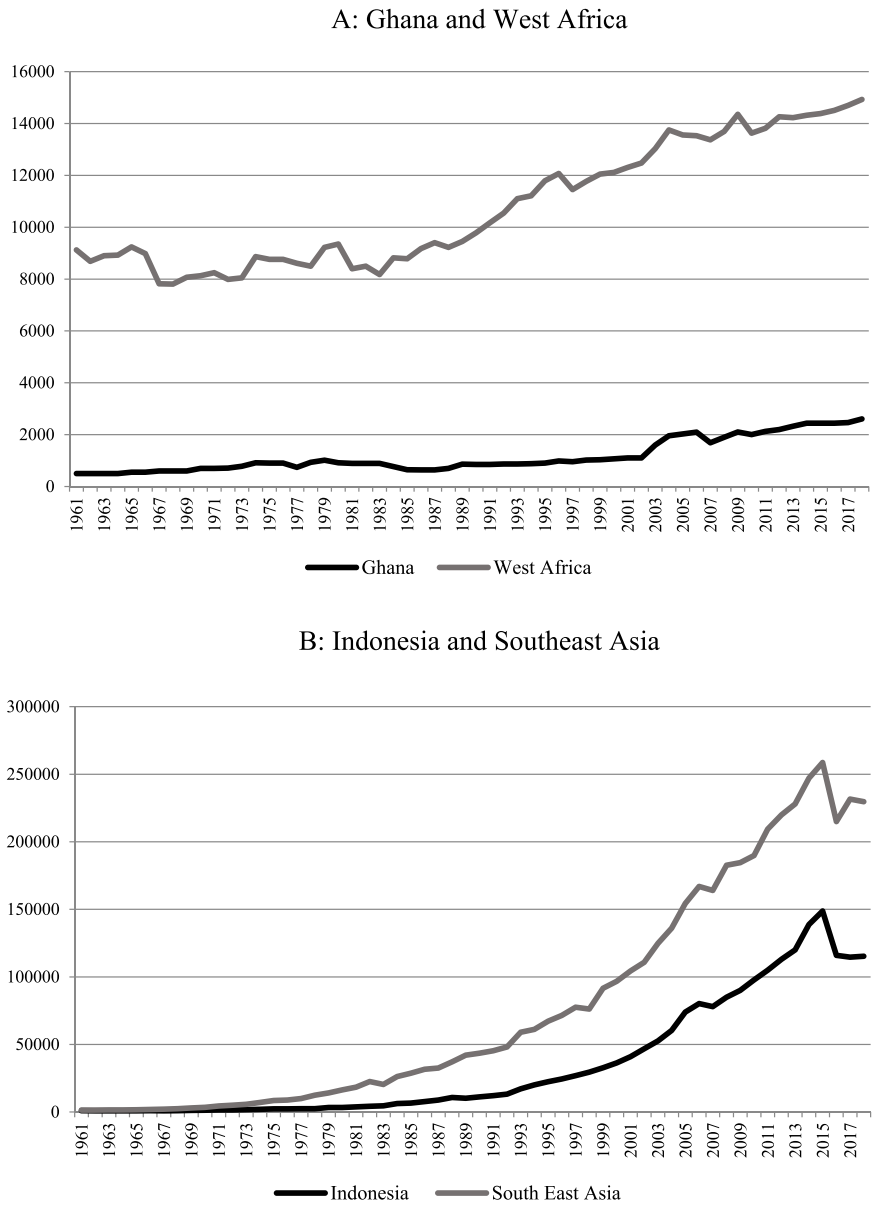

Fig. A2. Production 1961–2018 (1000 tons of FFBs).
Source: Authors' own illustration, based on data from FAO (2020).

Rapid oil palm expansion was achieved through extensive deforestation, and the massive associated environmental costs are well-documented (Meijaard et al., 2020; Vijay et al., 2016). The sector's expansion is characterized by a complex political economy made up of a number of different parties holding diverse interests. Prior to the boom, local and national governments had limited resources and the oil palm sector provided a potential source of revenue, including from concession fees and through taxation. With palm oil in high demand and sizeable commodity prices (particularly late in the first decade of the new century), the private sector was eager to secure access to land suitable for oil palm—and ideally with road connectivity. Smallholders—locals as well as migrants—wanted to improve their living conditions, but many residents in or close to concession areas were wary of losing their private and community lands (Zen et al., 2016).

These conflicting interests gave rise to land-tenure conflicts between private companies and local communities, but also within and between the latter (Abram et al., 2017; Obidzinski et al., 2012; Robins, 2021; Vijay et al., 2016). The lack of a strong legal framework to govern the land resources and little effective environmental and social regulation frequently meant that the interests of the strongest actors—often private companies supported by different levels of government—prevailed, resulting in breaches of contracts, the violation of community rights, and illegal land clearances (Levang et al., 2016). In addition the oil palm sector has been criticized for its working conditions, including precarious wages and the use of child labor (ILO, undated; Li, 2015; Pasaribu and Vanclay, 2021).

While the Indonesian oil palm expansion can be directly associated with large-scale deforestation, no such relationship has been observed in the Ghanaian context yet (see Fig. A5 in the Appendix): oil palm currently plays only a minor role in deforestation there (Khatun et al., 2020). Yet competition over land between companies and farmers in or close to concessions has also been observed in Ghana. According to Carrere (2013), Ghana's state-led oil palm expansion up until the 1990 s was accompanied by the expropriation of smallholders with adverse impacts on their living conditions and the surrounding environment. Land deals associated with oil palm have led to land losses for smallholders, often facilitated by local chiefs (Asante, 2021).

Notwithstanding the negative environmental effects, land conflicts,

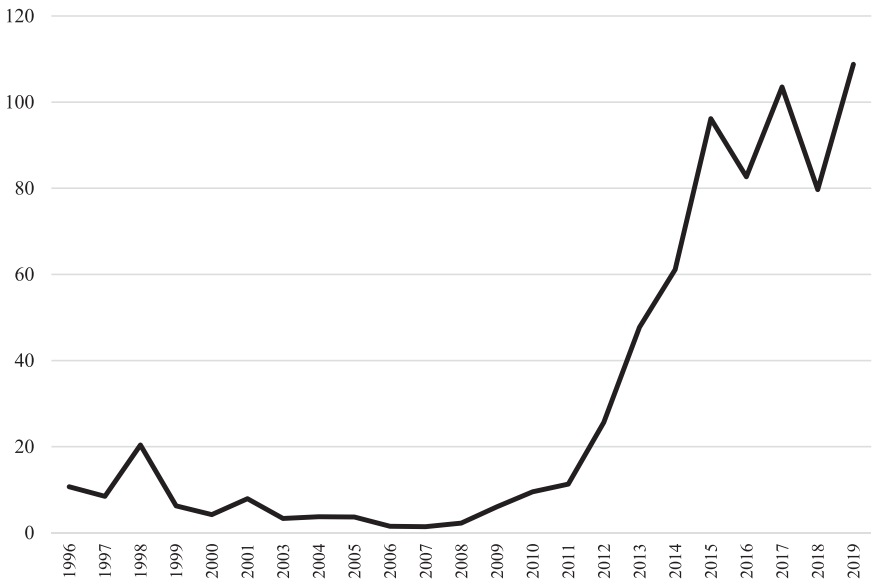

Fig. A3. Ghanaian palm oil exports 1996–2017 (million USD).
Source: Authors' own illustration, based on data from FAO (2020).

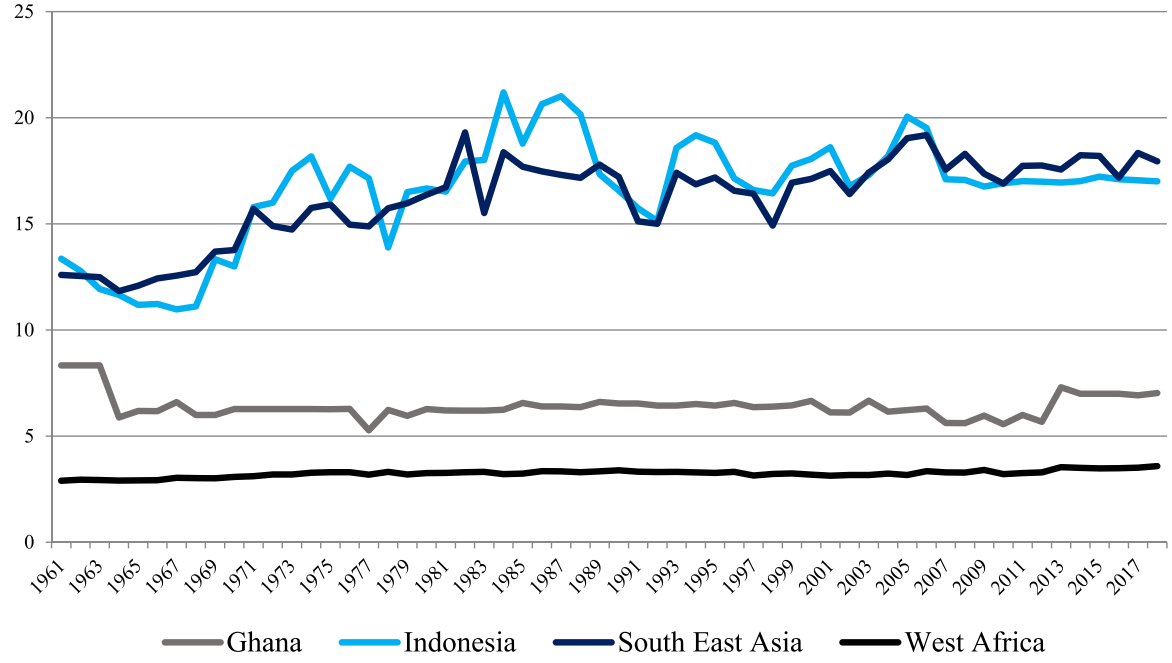

Fig. A4. Land productivity 1961–2018 (tons of FFBs per ha).
Source: Authors' own illustration, based on data from FAO (2020).

and recurrent social issues, oil palm expansion in Southeast Asia has made important contributions to rural development and poverty alleviation (Qaim et al., 2020). These effects have been documented at different levels: household, village, regional, and national (Edwards, 2019a; Euler et al., 2016; Gatto et al., 2017; Santika et al., 2019a). At the household level, oil palm adoption has been shown to increase income and expenditure (Euler et al., 2017; Feintrenie et al., 2010; Kubitza et al., 2018). Benefits arise through higher selling prices and profits compared to more traditional crops such as rubber and rice (Feintrenie and Levang, 2009). Moreover, oil palm cultivation requires less labor than the previously cultivated rubber, enabling households to expand their farms and participate in off-farm employment, thus generating additional income (Chrisendo et al., 2021; Euler et al., 2017). Nonfarm households benefit through employment in the sector, which has been found to improve their living conditions (Bou Dib et al., 2018; Rist et al., 2010). The gains for oil palm-adopting households extend beyond just income-related ones however, including improved nutrition (Chrisendo et al., 2020), health, education, higher asset ownership, and better family planning (Dradjat, 2012; Euler, 2016; Kubitza and Gehrke, 2018).

Economic benefits at the village and regional level include positive effects on village assets, including road and market infrastructure, electricity, schools, and healthcare facilities (Edwards, 2019b; Gatto et al., 2017; Rist et al., 2010; Zen et al., 2016). Yet these developments have been associated with rising inequality between oil palm-cultivating and nonadopting villages (Gatto et al., 2017; McCarthy et al., 2012). At

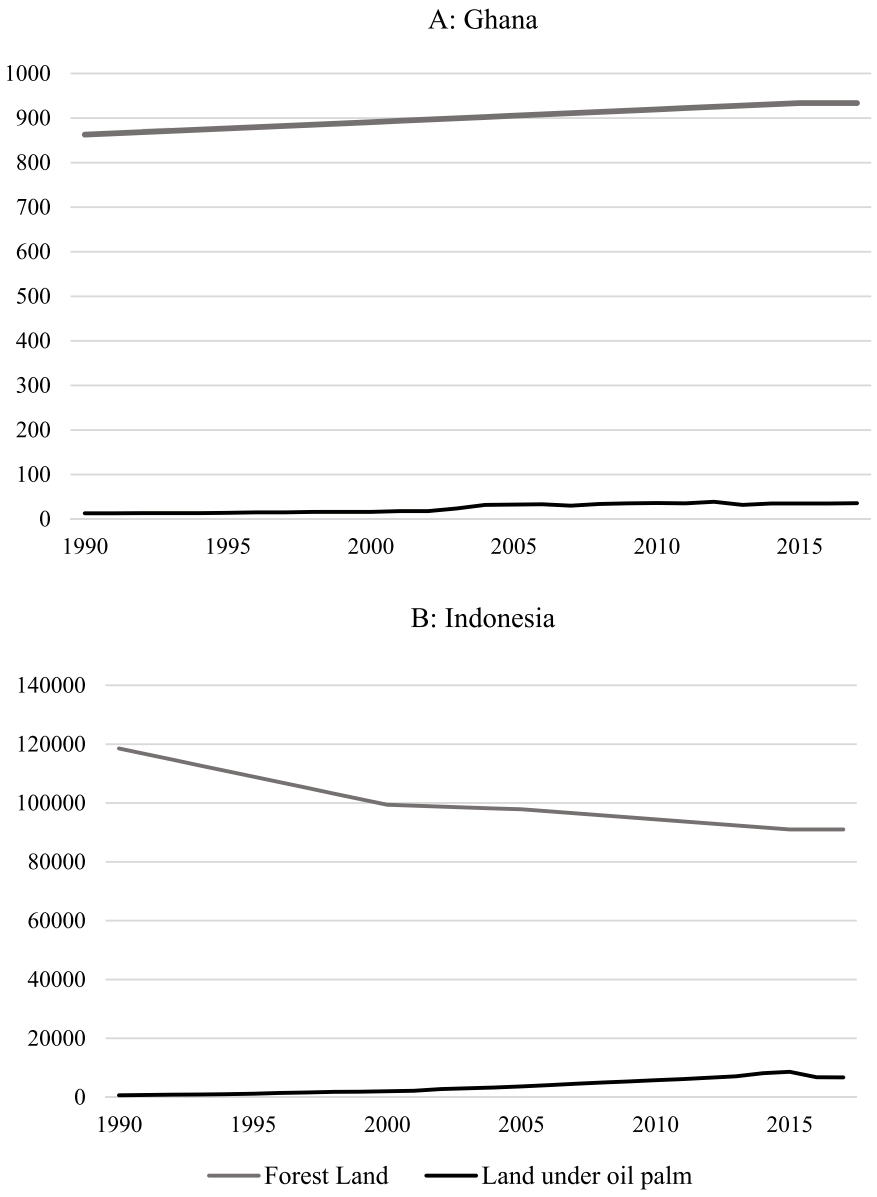

Fig. A5. Oil palm cultivation and available forest lands 1990–2017 (in 1000 ha).
Source: Authors' own illustration, based on data from FAO (2020).

the national level, oil palm production has contributed to poverty alleviation, indicated by lower poverty rates in areas surrounding oil palm plantations (Dradjat, 2012; Susila, 2004) and a faster decline in overall poverty rates (Edwards, 2019a). Significant economic improvements have also been reported for other parties involved in supply chains, such as traders and intermediaries (Bou Dib et al., 2018; Euler et al., 2017; Feintrenie et al., 2010). However it should be noted that the transition has not benefitted all households and villages to the same extent. Local settings and other social indicators play an important role too (Santika et al., 2019a, 2019b).

The development and welfare impacts of oil palm adoption are far less studied for Ghana (or other African cases). Some studies compare participation to nonparticipation in oil palm contract farming in Ghana. These studies find that participation leads to higher household assets and perceived future security (Väth and Kirk, 2014), higher subjective well-being (Väth et al., 2019), lower agricultural-labor requirements (Ruml and Qaim, 2021), and higher household incomes (Ruml et al., 2021). If the companies offer in-kind credit, it further leads to specialization, increased input intensity, and higher land productivity (Ruml and Qaim, 2020a), which underlines the severity of the capital constraints in the sector. We have shown above that producing under contract substantially reduces agricultural-labor requirements, which leads farm households to adjust accordingly. If production inputs and credit are provided by the contracting company, households substantially expand their oil palm plantations. If no such support is provided, households reallocate saved household labor toward off-farm income sources instead (Ruml and Qaim, 2021). Both strategies are associated with substantial gains in household incomes (Ruml et al., 2021), similar to what has been observed in Indonesia.

However the lower labor requirements in the modern supply chain lead to reduced employment, particularly of female laborers (Ruml and Qaim, 2021). Furthermore it has been argued that many contracts lack transparency, leading to dissatisfaction among (unorganized) farmers and in some cases a diversion away from oil palm (Agricultural Policy Research in Africa, 2020; Ruml and Qaim, 2020b). In general, contracting oil palm companies have been accused of opportunistic behavior, which may be related to their market power, with smallholders being dependent on them as the only buyer of their produce

(Ruml and Qaim, 2020b).

Overall, participation in the agro-industry through contract farming thus appears to be economically beneficial for oil palm farmers. However it is unclear whether oil palm production is, in general, beneficial compared to the production of other cash crops. In a recent study (Agricultural Policy Research in Africa, 2020), 12% of the surveyed oil palm farmers were clearing their plots to (re)adopt rubber production, due to a lack of credit to replace old palms, land grabbing, and (perceived) unfair practices by contracting companies—in line with the previous observations.

Our above analysis has clearly shown that artisanal farmers are not competitive, and it is likely that Ghanaian oil palm farmers may therefore—on average—not fare better than other farmers—as is the case in Indonesia. Because such evidence is lacking to date, we look at the relationship between oil palm adoption and poverty status among farm households in Ghana. We disaggregate the farm households in the Ghana Living Standard Survey (GLSS)—conducted in 2005/6, 2012/3, and 2016/7 respectively—by producer types and compare poverty headcounts. [5] Only looking at oil palm-producing districts, we distinguish oil palm producers, non-oil palm producers, cocoa farmers, and a fourth group that produces both cocoa and oil palm at a commercial scale. Table A2 in the Appendix provides information on sample sizes and shares of types of producers in each of the three datasets. It should be noted that less than 1.5% of the sampled oil palm farmers sell through contracts or cooperatives, and the data thus provide insights on mainly artisanal producers. In line with recent evidence, the data suggest that the share of producers cultivating oil palm decreased from 9% in 2006 to approximately 6% in 2017, while those producing both cocoa and oil palm increased from 3.2% to 5.5% in the same period.

Fig. 1 presents poverty headcount ratios by producer type. Overall, rural extreme poverty in the considered regions of Ghana declined (from 9% to 5%), while moderate poverty stagnated at about 20%. No clear pattern emerges when examining how the different groups of farmers fared. While specialized oil palm farmers are among the least poor in 2006 and 2013 for both moderate and extreme poverty and less poor than other types of farmers, in 2017 both moderate and extreme poverty are highest among these specialized farmers. This could mean that those who remained pure oil palm farmers were poorer to start with while better-off farmers diversified away from oil palm eventually. It may also indicate increased competitive pressure on artisanal farmers. In contrast, the growing group of farmers that cultivate both cocoa and oil palm sees poverty rates decline most strongly among their ranks. They fare even better than cocoa farmers, for whom poverty (both moderate and extreme) declines more than for other types of farmers.

6. Discussion and policy implications

We have investigated whether the positive socioeconomic effects of Southeast Asia's oil palm boom can be replicated in West Africa given important differences in structural conditions and local contexts. Our systematic comparison of the oil palm sectors in Ghana and Indonesia highlights major differences in their constitutive characteristics. While Indonesia hosts an industrial, internationally competitive oil palm sector with substantial smallholder involvement, Ghana's oil palm production is dominated by low-productivity artisanal smallholders who cater to the domestic market; few nucleus-estate and contract-farming schemes exist in the latter.

Our comparison of the oil palm sector's development and associated policies has identified substantial differences in respective structural conditions and policy foci, particularly regarding smallholder and private sector involvement. While Indonesia successfully launched large-scale programs to involve and link smallholders and private companies, Ghana focused on state-owned plantations and struggled to attract and involve private investors. This variation is in part due to differences in population densities, the availability of suitable land, and in land-tenure systems. The Indonesian government had abundant agroecologically suitable land available to establish large-scale government plantations, smaller plantations for (transmigrant) smallholders, and to provide land to international companies. The postindependence Ghanaian government had much less access to suitable land, most of which continued to be controlled by traditional authorities. Until today, land-tenure insecurity and the potential for land conflicts hampers investment in agriculture in Ghana—for smallholders and companies alike.

Under Ghana's conditions, cocoa emerged as the country's dominant cash crop and has maintained this importance—including the corresponding policy attention—until today. Although repeated policy efforts to foster oil palm cultivation were made, they were narrowly focused on nucleus plantations and (some) outgrower schemes, a model that was never destined to work (very well) in the Ghanaian context. In Indonesia, in contrast, the policy focus on oil palm turned out to lead to a massive expansion of the sector because conditions—namely the availability of suitable and accessible land as well as the nature of the international market—were favorable to the private sector's heavy involvement—to the benefit of smallholders and companies alike.

The oil palm sectors of the two countries differ in fundamental ways and have had contrasting rural-development implications. In Indonesia, the participation of smallholders in the exclusively industrial and well-coordinated oil palm sector has been associated with substantial economic gains and considerable poverty reduction. These overall economic gains have come at huge environmental costs; oil palm expansion has also created losers and caused social friction too. Large-scale deforestation implied massive biodiversity losses. Land-tenure conflicts—between private companies and local communities, but also within and between the latter—are common while social problems—for example precarious labor conditions—have frequently been reported as well. Further, socioeconomic inequalities between oil palm producers, often migrants, and non-oil palm producers, who are predominantly local people, are well-documented. Intervillage inequalities, especially in terms of infrastructure, are also observed.

Ghana's "dual" oil palm sector hosts two value chains, the artisanal and the industrial (export-oriented) one. Most of the country's oil palm, which is an integral part of the local food system, is produced by smallholders with diverse production and livelihood strategies. On average, oil palm-producing smallholders do not seem to be generally better off economically than other farmers. This is a result of the very low productivity, high costs, and, hence, low profits of Ghanaian producers in the artisanal palm oil supply chain. The emergence of more competitive producers (plantations and contract farmers) may even put greater pressure on artisanal producers. As these producers dominate the Ghanaian sector, oil palm adoption is not associated with the development and welfare impacts that have been shown for Indonesia. However oil palm-cultivating smallholders integrated in the agro-industry are economically better off than their artisanal counterparts, even though the market power of the companies and the (perceived) lack of transparency vis-à-vis contracts creates tensions between smallholders and companies. Further, in Ghana, oil palm production and expansion have not led to environmental degradation at scale, due to the low share of large-scale plantation monocultures and diverse production

[5] The GLSS datasets are nationally representative household surveys administered by the Ghana Statistical Service, usually with technical and financial support from the World Bank. Each wave of the GLSS dataset is an independent cross-sectional dataset that contains information on a wide range of demographic and socioeconomic factors. Households are selected using a two-stage stratified sampling design with specified enumeration areas (EAs) and primary sampling units (PSUs). The EAs are divided into urban and rural localities. Households are listed within the selected PSUs to form secondary sampling units. For comparability, we limit the data to farm households living in districts where oil palm is or was produced commercially in either of the three survey waves.

systems among small-scale farmers.

So, what can be learned from these comparative insights for rural-development policy and the role of smallholders in agri-food chains in general and for the specific Ghanaian or West African context in particular? While the integration of rural households into agro-industries is widely proposed as a facilitator of rural development and poverty alleviation, our results have clearly illustrated that the Indonesian success model of establishing large nucleus estates with contract-farming schemes cannot be simply replicated in Ghana. In the latter context, the sole focus on nucleus estates (with contract farmers) carries important risks. One is the potential for social conflict, in particular over land. Another is the potential crowding-out effects on the artisanal supply chain, which comprises a labor-intensive agricultural and manufacturing sector. Policies addressing the oil palm sector should hence pay due attention to the potential effects of their implementation on artisanal producers and the associated value chain.

Yet it is also apparent from our analysis that contract-farming schemes can be beneficial for smallholders, in particular through the transfer of technology and superior production inputs (e.g. Ruml et al., 2021). The establishment of a large agro-industry through nucleus estates can improve agricultural productivity, generate employment, and contribute to general rural development, for example through the development of input and other factor markets and infrastructure improvements (Ali et al., 2019; Lay et al., 2018). Due to Ghana's structural constraints on oil palm expansion, however, the sector and with it the "Indonesian model" will only be able to thrive in selected locations of the country—that is, at much smaller scale.

While farmers participating in agro-industries through contract arrangements are oftentimes better off and more productive (Ton et al., 2018; Wang et al., 2014), this is not always the case (Meemken and Bellemare, 2020). It depends, among other things, on the type of contract (Ruml and Qaim, 2020a) and its stipulated conditions. Transparency of contracts and conditions is often an issue. Further, conditions may be unfavorable—for example if companies hold monopsony power (Ruml and Qaim, 2020b). However, in particular with resource-providing contracts and favorable contracts conditions, oil palm contract farmers will be better-off – even when selection effects, i.e. more skilled and initially better-off farmers selecting into contract farming, are considered. The contractual arrangements and conditions as well as the behavior of contracting companies need more scrutiny and probably regulation.

In times of increasing scarcity of and competition over agricultural land, land governance and the protection of smallholder and communal lands needs due attention when formulating development policy. We have shown that "land matters" in both countries: it has been well-documented that the so-called global land rush has put increasing pressure on land held by smallholders and on communal land. Such pressures are reported throughout sub-Saharan Africa and carry important risks for the local population (e.g. Ali et al., 2019; Deininger and Xia, 2016, 2018; Lay et al., 2021), whose economic income and food security depends on their land as their livelihood (Acheampong et al., 2018; Gyapong, 2021). The scarcity of land should therefore clearly limit the potential for expanding large-scale modes of production in Ghana (and other parts of West Africa).

Finally, from an environmental perspective, the expansion of large monoculture plantations increases the risk of accelerated deforestation. If production methods in Ghana transition toward the ones utilized in Indonesia, monoculture establishment and agrochemical-input application will increase. This could all lead to severe environmental degradation due to landscape homogenization, as observed already in the oil palm-cultivating regions of Southeast Asia.

Based on close consideration of the opportunities and risks involved in making the nucleus estate and smallholder model work in Ghana, we thus propose to look much more carefully at the specific conditions of the model, including contractual arrangements and market power of companies, and to be realistic about the scope of oil palm contract farming in this context. We also recommend emphasizing the important risks to the artisanal palm oil supply chains and paying due attention to land issues. The existence of artisanal producers and processors, as well as the local demand for palm oil, should not only be seen as an obstacle to agricultural development but also as an opportunity to stimulate endogenous growth, for example by improving artisanal processing capacity through higher levels of mechanization and credit access. The constraints to artisanal palm oil processing, for example access to technology and credit, have not received enough policy attention and more research may be needed to identify specific constraints and appropriate policy instruments, for example formalization and technical assistance. Higher processing capacities in the artisanal value chain would not only increase miller incomes but also provide a larger and more stable market outlet for independent producers, relieve price pressures in peak seasons, and generate employment. Capacitated mills with more resources may also be able to build backward linkages with positive spillovers to farmers.

The establishment of large nucleus estates like in Indonesia is not the only way to improve market coordination. Smallholder productivity could be addressed through the expansion of agrochemical subsidy programs to oil palm and extension services regarding better (and agronomic) management practices. Currently farmers largely rely on private companies for information about, inter alia, appropriate fertilization techniques, crop and canopy management, proper harvesting intervals, and technical innovations. We further recommend that farmer cooperatives should be strengthened early on in the emergent sector to increase bargaining power and market access in the future. This is particularly important in light of the rising dissatisfaction among both contract and artisanal smallholders. Such cooperatives also provide a suitable platform for extension services and technology transfer. In fact, such cooperatives have been an important element of contract-farming schemes seeking to address the lack of farmer representation.

To conclude, the oil palm sector holds considerable potential to contribute to rural development in West Africa. Yet this contribution will have to take a different form to the pattern observed in large parts of Southeast Asia with its successful nucleus-estate and contract-farming schemes. The specificities of the region, including its land-tenure arrangements and scarcity of land as well as the presence of an important artisanal palm oil supply chain, need to be taken into account.

Declaration of competing interest

None.

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Appendix

See Tables A1,A2; Figs. A1,A2,A3,A4,A5.

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