

# SMALLHOLDERS AND MACHINES IN THE WEST AFRICAN PALM OIL INDUSTRY, 1850–1950<sup>©</sup>

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**ABSTRACT:** This article uses colonial-era Ghana as a case study in the challenges of mechanization in West Africa's oil palm industry during the 19th and 20th centuries. While European industrialists pursued plantation-mill complexes in places like Congo and Southeast Asia, African entrepreneurs and government officials in British colonies focused on developing machines suitable for the small-scale producers who had built up the industry over the course of the nineteenth century. As inventors and officials discovered, however, machinery was unable to address the full range of economic, social, and natural challenges posed by oil palm trees. While some colonial observers alleged that racial characteristics or cultural conservatism were to blame for the failure of machines, the economic logic that underlay farmers' decisions was straightforward. Machines were too expensive and insufficiently productive, given prevailing prices for palm oil. Frustrated colonial governments tried to bridge the gap between larger mills and smallholder machines in the 1920s and 1930s, but with no success. By the time local factors shifted in favor of smallholder machines, colonial and national governments had moved on to large mills with accompanying plantations, leaving small-scale producers behind.

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In 1908, John Buckman Esuman-Gwira presented the colonial government of the Gold Coast (modern Ghana) with plans for his “Fanti Palm Oil Machine.” He declared that the device, accompanied by a machine to remove shells from palm kernels, would aid “the African oil manufacturer, who having no scientific training cannot very well use the Palm Oil extracting machines which have hitherto been invented.”<sup>1</sup> Colonial officials, as well as local entrepreneurs, hoped the machine would revitalize the Gold Coast’s declining palm oil export industry, at a time when global demand for fat was soaring.<sup>2</sup> European industrialists were already experimenting with oil palm plantations in Africa and Southeast Asia, raising concerns about the future of West Africa’s huge smallholder palm oil industry. Unfortunately for Esuman-Gwira and oil palm farmers, experiments with the machine were disappointing. The challenges of small-scale palm oil production were embedded in economic, social, and environmental contexts, none of which could be easily addressed with a “technological fix.”<sup>3</sup>

This article situates Esuman-Gwira’s invention and the fate of the Ghanaian palm oil industry within a broader history of palm oil in Britain’s West African colonies.<sup>4</sup> While Belgian, French, and German colonial governments pursued a plantation-based palm oil strategy, the British administrations of the Gold Coast, Sierra Leone, and Nigeria continued to rely on small-scale producers, leading to decades of experimentation with machines for smallholder use. Much of the history of technology in sub-Saharan Africa has been the history of technology transfer, or as Daniel Headrick put it, the “conquest of the non-Western world by Western industrial technology.”<sup>5</sup> Esuman-Gwira’s machine was an indigenous response to the challenges of palm oil production. Its failure illustrates the ways in which African production systems efficiently made use of oil palm trees and labor without machinery. The palm oil story challenges the Eurocentric, culturally-based assertions of Headrick and others that the slow pace of mechanization in Africa resulted from a need to “learn to *understand*, and not just desire, the alien machinery” [emphasis added].<sup>6</sup> Palm oil and kernel producers had no difficulty grasping the functions of the machines they were introduced to, but they often did not see a convincing value proposition in adopting them.

While colonial archival sources are full of racist assertions about the economic behavior of Africans, colonial officials nonetheless saw that farmers were making rational choices when confronted with new technologies. Farmers were wary of new devices not because they feared change, but because they understood the palm oil business. Investing in a machine meant committing to a volatile export market; selling palm fruit to

a machine owner meant loss of ownership over oil and kernels, depriving producers of marketing income. Tall and often widely-dispersed palms were difficult to harvest, and the machinery introduced c. 1850–1950 did nothing to address this labor-intensive first step in palm oil production. While the widespread adoption of hand-powered machines in the West African palm oil industry after 1950 is beyond the scope of this paper,<sup>7</sup> that development had little to do with technical improvements in machinery: instead, the social, economic, and environmental factors which had worked against mechanization in earlier periods shifted, changing the costs and benefits for producers.

## Abundance and Opportunity

The oil palm tree (*Elaeis guineensis*) grows in humid regions across western Africa along the margins of tropical forests, and in scattered groves outside the forest belt. The tree was carried across the Atlantic to Brazil by the seventeenth century, and arrived in Southeast Asia only in the nineteenth century.<sup>8</sup> Oil palm fruit grows in tightly-packed bunches at the top of the tree, which can reach a height of over 20 meters. Once removed from the bunch stem, the crushed flesh (pericarp) of the fruit yields a red-colored oil. Inside the pericarp, a shell protects the palm kernel, an oil-rich seed that was at times more valuable than the pericarp oil. Botanists argue that the oil palm was historically a “semi-wild” tree: in exporting regions, producers harvested from dense groves that were either natural, or that emerged as a result of forest-fallow agriculture.<sup>9</sup> Austen argued that palm products, like other key exports of the nineteenth century, “were procured outside the system of agriculture, animal husbandry and handicrafts which constituted the core of the internal African economy,” reflecting a scarcity of labor which encouraged control over trade and marketing, rather than investment in intensive production.<sup>10</sup> Opposing these descriptions of a “forest” or “extractive” industry, however, is a wealth of unambiguous evidence that oil palms were planted and cultivated as a commercial crop in major exporting regions.<sup>11</sup> Regardless of how the trees came to be, oil and kernels were usually produced by households operating under a gendered division of labor. Men climbed trees to cut fruit bunches and often transported bunches. They might also have crushed fruit (“digesting,” in industry parlance) and extracted oil, though this was often the domain of women, who might transport, digest, cook, and extract oil, while also cracking kernel shells, collecting fuel and water, and marketing finished oil and kernels.<sup>12</sup> The order of operations and the equipment used varied across the oil palm belt.

Palm oil was widely consumed across West Africa, and significant quantities were produced c. 1600–1800 to feed captives sold into the transatlantic slave trade. Palm oil only became a major export commodity in the early nineteenth century, however.<sup>13</sup> The origin of the palm kernel trade is murkier, but by the 1830s kernels appeared in French and British import records.<sup>14</sup> Kernels were secondary products for palm oil exporters, who might expend additional labor drying and cracking kernels if prices were attractive. In some areas, like Sierra Leone, producers specialized in kernel exports, collecting them in the course of domestic palm oil consumption.<sup>15</sup> For both commodities, the entire production process lay in the hands of African producers.<sup>16</sup> European merchants simply bought oil and kernels and exported them to Europe. The palm oil trade was a critical factor in the expansion of formal colonial rule in West Africa, as European merchants battled with each other, and with African merchants and middlemen, for control of the business.<sup>17</sup> Yet palm oil production itself was of little concern to the new colonial governments.

Two interrelated assumptions shaped early colonial views of the oil palm industry. First, Europeans had a limited understanding of African agricultural systems and initially assumed that lush foliage implied rich soils.<sup>18</sup> The author of a Gold Coast agricultural survey claimed, “cultivation is of the rudest sort, hardly worthy of the name, a mere scratching of the surface, but so fertile is the soil, and so forcing the climate that these easy toils are repaid by a return of one to two-hundredfold in the corn, and other crops in proportion.”<sup>19</sup> Enormous groves of “wild” oil palms, bearing far more fruit than could be harvested, were prime examples of this supposed tropical fecundity.<sup>20</sup> Secondly, foreigners assumed that African labor was cheap. Early promoters of the trade were sure that palm oil would be “one of the heaviest articles of traffic in the commercial world,” thanks to “the wonderful productiveness of the palm tree . . . and the boundless extent of territory in which it grows spontaneously, and the myriads of inhabitants which swarm these fruitful forests, ready to labour for the smallest consideration.”<sup>21</sup>

By the late nineteenth century, European writers portrayed the vast quantities of palm fruit which went unharvested as a wasted resource. A Gold Coast official remarked in 1889, “It is impossible to travel through the oil districts without being struck by and lamenting the enormous waste of produce which is everywhere apparent. One walks among the thousands of splendid trees in full bearing with the nuts falling off ungathered . . . because with his defective means the owner cannot bring them to market.”<sup>22</sup> Another official said it was “heart rending to see thousands of palm fruits spoiling in the season” due to a lack of labor to process them.<sup>23</sup> This

apparent mismatch between labor supplies and natural resources inspired foreign and local efforts to mechanize the palm oil industry. If less labor were expended processing fruit, more labor could be directed toward fruit collection, increasing exports.

One early effort at mechanization came in Liberia. Stephen A. Benson, an African-American colonist who later served as president, noted in 1852 that indigenous oil palm producers responded to his demonstration of an oil-pressing machine with “emotions of astonishment, and admiration.” After seeing the Liverpool-built machine, they “indulge[d] in expressions of ridicule . . . at their own imperfect method of making oil.” He added, “Many of them have inquired the price of a similar press, and declared their determination to purchase.” From Benson’s perspective, the desire for machinery reflected the success of trade as an agent of European “civilization:” “the natives . . . becoming increasingly assimilated to us [colonists] in manners and habits; their requisitions for civilized productions increase annually.”<sup>24</sup>

Benson’s confidence that mechanization was a natural accompaniment of the expansion of commerce and “civilization” was misplaced, however. Palm oil and kernel exports boomed across the nineteenth and early twentieth centuries without any notable imports of machinery. While some of the increase was attributable to a “vent for surplus” effect, in which producers took advantage of new export opportunities to increase production without substantive changes in production factors,<sup>25</sup> a number of indigenous innovations did increase productivity. The “hard oil” process adopted by many producers employed natural fermentation to soften palm fruit, saving two-thirds of the labor that would have ordinarily been required for cooking and pulping fruit (to make “soft” oil). Hard oil was, in effect, a new commodity: a rancid, semi-solid, inedible fat with few domestic uses, produced to meet foreign demand.<sup>26</sup> Besides being easier to make, hard oil could be rafted down rivers in puncheons, whereas soft oil had to be carried by canoe.<sup>27</sup> Hard oil producers sometimes did away with cooking entirely, eliminating the need for specialized women’s labor and allowing men to expand output beyond their household’s typical capacity.<sup>28</sup> In soft oil areas, the identification of palm oil with women’s work proved no obstacle to men entering the business “as soon as it became clear that they could make money by doing so.”<sup>29</sup>

The increasing value of palm oil spurred institutional changes: in southeastern Nigeria, communal groves became private property, while in Dahomey, King Ghezo gave oil palms legal protection and required taxes to be paid in palm oil.<sup>30</sup> Sophisticated credit arrangements emerged, allowing middlemen to efficiently transfer oil and goods across long distances.<sup>31</sup>

Some producers, like the Krobo of southeastern Ghana, cleared forests to plant oil palms, intensifying their use of land.<sup>32</sup> Technology also changed. Producers scaled up their equipment, building large, stone-lined pits for crushing fruit or carving purpose-built “oil canoes” out of trees.<sup>33</sup> The novel “Asono” method of southeastern Ghana used iron bars to transfer heat from fires into earthen pits, avoiding the need to transfer crushed fruit to smaller metal or pottery vessels for cooking.<sup>34</sup>

Slave labor played an important, though uneven, role in the expansion of palm oil and kernel production in the nineteenth century. The prevalence of slavery has been invoked by a number of scholars to explain the lack of agricultural mechanization across the continent. Acemoglu and Robinson, for example, have argued that the institutions created by the transatlantic slave trade “precluded many societies in West and Central Africa from taking advantage of all the innovations in economic situations and technology then taking place.”<sup>35</sup> The decline of the transatlantic slave trade encouraged elites to employ slaves in palm oil production and transport, and in Dahomey and several other places, large oil palm plantations worked by slaves were reported by Europeans.<sup>36</sup> Small producers may have also bought labor as the price of slaves declined.<sup>37</sup>

Palm oil was not well-suited to the slave- or wage-labor plantation model, however. The large fruit-crushing pits built in Dahomey, among other places, offered some economies of scale, but Martin and other scholars conclude that the overall benefits of scale were small.<sup>38</sup> Indeed, contemporary Danish efforts at plantation agriculture, including palm oil, were unsuccessful on the Gold Coast.<sup>39</sup> Around Lagos, enslaved individuals took up palm oil production, using accumulated profits to purchase their freedom.<sup>40</sup> As Hopkins argued, “the ‘do it yourself’ character of staple export production” meant that individuals with little or no capital and their own labor power could easily join the ranks of export producers.<sup>41</sup>

Whether we consider large or small producers, the growth of palm oil exports across the nineteenth century was a labor-intensive process. This fact, coupled with the seemingly limitless amount of palm fruit available in “wild” palmeries, suggested that even greater exports were possible if labor productivity could be augmented—even in small ways—by machinery.<sup>42</sup> A Gold Coast official writing in 1911 remarked, “In the near future the more general use of mechanical transport and it is to be hoped of labour saving machinery will set free a number of people to engage in more immediately productive services and in more economical effort than, for example, head transport.”<sup>43</sup> The effect of machinery was readily apparent in transport. Railroads and the motor truck greatly expanded cash crop exports across West Africa, while also fueling growth in domestic trade.<sup>44</sup> In the palm oil

industry, recycled kerosene tins and bicycles allowed producers to carry oil to distant markets.<sup>45</sup> Machines for extracting palm oil would save labor, but could also recover more oil from a given quantity of fruit than manual methods, adding to their appeal. A German study in Cameroon found that producers could manually extract only 30 percent of the total oil available in fruit, though other studies reported figures closer to 50 percent.<sup>46</sup> Colonial officials lamented, “even in districts where the best native methods are employed much waste of oil takes place.”<sup>47</sup>

At least one machine builder, Gunnell, sold palm oil presses and kernel crackers in West Africa in the 1880s and 1890s, claiming that there was “constant demand from Native Merchants and Traders for such a machine.” Advertisements for the firm stated that the “necessary conditions for such a machine have been carefully studied, viz: simplicity, durability, portability, and moderate cost.”<sup>48</sup> The firm claimed its press could extract 25 percent more oil than manual methods, but it cost £30, and was marketed in the midst of a long depression in palm oil prices. Few seem to have been purchased by African producers. Shields found that in the Lagos hinterland, women (who produced most oil for export in that region) “still used the techniques that they had employed since the beginning of the [nineteenth] century.” Machines like the Gunnell press were too expensive, and “if a producer wished to expand it may simply have been cheaper to employ or recruit more labour instead of machines.”<sup>49</sup>

While West Africans embraced new transport technologies, they did not eagerly invest in palm oil machines. The result, at least according to colonial officials, was that “palm products to the value of hundreds of thousands of pounds go to waste annually because it is too laborious or costly to prepare them in proportion to the return obtained.”<sup>50</sup> As late as 1926, Allan McPhee could quip that the palm oil business juxtaposed a European industry of the twentieth century A.D. with an African industry from the twentieth century B.C.; he argued that “the greatest immediate improvement in the trade will be in connection with less wasteful methods of preparation by means of machinery.”<sup>51</sup> Some Europeans resorted to racist explanations for the slow pace of technological change. An agent for one machinery firm blamed poor sales on the “conservative” nature of Africans.<sup>52</sup> A Lever Bros. employee reported that “skilled labour was a difficulty,” complaining that “it is very difficult to teach the natives how to work and handle the machinery.”<sup>53</sup> Another European writer concluded that the African worker was “all hand and no head.”<sup>54</sup> The inability to grasp foreign technology was a common colonial trope across the globe, reflected in mocking stories about wheelbarrows carried on heads and other mishaps.<sup>55</sup>



## The Fanti Palm Oil Machine

By the turn of the twentieth century, the world market for fat had shifted. The late nineteenth century saw prices for palm oil decline as mineral oil and other products competed with hard palm oil in industrial markets. The rise of a new market for edible fat offered relief to producers, however. By the 1880s, margarine manufacturers were using palm kernel oil, and by the 1890s they found that the best-quality soft palm oil could also be used. After a century of service as soapstock and axle grease, palm oil was reimagined in Europe as a foodstuff. Europeans who formerly saw no trouble with the hard oil process now derided “wasteful, extravagant and costly” production methods that turned edible fat into rancid hard oil.<sup>56</sup>

This was the context in which John Mensah Sarbah, an eminent lawyer and businessman, introduced Esuman-Gwira’s “Fanti Palm Oil Machine” to the Gold Coast government.<sup>57</sup> Industrialists, officials, and merchants were clamoring to find a machine or set of machines that would allow African producers to efficiently make high-quality soft oil. The Gold Coast government took an interest in palm oil mechanization at an early stage, in the hopes of reviving the colony’s flagging oil and kernel trade. Cocoa, which was successfully adopted by many Gold Coast farmers beginning in the 1890s, lured many farmers away from palm oil and left the colony with a worrying dependency on a single cash crop.<sup>58</sup> Farmers were cutting down oil palms in increasing numbers to tap them for wine, and they often replanted with cocoa and food crops instead of allowing oil palms to regenerate.<sup>59</sup> Revitalizing the palm oil industry would have checked the expansion of cocoa, preserving forest cover while giving farmers outside prime cocoa areas an incentive to keep their oil palms in production instead of felling them for wine.<sup>60</sup> From the colonial point of view, machinery was the key: “do away with the waste of energy and then the same energy will bring the native as much money [from palm oil] as he now gets from cocoa,” argued one British businessman.<sup>61</sup> Moreover, the Gold Coast colony had a large group of western-educated indigenous capitalists who could plausibly lead a technological revolution in the oil palm sector.<sup>62</sup>

The Fanti Palm Oil Machine addressed major complaints about earlier machinery: it was portable, relatively cheap at £10, and easy to operate. The machine was a vertical metal cylinder containing knives affixed to an axle, rotated by a hand crank. Fruit and hot water were fed into the machine, and after turning the crank repeatedly to shred the fruit, the operator drained off the oily juices and allowed the oil and water to separate by gravity. The machine combined two laborious steps (digestion and oil extraction) in a single process. As Mensah Sarbah explained, digesting and then squeezing



palm fruit to extract oil consumed most of the worker's time in the soft oil process.<sup>63</sup> He was sure the new machine met "all the requirements of the small producer," and argued that it also responded to growing demand from palm oil importers for cleaner, higher-quality oil. "[W]ithout touching the fruit after it is put into the machine, a man can pulp it and collect the first quality oil quickly."<sup>64</sup> Mensah Sarbah understood that machines would only be worthwhile if producers were rewarded by higher prices for edible oil, given the possibility of cultivating alternative crops like cocoa.

Mensah Sarbah envisioned two markets for the machine. First, he stressed its appeal to yeoman farmers, who he believed could profitably operate the machine on a part-time basis, earning up to £7 per month from palm oil while growing other crops.<sup>65</sup> Because oil palms fruit continually (though not evenly) throughout the year, a farmer could focus on palm oil in periods that might otherwise be idle. Mensah Sarbah hoped that the use of machinery would make oil palm farming more appealing to educated men, stemming the tide of migration to urban centers. He urged West African schoolmasters to teach their pupils to "know and appreciate the uses and economic value of the oil-palm as well as the advantages of a farmer's career."<sup>66</sup> Mensah Sarbah saw a second market for the machine among African capitalists who might produce palm oil on a larger scale, using batteries of the machines. He reported that a local company was forming to use the pulping machine, and the "Mensakoff Industries Company" was awarded a prize in 1911 for machine-made oil, though the firm left no other records.<sup>67</sup>

A. E. Evans, the Gold Coast agricultural director, eagerly ordered an experiment with Esuman-Gwira's prototype. His staff found that two men and one woman could make eight to ten imperial gallons of finished oil per day with the machine. They offered contradictory comments about the machine's performance. On the one hand, staff complained that the machine was too small, requiring repeated cycles of loading and unloading. They also argued that the machine required too much effort to operate. Reducing the size of the machine would have solved the latter problem, but exacerbated the first. A kernel cracker Esuman-Gwira designed to accompany the oil extractor also failed to meet expectations, leaving too many kernels uncracked.

While Esuman-Gwira was a talented engineer, there is little to suggest that he had any special insight into the needs of palm oil producers. He was probably educated in Britain, worked as a mining surveyor, and was a fellow of the Royal Colonial Institute. The palm oil machine might not even have been his idea: Mensah Sarbah reported that he asked Esuman-Gwira to draw up plans for it. Mensah Sarbah acknowledged in a letter that Esuman-Gwira had not even seen his invention at work, and he conceded

that the machine was “capable yet of further improvements.” Still, Mensah Sarbah believed that “when put on the market this machine would increase considerably the production of palm oil and the saving of much valuable produce now rotting in the forests.”<sup>68</sup> Britain’s Imperial Institute included it in a 1909 survey of machinery, though it had no special praise for it.<sup>69</sup> An American consular official urged its adoption in Liberia in 1910, and repeated claims about the need for such a machine in a 1915 article for the *Journal of Race Development*.<sup>70</sup>

Although Esuman-Gwira refined the design and received a patent (Figure 1) for an improved—and much more complicated—design in 1909, the colonial government lost interest in the machine. A similar palm oil extractor patented in Nigeria in 1907 by the famous bishop Samuel Charles Phillips also found few purchasers. The Phillips machine (Figure 2) used the same principle as Esuman-Gwira’s machine, though the rotating cylinder was mounted horizontally and included a water tank. Phillips’ son, Thomas Ekundayo Phillips, received a patent for an improved version in 1913. Unlike Esuman-Gwira, the Phillipses made no special claim about the suitability of their machine for African producers, merely stating that it was of “simple and cheap construction” and “easy of manipulation.”<sup>71</sup> There is no record in the Ghanaian or Colonial Office archives suggesting that the inventors were aware of the others’ work, but the patent awarded to Esuman-Gwira in 1909 for his updated design bears a striking resemblance to Phillips’ 1907 machine.<sup>72</sup>

## Labor, Gender, and Machinery in Ghana

Both the Esuman-Gwira and Phillips machines worked, in the sense that they extracted palm oil from fruit faster than manual methods. They were incomplete solutions to the challenges of palm oil production, however. The nature of the oil palm tree was partly to blame. The tree’s height made harvesting a time-consuming and dangerous task.<sup>73</sup> The fruit had to be harvested at peak ripeness—but no later—and cooked within a day to prevent the build-up of undesirable free fatty acids. Depending on the age, density, and distance from the production site of a palm grove, harvesting and transporting fruit might require 20–30 percent or more of the total labor required to produce oil. Studies made in the 1950s and 1960s indicate that a ton of fruit could be harvested in 14 man-hours, but this figure does not provide rest for the climber and ignores time spent transporting bunches. Additionally, men wisely refused to climb slippery trunks after rain, limiting the number of days the work could be done. An early twentieth century source reported that seven men could harvest and transport a ton of fruit

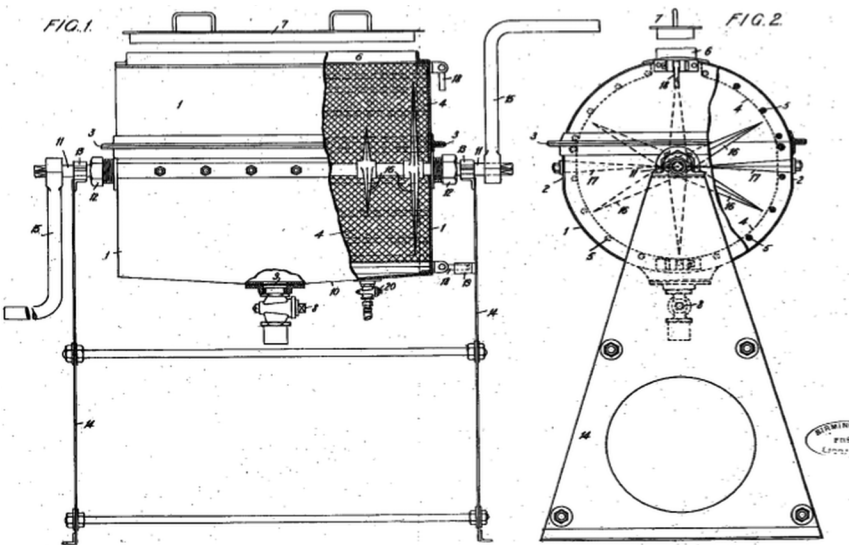


Figure 1. Detail from J. B. Esuman-Gwira, "Improved Apparatus for Extracting Oil from Palm and Other Nuts," Great Britain patent 3357, applied 11 February 1909, and issued 10 February 1910.

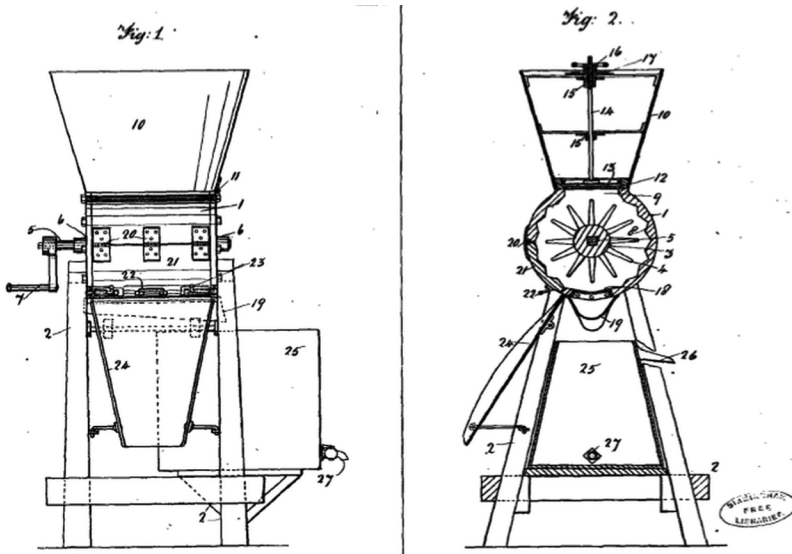


Figure 2. Detail from Samuel Charles Phillips, "An Improved Machine for Extracting Palm Oil from the Chaff of Palm Nuts," Great Britain patent 9733, filed 26 April 1907, and issued 27 June 1907.

in one day, a more realistic figure.<sup>74</sup> As Martin has argued, there were no economies of scale in harvesting fruit and no plausible technological solutions, at least until the development of the short, “dumpy” palm in the late twentieth century.<sup>75</sup>

Reconstructing the economics of the Esuman-Gwira machine is challenging, given wide variation in oil yields from different types of palm. Using average figures reported from Ghana in the early twentieth century, an enterprise making ten imperial gallons of oil per day with one machine would have required three or four men working as harvesters, collecting about a half-ton of fruit per day. With two men and a woman cooking fruit and operating the device, six or seven workers in total were needed per machine. At unskilled rates, the owner of a press would pay 70–80 d. per day in wages, or 175–205 d. at skilled rates, without considering the cost of gathering firewood and water. Ten gallons of oil were only worth about 150 d. at hard oil prices. Mensah Sarbah was optimistic that machine-made oil would compete with the best soft oil from Lagos, however, earning up to double the hard oil price.<sup>76</sup> If machine operators had to buy fruit on the market, instead of harvesting from their own trees, the profit margin would have shrunk. The First World War severely disrupted the palm oil market just as the Esuman-Gwira machine and others like it were being tested, however. The price incentive for soft oil weakened in the 1920s and 1930s as prices for fats fluctuated and then tumbled to record lows.<sup>77</sup>

Finding any wage labor at all was another concern for entrepreneurs. Before the colonial era, the inland slave trade provided one source of labor for growing commercial operations. In Ghana, the colonial government's campaign against slavery and pawnship seems to have diminished the active trade in slaves from the 1870s onward, though Akurang-Parry argues that coerced labor, especially from females and children, remained important well into the twentieth century.<sup>78</sup> Official proclamations against coerced labor did not significantly impact palm oil exports from the Gold Coast, despite reports of significant numbers of slaves working in the oil palm sector in key producing regions. Contemporaries reported defections of slaves involved in the transport of palm oil, but production does not appear to have been affected in any notable way.<sup>79</sup>

Surprisingly, promoters of palm oil machines made no mention of mechanization as a replacement for now-scarce slave labor. In part, this was because many slaves in Ghana worked within or were assimilated to households, obscuring their status and labor contributions, at least to foreign observers. The absence of slavery in the mechanization discourse also reflected government and elite reticence about surviving forms of coerced labor, which both groups saw as relatively benign and destined for gradual

extinction.<sup>80</sup> While a market for wage labor did develop in Ghana, it remained expensive and highly mobile throughout the early decades of the twentieth century: gold mining, railroad construction, and other industries competed for wage labor, while new land-use arrangements allowed landless individuals to take part in the cocoa boom, providing an alternative to the wage labor market.<sup>81</sup> The colonial government often resorted to forced labor to carry supplies and build infrastructure.<sup>82</sup>

The gendered nature of work in the oil palm industry further complicated the entrepreneur's calculations. Devices like presses and crackers were universally operated by men, depriving women of some or all of their earnings from oil and kernel production.<sup>83</sup> Early machines like the Miller kernel cracker were vigorously challenged by women, who took "a kind of trade union view of things," according to one observer.<sup>84</sup> If men with capital ignored women's protests, they could replace female labor with machines to crush and cook fruit or crack kernels, but they would struggle to find male wage workers to operate the machines and harvest enough fruit to justify mechanization.<sup>85</sup> The re-gendering of labor in response to mechanization was certainly not unique to the palm oil belt. In Europe and North America, machine spinning turned women's work into men's work, and then back to women's work with the arrival of ring spinning frames. Elsewhere in West Africa, a woman's task like rice threshing was "transformed into young men's wage-work when it involved an industrial machine."<sup>86</sup> These shifts were premised on the intersection of gender roles with social understandings of machines as complex or simple, prestigious or mundane, safe or dangerous.<sup>87</sup> While expert observers like Mensah Sarbah were well aware of the importance of women in palm oil and kernel production, their written records paid no attention to the impact of mechanization on women, and vice-versa.

An agricultural officer in Nigeria, A. C. Barnes, argued that women's work was in fact low-hanging fruit for mechanization. Barnes noted that cooking was a vital step for producers hoping to make top-quality edible oil. He urged the distribution of metal cookers, including pressurized "rapid" cookers that would conserve fuel, save time, and more effectively deactivate the enzymes which contributed to rancidity in "hard" oil.<sup>88</sup> For about £50 (1925 prices), an entrepreneur could buy a hand-press, a cooker, and a kernel cracker to mechanize the whole operation, except harvesting.<sup>89</sup> Another device aimed exclusively at women, an iron kernel-cracking set, cost 2s. 6d. but was no more useful than a pair of rocks.<sup>90</sup>

Colonial experiments in the Gold Coast and Nigeria showed that indigenous tools and techniques drawing on women's domestic labor were often competitive with the new machines. In one example, the Miller

kernel-cracking machine, operated by two men, faced off against two women cracking kernels by hand. The machine was much faster, but it yielded only 22 percent saleable kernels by weight, versus 29.2 percent for hand-cracking. Hand cracking therefore increased a producer's yield of kernels for a given quantity of fruit. The labor cost was comparable, because a number of factors worked in favor of hand-cracking: the intermittent nature of kernel-cracking; the cost of machines versus the stones used to crack by hand; and few wage-labor jobs for women (resulting in what economists euphemistically call a "low opportunity cost" of women's labor).<sup>91</sup> If a man had access to women's labor, it made sense to maximize kernel yields from a given quantity of fruit by continuing to use hand-cracking; the same women would also work in crushing, cooking, and extracting oil from fruit.

Ultimately, investing capital in a palm oil machine committed producers to the export market. If prices fell, other production factors—land, wives and children, slaves, and wage workers—could be shifted to other crops, but the machine itself would sit idle. The Esuman-Gwira machine was perhaps two or three times faster at making oil than traditional soft oil methods, but as we have seen, it was only worthwhile if one had access to significant numbers of trees and male laborers.<sup>92</sup> The price differential between labor-saving hard oil and the soft oil desired by European manufacturers was significant before 1914, but eroded over time. Domestic prices for soft oil were often higher than export prices, however, especially in Ghana. A small European-owned mill in Ghana reported in 1936 that it could hardly export any oil, as its edible product was "increasingly absorbed by the local market."<sup>93</sup> Once this market was satisfied, producing hard oil or finding other work would have made the most sense for would-be soft oil producers. A colonial official remarked in 1933, "It is not in the least curious . . . that owners of oil palms, with this large and remunerative [domestic] market open to them, do not exert themselves still more and manufacture a surplus for export."<sup>94</sup> One official affirmed that West Africans had "evolved a system of palm culture which gives them the maximum output with the minimum labour expenditure, and must be considered eminently suitable and efficient for working natural palm forests."<sup>95</sup>

## Scaling-up Machinery

During the First World War, food shortages in Europe heightened interest in palm oil and kernels, and a post-war boom in global demand for fat led to increased pressure across Africa for palm products, coconuts, peanuts, and other oilseeds.<sup>96</sup> Earlier failures with small machines left some colonial officials with "no doubt that large-scale factory mills give the best results, both



for quality of oil and reduction of waste.”<sup>97</sup> The problem was that capitalists willing to build such mills also demanded concessionary rights over land or oil palm trees to ensure that they could find enough fruit. West African elites and colonial officials had fought against plantation concessions in the 1890s and 1900s, and they continued to resist when industrialists like Lever made new proposals in the 1920s.<sup>98</sup>

A few officials argued that West African leaders were potential industrialists in their own right. Rulers like Sir Emmanuel Mate Kole (r. 1892–1939), the Konor of Krobo, were “quite sufficiently advanced in [their] ideas to be able to conceive a scheme for . . . mechanical power, and would experience little difficulty in raising the necessary funds for such a purpose.”<sup>99</sup> Other officials countered that few Africans had “the initiative to install the necessary machinery; and, even if they had, there are not many affluent enough to purchase the machinery themselves, or have a sufficiently large area of palms to justify them doing so.”<sup>100</sup> Whether the problem was “initiative,” capital, or appropriate machinery, African investors did not materialize in significant numbers in the 1920s.

Colonial governments continued to experiment with hand-powered machines into the 1920s.<sup>101</sup> Like the Esuman-Gwira and Phillips machines, devices like the “Ibadan Lever Press” and various screw-presses did the job of extracting oil, but failed to find a wide market. Colonial Secretary Ormsby-Gore noted that West African elites had a “keen interest” in such devices,<sup>102</sup> but officials explained that “the machines hitherto introduced to the natives have not been really satisfactory and his interest in them has naturally been languid.” Expressing confidence in the economic rationality of palm oil producers, one governor insisted: if “there is a machine which is within his means and will save him labour and increase his output of oil it is obvious that the potential demand will be large.”<sup>103</sup> Unfortunately no such machine appeared.

In 1925, Governor A. R. Slater had explained the lack of interest in machines with racist assertions: “To the native, time and labour do not count and are not reckoned as factors at all when calculating the cost of a manufactured article.”<sup>104</sup> Yet Slater also saw the factors which motivated farmers’ decisions. He noted that in an earlier Sierra Leone experiment, a mill paid only £1.10.0 per ton of fruit, while the same amount of fruit yielded £4 of oil and kernels. Men preferred to harvest what their households could process, minimizing the dangerous task of tree-climbing while maximizing earnings by retaining ownership of the oil and kernels. Harvesting fruit for the mill instead of making oil might have been a more efficient use of labor, but not all labor was equal: women did not climb trees to harvest fruit. An official remarked, “If all palm fruit were carried to a mill the women would



escape their share of the work and I cannot imagine the Sierra Leone native taking kindly to a system whereby he did all the work and his wife none.”<sup>105</sup> Because men could draw on the labor of women and children to process the fruit, they had every incentive to maintain control over the production process. One expert nonetheless blamed machine failures on African conservatism: “[the African] prefers to keep to his methods simply because they are familiar methods.”<sup>106</sup>

By the end of the 1920s, Britain’s West African colonies began to experiment with mechanization at a scale somewhere between the small producer and the commercial plantation. Though they acknowledged it was “rank socialism,” officials used the discourse of wasted natural resources to justify government intervention in the industry.<sup>107</sup> The governments of Sierra Leone and the Gold Coast negotiated in 1927–1928 with the African & Eastern Corporation to build small, power-driven mills without plantation concessions as public-private ventures.<sup>108</sup> The Sierra Leone project soon stalled, however, and the machinery was shipped to the Gold Coast for a plant at Bukunor in Many Krobo. The Gold Coast government agreed to a subsidy scheme to prevent losses if farmers failed to deliver fruit. The *konor* of Krobo assured officials that his people would deliver enough fruit.<sup>109</sup> Like earlier experiments, the Bukunor mill targeted tree-owning men, with no regard for the role of the household in the oil-making process. Despite the *konor*’s assurances, the mill could not buy enough fruit to maintain a viable level of throughput when it opened in 1931. One expert surveying the project invoked racist ideas of economic irrationality, arguing that “the native . . . appears to attach no value to the labour of himself, and more particularly his women-folk, in preparing oil, and extracting kernels.”<sup>110</sup> Gold Coast officials acknowledged, however, that they could not pay men enough to convince them to specialize in fruit harvesting, a fact they chalked up to low palm oil prices in the wake of the global depression. The Gold Coast government canceled the experiment in 1936 and sent the machinery back to Sierra Leone, where a small “nucleus estate” at Masanki was being planted with convict labor to ensure a minimum supply of fruit for the mill.<sup>111</sup>

The United Africa Company (UAC), formed by the 1929 merger of the African & Eastern Co. and the Royal Niger Co., made further experiments with the Nigerian government in the 1930s. Again, farmers could not be paid enough to convince them to sell fruit to the mills.<sup>112</sup> Lever Bros. encountered similar trouble in the Belgian Congo, where initial plans called for the collection of fruit from wild palms while plantations were gradually established.<sup>113</sup> The UAC insisted that cumulative experience in Africa proved “a palm plantation and mill should form a self-supporting unit, and

should not in any way be dependent on supplies of fruit being brought by African farmers.”<sup>114</sup>

## Late Colonial Development

After the Second World War, the colonial powers redoubled their efforts to extract resources from Africa, a period often described as a “second colonial occupation.”<sup>115</sup> A postwar British committee tasked with assessing the potential for edible fat production in the colonies wrote off the Gold Coast and Sierra Leone, seeing little hope for significant increases in palm oil or kernel exports. It focused its attention on Nigeria, and its report erroneously concluded that the oil palm sector there was primitive and unchanged, with exports limited to “the surplus over the producers’ own modest oil requirements.” The committee’s report ignored decades of work on oil palm questions and repeated racist assertions that Africans were short-sighted, bound by custom, and unresponsive to price incentives. The committee nonetheless urged governments to “persuade the producer to adopt new methods of processing.”<sup>116</sup>

The cornerstone of British policy in West Africa—indirect rule and, by extension, indigenous land tenure—came under attack. The wartime governor of Nigeria, Sir Arthur Richards, remarked to UAC director Lord Trenchard that land policy had degenerated from “a policy of unimpeachable principle” to “almost fanatical fetish worship,” blocking most attempts to create oil palm plantations.<sup>117</sup> In 1946, an official pondered whether “the likelihood of a long term fats shortage [was] so great that the sociological [sic] objections to the development of plantation production of palm products in British West Africa . . . should be overcome?”<sup>118</sup> Metropolitan officials were ready to give up on small producers entirely, preferring “bold experiments” like the ill-fated Tanganyika mechanized groundnut scheme.<sup>119</sup>

UAC drafted a blueprint for such an experiment in a 1944 memo. The company called for a network of oil palm plantations “of at least 10,000 acres,” insisting that “it is absolutely certain that if the plantation is to be a success, it cannot be run by the Africans themselves. For that matter it cannot be run by any European without up to date experience of managing scientifically-organised, large-scale estates on a commercial basis.” The report noted that “the only firm which combines the requisite knowledge, with first-hand experience both of palm cultivation and West African peoples and conditions, is The United Africa Company.”<sup>120</sup> UAC was so confident in its proposal that it published the memo in *African Affairs* after the war.<sup>121</sup>

The postwar government did not hand over the palm oil industry to UAC, but it developed a two-pronged strategy. First, colonial governments tested the UAC's plans for the "Pioneer Mill," a small power-driven mill that could operate in a plantation or serve a smallholder district.<sup>122</sup> Colonial officials dismissed "feeble attempts to make small portable machines for use by villagers who have no idea of how to keep them in operation." S. M. Taylor, stationed in Sierra Leone, derided the "old-fashioned idea that labour is cheap and plentiful: machines should therefore be designed to employ as many workers as possible." Taylor called on the state to supply motor-driven machines like the Pioneer Mill as a public utility, letting farmers retain ownership of the finished products.<sup>123</sup>

This model was impractical with the Pioneer Mill, which was designed for batches much larger than a typical household production run. Farmers were once again asked to specialize in tree-climbing and fruit harvesting and give up the oil business, though the first mills were intentionally built without kernel crackers to avoid disrupting women's incomes.<sup>124</sup> Women nonetheless protested the first post-war mill planned for Nigeria. As Mba's account demonstrates, these women were not luddites: they feared a loss of income from oil and kernel sales, but they were willing to negotiate, even proposing that "the men sell the palm fruits to the women, who would then extract the oil through the mill [as a cooperative] and sell the oil and kernels to the men."<sup>125</sup> The local (male) council objected to the mill, however, and the plan was abandoned. Later mills also met with protest, in part by women protesting the assault on their livelihoods, and in part by whole communities enraged by intrusions on their land.<sup>126</sup> A 1949 report disingenuously claimed "there was never any positive opposition to the mills," though it blamed the slow progress of the Pioneer Mills on the inability of local people "to appreciate their value."<sup>127</sup> After 1953 the protest movement faded, suggesting that gendered labor roles were not immutable obstacles to economic change.<sup>128</sup> In some areas, Pioneer Mills quickly "became associated with progress and modernity which helped to enhance the status of the communities they were located in," though the role of the state Marketing Board in setting prices which strongly disfavored hand-made oil vis-à-vis mill oil certainly played a role.<sup>129</sup>

The Eastern Region Development Board (ERDB), which had jurisdiction over the key oil-exporting region of southeast Nigeria, hoped to use revenue from the mills to diversify the Nigerian economy away from agriculture.<sup>130</sup> The ERDB began building what colonial capitalists could not: a mechanized, plantation-based palm oil industry. The ERDB invested in "nucleus" plantations with hybrid oil palm trees, and also took an interest in new technologies like the Stork hydraulic press, which was developed by

a European firm with help from S. C. Nwanze, a Nigerian researcher.<sup>131</sup> The Stork and Pioneer mills both proved costly, however, and operators often struggled to find enough fruit to maintain a profitable level of throughput.<sup>132</sup> Ultimately, the Nigerian experiments were interrupted by civil war, which was fought across the oil palm belt between 1967 and 1970.

Parallel to the Pioneer Mill program, British administrations continued to promote smallholder machinery, augmented by efforts to improve the yield and density of oil palms through replanting schemes. In the 1930s colonial officials had settled on the “Duchscher” screw press as the ideal smallholder machine. Unlike the Esuman-Gwira or Phillips machines, the press only extracted oil, requiring fruit to be cooked and crushed by hand. It did promise higher oil extraction rates than manual methods, however, and the cost of the machine was relatively low.<sup>133</sup> Few Ghanaian producers were enticed to buy the machines in the 1930s, but by 1938 Nigerians had bought at least 834 presses.<sup>134</sup> Men who bought presses tried to buy fruit, but, like the experimental mills, found their neighbors willing to sell only near the price of oil and kernels. Instead, most presses operated as custom mills. By 1937 the fee was 7d. per tin of oil, which was a significant portion of the sale price (at least thirteen percent of the export price).<sup>135</sup> By 1946, the fee was down to 2d. per tin. In the immediate post-war years, officials reported that demand for presses in Nigeria “[exceeded] the number available,” despite relatively high machinery prices.<sup>136</sup> The Nigerian agricultural department promoted tree replanting schemes alongside the sale of presses, boosting yields per tree to a level where producers might see the benefits of a machine. By 1953, more than 9,000 presses had been sold, and by March 1964, at least 17,644 were in service in eastern Nigeria alone.<sup>137</sup>

Ghanaian farmers were slower to adopt the presses than Nigerians. Palm oil producers were keenly aware that their product was, as a colonial official put it, “one of a whole tribe” of competing oils and fats in the global marketplace.<sup>138</sup> Even the fast-growing domestic market was vulnerable to unpredictable shifts. While I was unable to locate comparable records on palm oil producers, a 1947 study found that Ghanaian coconut oil producers “were willing to try an experiment [with machines] but not one that involved the expenditure they envisaged. They felt that the industry was only temporary; imported linseed oil might arrive on the market any day.”<sup>139</sup> Konor Azu Mate Kole, who called for “some simple press” for palm oil producers as well as power-driven mills in his 1945 ten-year plan for Many Krobo, asked for tariff protection to support mechanization. “It seems so silly that we should produce palm-nuts in the Gold Coast, send it all the way to the United Kingdom for refinery only to be brought back to us in bottles for consumption in the Gold Coast,” he remarked.<sup>140</sup>

The Gold Coast Agriculture Department could not dictate imperial trade policy to protect oil producers, but it continued to encourage the adoption of hand-powered machines to serve the domestic market. In 1956 the department produced an illustrated, dual-language handbook titled “Mensah the Oil Palm Farmer.”<sup>141</sup> The book documented Mensah and his household’s journey from “traditional” production to mechanization, emphasizing the ways in which the Duchscher press (Figure 3) and a kernel cracker would improve the quality and quantity of the household’s palm produce. The booklet sheds no light on how Mensah could afford the machines, but it highlights other factors that were becoming vital for success in the domestic and export palm oil businesses: proximity to markets and high-yielding tree varieties that maximized returns from land and harvesting labor.

After independence, Ghanaian farmers were still reluctant to invest in machines: two brothers identified by the *Ghana Farmer* as oil palm pioneers planted a significant acreage with trees and hired wage labor to harvest them, but they sold all their fruit in the marketplace to small producers instead of processing it with machines.<sup>142</sup> Ghanaian farmers did eventually begin to use presses on a wider scale.<sup>143</sup> Nkrumah’s government paid little attention to small-scale machines, however, focusing on large oil mills and refineries, along with plantations. These state-owned enterprises struggled to meet domestic demand, much less serve export markets. Ghana became a net importer of edible fat in the 1960s.<sup>144</sup> Today, small-scale producers rely on a mix of hand- and power-driven machines owned by local entrepreneurs or cooperatives. They supply much of Ghana’s domestic needs for edible palm oil, thanks in part to local preferences for more flavorful, less-refined oil from *dura* palm varieties, rather than the *tenera* varieties favored by plantations.<sup>145</sup>

## Conclusion

The Duchscher press bought by farmers in 1952 was not radically different from the screw-press imported by Benson to Liberia in 1852.<sup>146</sup> Why had it taken so long to adopt such a tool, which significantly increased the amount of oil one could extract from oil palm fruit? Surveying various explanations for the path of agricultural mechanization in West Africa, Austen and Headrick concluded that “many more technological changes may have been possible than actually took place, but because of various mutually-reinforcing material, social, and cultural factors, African technological conservatism was overdetermined and therefore hard to overcome when deliberate attempts were made to introduce more modern technologies into Africa.”<sup>147</sup> Some colonial officials blamed the pace of technological



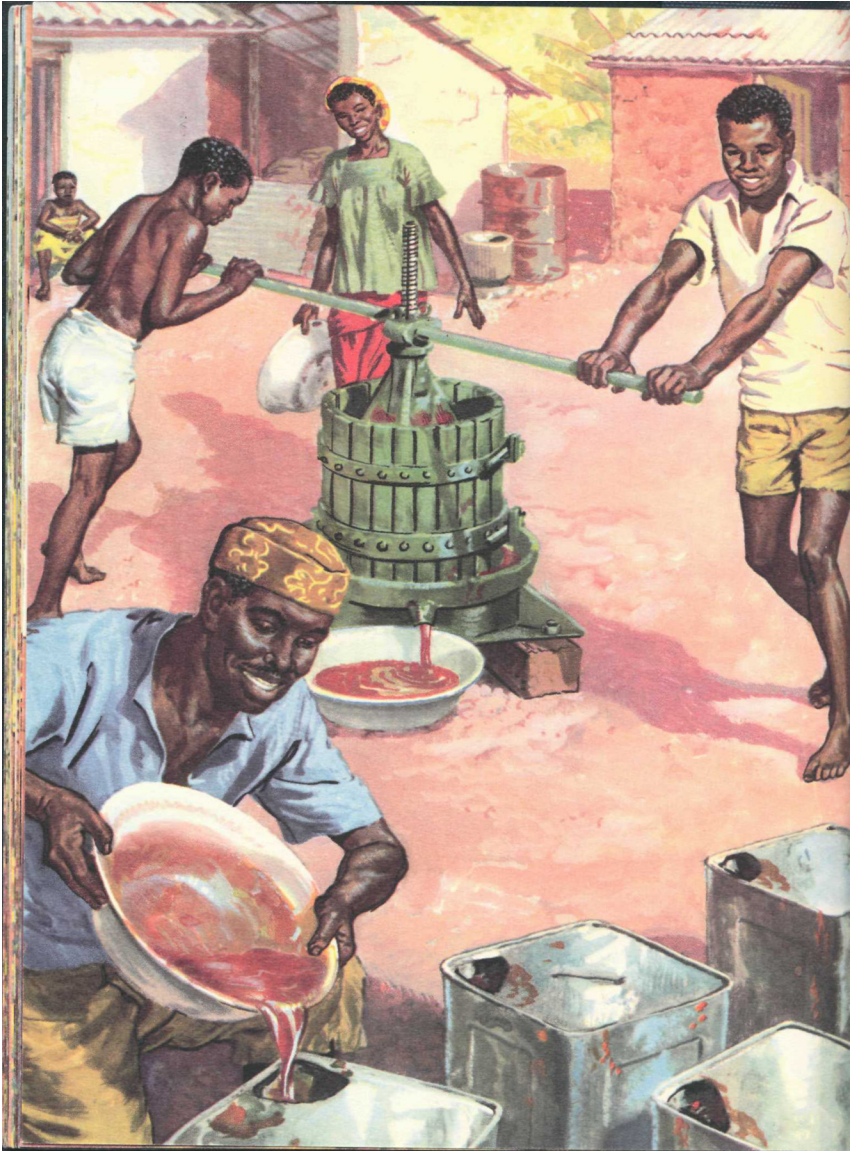


Figure 3. Depiction of a Duchscher palm oil press in use. Gold Coast Agricultural Development Corporation, *Mensah the Oil Palm Farmer* (Accra, 1956), 24.

change on “mere negative conservatism and irrationality” among African farmers, highlighting the role of culture.<sup>148</sup> Yet other observers readily acknowledged that “traditional” methods made efficient use of resources, reflecting material realities.

There is no evidence supporting the notion that a sudden cultural shift occurred in the 1940s or 1950s that made West Africans receptive to palm oil presses. Nor were export prices particularly attractive, especially in Nigeria, where the palm oil Marketing Board artificially held down producer prices.<sup>149</sup> Rather, machine adoption should be seen as part and parcel of domestic market expansion, improved transportation, and population growth. Fast-growing markets created new opportunities for labor (male and female), while growing populations increased pressure on land resources and encouraged producers to get more value out of their oil palms.<sup>150</sup> In Ghana, the fragmentation of the oil palm belt likely contributed to mechanization. Farmers with limited access to trees found it worthwhile to sell fruit instead of manufacturing small amounts of oil themselves.<sup>151</sup>

In conditions prevailing before 1950, there was no point between the large plantation-mill complex and the household producer at which mechanization made sense. The much-highlighted resistance of women to machines reflected cultural notions of gendered labor, but it was premised on practical economic issues. To take one example from Ghana, anthropologist Margaret Field reported in the 1930s that Krobo women cracked palm kernels by hand, but then paid a miller to grind the nuts for oil-making. It is difficult to believe that these women would have refused to patronize a kernel cracking machine on cultural grounds, had it been an economically viable proposition.<sup>152</sup>

While there is still much to learn about the social and economic transformations of the second half of the twentieth century in West Africa, research across that period has confirmed that culture is no impediment to mechanization. In the 1950s and 1960s, researchers working in Nigeria found that many palm oil producers lacked access to enough trees to sustain the kind of throughput which might justify an investment in a machine.<sup>153</sup> Where labor markets were underdeveloped and women's labor was unwaged, manual oil production and kernel cracking remained competitive with small-scale machine methods, though not with larger plantation-scale mills.<sup>154</sup> Mbanefoh found that Nigerian women working in labor-scarce areas often wanted machinery to make palm oil and kernels but simply could not afford it.<sup>155</sup> Adjei's recent study of Ghanaian palm oil producers showed how, given a sizeable local market, affordable machines, and access to capital, women were able to cooperatively acquire tools and machines, hire



male press-operators, and successfully market their oil in urban centers, even exporting significant amounts.<sup>156</sup>

Researchers have continued to develop oil-making machines for African smallholders with little regard for the long history of mechanization, assuming that in the colonial period machines were not used simply because “farm labour was cheap and easily available.”<sup>157</sup> Recent trends suggest that these smallholder-focused efforts are unlikely to fare better than the experiments of the past century. Commercial oil palm plantations have been expanding in West Africa since the 1980s, selling oil in domestic and export markets. While smallholders continue to produce oil manually and with small machines across the region, plantations have forged ties with smallholders through “outgrower” agreements, in which farmers plant and harvest oil palms and deliver fruit to a central mill.<sup>158</sup> This model is practically identical to the unsuccessful mill experiments in Sierra Leone and Ghana in the 1920s and 1930s. Much has changed in the intervening decades, however: cheaper transport increases the prices that can be paid to producers; new tree varieties are more productive and easier to harvest; and most importantly, global prices for palm oil are strong compared to alternative crops.

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## Notes

1. Report of J. B. Esuman-Gwira, 16 May 1909, Public Records and Archives Administration of Ghana, Accra (PRAAD-Accra hereafter): ADM 11/1/223.

2. For an overview of the Gold Coast palm oil trade, see James Sanders, “Palm Oil Production on the Gold Coast in the Aftermath of the Slave Trade: A Case Study of the Fante,” *The International Journal of African Historical Studies* 15, no. 1 (1982): 49; Seth La-Anyane, *Ghana Agriculture: Its Economic Development from Early Times to the Middle of the Twentieth Century* (London: Oxford University Press, 1963).

3. See Lisa Rosner, “Introduction,” in *The Technological Fix: How People Use Technology to Create and Solve Problems*, ed. Lisa Rosner (New York and Abingdon: Routledge, 2004), 1–12.

4. Much of the palm oil literature has focused on Nigeria, the largest exporter of palm oil until the mid-twentieth century. For an overview, see Basil Nnanna Ukegbu, “Production in the Nigerian Oil Palm Industry, 1900–1954” (PhD diss., University of London, 1974); Eno J. Usoro, *The Nigerian Oil Palm Industry: Government Policy and Export Production, 1906–1965* (Ibadan: Ibadan University Press, 1974); S. O. Aghalino, “British Colonial Policies and the Oil Palm Industry in the Niger Delta Region of Nigeria, 1900–1960,” *African Study Monographs* 21, no. 1 (2000): 19–33.

5. Daniel R. Headrick, *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century* (New York: Oxford University Press, 1981), 4.

6. Daniel R. Headrick, *The Tentacles of Progress: Technology Transfer in the Age of Imperialism, 1850–1940* (New York: Oxford University Press, 1988), 16.

7. The history of palm oil machinery has not been well documented, but see descriptions of machines and processing methods in Martin Kaniki, “Economical Technology against Technical Efficiency in the Oil Palm Industry of West Africa,” *Development and Change* 11, no. 2 (1980): 273–84; C. Barlow, *Oil Palm as a Smallholder Crop*, PORIM Occasional Paper 21 (Kuala Lumpur: PORIM, 1986); C. Ossei-Amponsah et al., “Processing Practices of Small-Scale Palm Oil Producers in the Kwaebibirem District, Ghana: A Diagnostic Study,” *NJAS–Wageningen Journal of Life Sciences* 60 (2012): 49–56; Malcolm Purvis, “New Sources of Growth in a Stagnant Smallholder Economy in Nigeria: The Oil Palm Rehabilitation Scheme,” in *Growth and Development of the Nigerian Economy*, ed. Carl Eicher and Carl Liedholm (Lansing: Michigan State University Press, 1970), 267–81; African Training and Research Centre for Women, *Traditional Palm Oil Processing: Women’s Role and the Application of Appropriate Technology* (Addis Ababa: United Nations, African Training and Research Centre for Women, 1983); Nkechi Mbanefoh, *Adoption of Sustainable Palm Oil Mini-Processing Technology in Nigeria* (Nairobi: African Technology Policy Studies Network, 2001); Kwasi Poku, *Small-Scale Palm Oil Processing in Africa*, FAO Agricultural Services Bulletin 148 (Rome: FAO, 2002).

8. The standard reference work on the biology and natural history of the oil palm is R. H. V. Corley and P. B. Tinker, *The Oil Palm*, 5th ed. (Chichester: Wiley Blackwell, 2015).

9. A. C. Zeven, *The Semi-Wild Oil Palm and Its Industry in Africa*, (Wageningen: Centre for Agricultural Publications and Documents, 1967); Jean Maley and Alex Chepstow-Lusty, “*Elaeis Guineensis* Jacq. (Oil Palm) Fluctuations in Central Africa during the Late Holocene: Climate or Human Driving Forces for This Pioneering Species?” *Vegetation History and Archaeobotany* 10, no. 2 (2001): 117–20.

10. Ralph A. Austen, “The Abolition of the Overseas Slave Trade: A Distorted Theme in West African History,” *Journal of the Historical Society of Nigeria* 5, no. 2 (1970): 269.

11. Donna J. E. Maier, “Precolonial Palm Oil Production and Gender Division of Labor in Nineteenth-Century Gold Coast and Togoland,” *African Economic History* 37, no. 1 (2009): 7–8; Patrick Manning, *Slavery, Colonialism and Economic Growth in Dahomey, 1640–1960* (Cambridge: Cambridge University Press, 1982); Louis E. Wilson, “The ‘Bloodless Conquest’ in Southeastern Ghana: The Huza and Territorial Expansion of the Krobo in the 19th Century,” *The International Journal of African Historical Studies* 23, no. 2 (1990): 269; for contemporary testimony see Committee on Edible and Oil-Producing Nuts and Seeds, *Minutes of Evidence*, Cd. 8248 (London: HMSO, 1916), 33, 193. Mr. Birstwistle asserted that 90% of trees were wild, while Mr. Trevor insisted there was “never” a wild tree.

12. Ukegbu asserts that the earliest oil producers harvested fallen fruit from the base of trees, making it entirely a women’s industry, at least in Nigeria. Ukegbu,

“Nigerian Palm Oil Industry,” chap. 1. For descriptions of production processes see Maier, “Precolonial Palm Oil;” Robin Law, “Trade and Gender in Yorubaland and Dahomey,” in *From Slave Trade to “Legitimate” Commerce: The Commercial Transition in Nineteenth-Century West Africa* (Cambridge: Cambridge University Press, 2002), 195–214; Susan M. Martin, *Palm Oil and Protest: An Economic History of the Ngwa Region, South-Eastern Nigeria, 1800–1980* (Cambridge: Cambridge University Press, 1988), 25, 31–33; Anne Martin, *The Oil Palm Economy of the Ibibio Farmer* (Ibadan: Ibadan University Press, 1956); compare with accounts from French colonies in Jean Daniel, *Le palmier à huile au Dahomey* (Paris: Challamel, 1902); Paul Hubert, *Le palmier à huile* (Paris: H. Dunod et E. Pinat, 1911).

13. David Eltis, “The Slave Trade and Commercial Agriculture in an African Context,” in *Commercial Agriculture, the Slave Trade and Slavery in Atlantic Africa*, ed. Robin Law, Suzanne Schwarz, and Silke Strickrodt (Woodbridge: James Currey, 2013), 43; N. H. Stilliard, “The Rise and Development of Legitimate Trade in Palm Oil” (MA thesis, University of Birmingham, 1938), chap. 1; Martin Lynn, *Commerce and Economic Change in West Africa: The Palm Oil Trade in the Nineteenth Century* (Cambridge: Cambridge University Press, 2002).

14. Auguste Chevalier, *Documents sur le palmier à huile* (Paris: A. Challamel, 1910), 15; Lynn, *Commerce and Economic Change*, 124–25. Hopkins argues that kernel exports rose in response to declining palm oil prices from the 1850s onward, but noted that the kernel trade remains under-researched (*Economic History of West Africa* [New York: Columbia University Press, 1973], 139). Identifying references to palm kernels is frustrating, due to a tendency in historical sources to use “palm nuts” to refer to the fruit as well as the kernel, often in an ambiguous way. French sources pose a similar challenge (though *palmiste* gradually won out to describe the kernel over *noix* and similar terms).

15. Different ratios of pericarp to kernel in local varieties of oil palm explain, in part, why some areas exported only kernels. Lynn, *Commerce and Economic Change*, 124–25.

16. Hopkins, *Economic History*, 139.

17. Lynn, *Commerce and Economic Change*, 171–90.

18. P. D. Curtin, *The Image of Africa: British Ideas and Action* (London: Macmillan, 1964); Helen Tilley, *Africa as a Living Laboratory: Empire, Development, and the Problem of Scientific Knowledge, 1870–1950* (Chicago: University of Chicago Press, 2011).

19. W. F. Hutchinson, “Report of the Commission on Economic Agriculture in the Gold Coast,” 1889, PRAAD-Accra: ADM 5/3/7, 24–25.

20. James Fairhead and Melissa Leach, *Reframing Deforestation: Global Analyses and Local Realities: Studies in West Africa* (London: Routledge, 1998), chap. 4; E. A. Gyasi, “Emergence of a New Oil Palm Belt in Ghana,” *Tijdschrift Voor Economische En Sociale Geografie* 83, no. 1 (1992): 39–49.

21. *Maryland Colonization Journal*, new series, vol. 1, no. 11 (1842), 165.

22. W. F. Hutchinson, “Report of the Commission on Economic Agriculture in the Gold Coast,” 1889, PRAAD-Accra: ADM 5/3/7, 149–150.

23. Report by Mr. Brew, 15 September 1910, PRAAD-Accra: ADM 11/1/821.

24. Reprinted in the American Colonization Society, *African Repository*, vol. 29 (1853), 347–348.

25. For a review of the VFS model and its applicability to West Africa, see Gareth Austin, “Explaining and Evaluating the Cash Crop Revolution in the ‘Peasant’ Colonies of Tropical Africa, ca. 1890–ca. 1930: Beyond ‘Vent for Surplus,’” in *Africa’s Development in Historical Perspective*, ed. Emmanuel Kwaku Akyeampong et al. (New York: Cambridge University Press, 2014), 295–230; the classic statement of VFS for West African history can be found in Hopkins, *Economic History*, 231–36.

26. Lynn, *Commerce and Economic Change*, 49; G. I. Jones, *From Slaves to Palm Oil: Slave Trade and Palm Oil Trade in the Bight of Biafra* (Cambridge: African Studies Centre, 1989), 48–49.

27. Jones, *Slaves to Palm Oil*. In southern Ghana, puncheons of hard oil were rolled along roads, a challenging prospect if the fat had been liquid. Olasiji Oshin, “Extending Lagos Commerical Frontiers: The Background to the Nigerian Railway Revisited, 1880–1896,” *Transafrican Journal of History* 18 (1989): 110.

28. Susan Martin, “Gender and Innovation: Farming, Cooking and Palm Processing in the Ngwa Region, South-Eastern Nigeria, 1900–1930,” *The Journal of African History* 25, no. 4 (1984): 422.

29. Kristin Mann, *Slavery and the Birth of an African City: Lagos, 1760–1900* (Bloomington: Indiana University Press, 2007), 140; but see Robin Law’s counter-example in “Trade and Gender in Yorubaland and Dahomey,” 205.

30. Elisee Soumonni, “Slave and Palm Oil Trades in Dahomey, 1818–1858,” in *From Slave Trade to “Legitimate” Commerce: The Commercial Transition in Nineteenth-Century West Africa*, ed. Robin Law (Cambridge: Cambridge University Press, 2002), 83.

31. Kenneth Onwuka Dike, *Trade and Politics in the Niger Delta: 1830–1885* (Oxford: Oxford University Press, 1956); Edward Reynolds, *Trade and Economic Change on the Gold Coast, 1807–1874* (London: Longman, 1974); Emmanuel Akyeampong, “Commerce, Credit, and Mobility in Late Nineteenth-Century Gold Coast: Changing Dynamics in Euro-African Trade,” in *Africa’s Development in Historical Perspective*, 231–63.

32. Wilson, “Bloodless Conquest;” Inez Sutton, “Labour in Commercial Agriculture in Ghana in the Late Nineteenth and Early Twentieth Centuries,” *Journal of African History* 24 (1983): 461–83; Sanders, “Palm Oil Production,” 62–63.

33. Jones, *Slaves to Palm Oil*; Lynn, *Commerce and Economic Change*; Robin Law, *From Slave Trade to “Legitimate” Commerce*, 199; Manning, *Dahomey*, 53–54.

34. Sarbah to Secretary for Native Affairs, 22 January 1909, PRAAD-Accra: ADM 11/1/24. See also report by A. E. Evans, c. 1908, PRAAD-Accra: ADM 11/1/1144.

35. Daron Acemoglu and James A. Robinson, “Why Is Africa Poor?,” *Economic History of Developing Regions* 25, no. 1 (2010): 23; see also Ralph A. Austen, *African Economic History: Internal Development and External Dependency* (Portsmouth, NH: Heinemann, 1987).

36. Paul E. Lovejoy, *Transformations in Slavery: A History of Slavery in Africa* (Cambridge: Cambridge University Press, 2000), 177; see also Robin Law, "The Politics of Commercial Transition: Factional Conflict in Dahomey in the Context of the Ending of the Atlantic Slave Trade," *The Journal of African History* 38, no. 2 (1997): 222; Manning, *Dahomey*, 54. Large pits for crushing fruit required more labor, but groups like the Krobo resorted to communal labor gangs, paid with feasting and alcohol, to deal with the increased throughput. See description in Willie N. Tekper, "Oil Palm Industry in Krobo," *Ghana Farmer* 2, no. 3 (1958). Akurang-Parry cautions, however, that little is actually known about precolonial communal labor in Ghana. "Colonial Forced Labor Policies for Road-Building in Southern Ghana and International Anti-Forced Labor Pressures, 1900–1940," *African Economic History* 28 (2000): 7.

37. A. G. Hopkins, "Britain's First Development Plan for Africa," in *From Slave Trade to "Legitimate" Commerce*, 255.

38. Susan M. Martin, "Slaves, Igbo Women, and Palm Oil," in *From Slave Trade to "Legitimate" Commerce*, 186.

39. Ray A. Kea, "Plantations and Labour in the South-East Gold Coast from the Late Eighteenth to the Mid Ninetenth Century," in *From Slave Trade to "Legitimate" Commerce*, 119–43.

40. Kristin Mann, "Owners, Slaves, and the Struggle for Labour in the Commercial Transition at Lagos," in *From Slave Trade to "Legitimate" Commerce*, 149.

41. Hopkins, *Economic History*, 139.

42. For descriptions of the extent of oil palms in precolonial and early colonial forests in Ghana, see Fairhead and Leach, *Reframing Deforestation*, chap. 4.

43. Report on the 1911 Census, PRAAD-Accra: ADM 5/2/3.

44. For railroads, see Stanley L. Engerman, Isais N. Chaves, and James A. Robinson, "Re-Inventing the Wheel: The Economic Benefits of Wheeled Transportation in Early Colonial British West Africa," in *Africa's Development in Historical Perspective*, 321–65. For truck transport, see Simon Heap, "The Development of Motor Transport in the Gold Coast, 1900–39," *Journal of Transport History* 11, no. 2 (September 1990): 19–37; Jennifer Hart, *Ghana on the Go: African Mobility in the Age of Motor Transportation* (Bloomington: Indiana University Press, 2016).

45. Jones, *Slaves to Palm Oil*, 54.

46. "Investigations in Connection with the African Palm Oil Industry," *Bulletin of the Imperial Institute* VII, no. 4 (1909): 384; R. G. Saylor, *A Study of Obstacles to Investment in Oil Palm and Rubber Plantations* (East Lansing: Consortium for the Study of Nigerian Rural Development, Michigan State University, 1968), 3.

47. "African Palm Oil," 384.

48. Advertisement, *Gold Coast Times*, 8 February 1884. No other makers of presses or crackers were apparent in a search of relevant West African papers in the Readex *African Newspapers Series 1–2* (1800–1925) database.

49. Francine Shields, "Palm Oil and Power: Women in an Era of Economic and Social Transition in 19th Century Yorubaland" (PhD diss., University of Stirling, 1997), 88–89.

50. Tudhope to [illegible], 15 January 1925, PRAAD-Accra: ADM 36/1/11.

51. Allan McPhee, *The Economic Revolution in British West Africa* (New York: Negro Universities Press, 1970), 36.

52. Evidence of Mr. Cowan, Committee on Edible and Oil-Producing Nuts and Seeds, *Minutes of Evidence*, 1970–71.

53. Testimony of C. C. Knowles, Committee on Edible and Oil-Producing Nuts and Seeds, 95.

54. George Douglas Hazzledine, *The White Man in Nigeria* (New York: Negro Universities Press, 1969), 118.

55. In places as far-flung as Mexico, Nigeria, and India, writers told apocryphal stories of workers filling new wheelbarrows, only to carry the entire load on their heads. For Mexico, see J. H. Kellogg, “Pictures in Mexico,” *The Medical Missionary* 4, no. 10 (1894): 289–92; for India, L. P. Jacks, “The Degradation of Policy,” *The Atlantic Monthly* 124 (1919): 298–309; for Nigeria, Hazzledine, *White Man in Nigeria*. The oldest example I have located is Captain Bellew, “Memoirs of a Griffin,” *The Asiatic Journal* 37 (1842): 50.

56. Quoted in Harry Clyde Billows and Harold Beckwith, *Palm Oil and Kernels. “The Consols of the West Coast.” An Exposition of the Palm Oil Industry* (Liverpool, 1913), 7.

57. Sarbah was Esuman-Gwira’s brother-in-law as well as his patron.

58. For a comprehensive overview of the main cocoa-producing region, see Gareth Austin, *Labour, Land, and Capital in Ghana: From Slavery to Free Labour in Asante, 1807–1956* (Rochester, NY: University of Rochester Press, 2005); see also Corey Ross, “The Plantation Paradigm: Colonial Agronomy, African Farmers, and the Global Cocoa Boom, 1870s–1940s,” *Journal of Global History* 9, no. 1 (2014), 49–71.

59. Jonathan E. Robins, “Imbibing the Lesson of Defiance: Oil Palms and Alcohol in Colonial Ghana,” *Environmental History*, 23, no. 2 (2018), 293–317.

60. By the 1920s, the Director of Agriculture recommended that new forest clearing for cocoa be halted immediately: “already the danger of extensive clearings are becoming apparent in a reduced humidity affecting the health of the cocoa trees.” Tudhope, “The Development of Oil Palm Products by Communal or Co-Operative Power-driven Factories,” trade supplement to the *Gold Coast Gazette*, 1922, PRAAD-Accra: ADM 6/142. See also Joseph Morgan Hodge, “Colonial Foresters versus Agriculturalists: The Debate over Climate Change and Cocoa Production in the Gold Coast,” *Agricultural History* 83, no. 2 (2009): 201–20.

61. Evidence of Mr. Smart, Committee on Edible and Oil-Producing Nuts and Seeds, *Minutes of Evidence*, 3342.

62. For a discussion of the Gold Coast commercial class, see “Commerce, Credit, and Mobility,” Raymond E. Dumett, “African Merchants of the Gold Coast, 1860–1905: Dynamics of Indigenous Entrepreneurship,” *Comparative Studies in Society and History* 25, no. 4 (1983): 661–93; Roger Gocking, *Facing Two Ways: Ghana’s Coastal Communities Under Colonial Rule* (Lanham, Maryland: University Press of America, 1999).



63. Sarbah, "The Oil Palm and Its Uses," *Journal of the Royal African Society* 8 (1909): 232–50.

64. Sarbah, "Oil Palm," 243; other inventors also highlighted the fact that their inventions kept "dirty hands" out of the palm oil process. See testimony of Mr. Trevor, Committee on Edible and Oil-Producing Nuts and Seeds, *Minutes of Evidence*, 192.

65. Sarbah to SNA, 28 November 1908, PRAAD-Accra: ADM 11/1/223.

66. Sarbah, "Oil Palm," 250; for a comparative overview of "industrial education" in America and Africa see Donald Spivey, *Schooling for the New Slavery: Black Industrial Education, 1868–1915* (Westport: Greenwood Press, 1978).

67. Sarbah to SNA, 22 January 1909, PRAAD-Accra: ADM 11/1/24; *Gold Coast Leader*, 25 March 1911, 2.

68. Sarbah to SNA, 28 November 1908, PRAAD-Accra: ADM 11/1/223.

69. "African Palm Oil."

70. Department of Commerce and Labor, *Monthly Consular and Trade Reports*, No. 354 (Washington, DC: GPO, 1910), 106; George W. Ellis, "Political and Economic Factors in Liberian Development," *Journal of Race Development* 6, no. 1 (1915): 65–90.

71. Samuel Charles Phillips, An Improved Machine for Extracting Palm Oil from the Chaff of Palm Nuts. Great Britain patent 9733, filed 26 April 1907, and issued 27 June 1907; Thomas King Ekundayo Phillips, "Improvements in Palm Oil Extracting Machines. Great Britain patent 18,370, applied 9 August 1912 and issued 12 June 1913.

72. J. B. Esuman-Gwira, Improved Apparatus for Extracting Oil from Palm and other nuts. Great Britain patent 3357, applied 11 February 1909, and issued 10 February 1910.

73. Zeven, *Semi-Wild Oil Palm*, 91–92; see also L. Mbuagbaw and S. G. Noor-duyn, "The Palm Wine Trade: Occupational and Health Hazards," *International Journal of Occupational and Environmental Medicine* 3, no. 4 (2012).

74. Zeven, *Semi-Wild Oil Palm*, 93; Committee on Edible and Oil-Producing Nuts and Seeds, *Minutes of Evidence*, 5629. The 20–30 percent figure is based on Forde's pre-war research in Nigeria and does not include drying and cracking kernels. Forde estimated 1–1.5 days for harvesting, 1 day for stripping bunches, 1–2 days for pulping and cooking, and a half day to collect fuel and water. Daryll Forde, "The Rural Economies," in *The Native Economies of Nigeria*, ed. Margery Perham (London: Faber and Faber, 1946), 51.

75. Martin, "Plantations and Labour," 186.

76. Based on figures for dura palms in "African Palm Oil," La-Anyane, *Ghana Agriculture*, 201; and ADM 11/1/223, PRAAD-Accra. Prices from Ewout Frankema and Marlous Van Waijenburg, "Wages, Prices and Welfare Ratios in Colonial Africa, 1880–1965," 2011, <http://www.iisg.nl/hpw/data.php>.

77. For palm oil price series, see Martin, *Palm Oil and Protest*; La-Anyane, *Ghana Agriculture*.



78. Kwabena Opare Akurang-Parry, "'The Loads Are Heavier than Usual': Forced Labor by Women and Children in the Central Province, Gold Coast (Colonial Ghana), CA. 1900–1940," *African Economic History* 30 (2002): 31–51; Beverly Grier, "Pawns, Porters, and Petty Traders: Women in the Transition to Cash Crop Agriculture in Colonial Ghana," *Signs* 17, no. 2 (1992): 304–28.

79. Raymond E. Dumett and Marion Johnson, "Britain and the Suppression of Slavery in the Gold Coast Colony, Ashanti, and the Northern Territories," in *The End of Slavery in Africa*, ed. S. Miers and R. Roberts (Madison, WI: University of Wisconsin Press, 1988), 80–81; Trevor R. Getz, *Slavery and Reform in West Africa: Toward Emancipation in Nineteenth-Century Senegal and the Gold Coast* (Athens, OH: Ohio University Press, 2004), 38–41; Kwabena Opare Akurang-Parry, "'Missy Queen in Her Palaver Says de Golfe Cosse Slaves Is Free': The British Abolition of Slavery/Pawnship and Colonial Labor Recruitment in the Gold Coast 1874–c. 1940" (York University, 1999), 118–20.

80. Getz, *Slavery and Reform*, chap. 6; Grier, "Pawns, Porters, and Petty Traders."

81. Sutton, "Commerical Agriculture," 480–81; Austin, *Labour, Land, and Capital*, 247–48.

82. Akurang-Parry, "Colonial Forced Labor."

83. Usoro, *Nigerian Oil Palm Industry*, 93.

84. Committee on Edible and Oil-Producing Nuts and Seeds, *Minutes of Evidence*, 2080.

85. In Ghana, crushing fruit was often performed by men or by men and women together, meaning that machines like Eusman-Gwira's augmented, rather than replaced, male labor. Mr. Trevor, who operated a small power mill across the border in Ivory Coast, insisted that he had never seen women or children crushing fruit in the Gold Coast; he considered it a more laborious task than climbing trees. Committee on Edible and Oil-Producing Nuts and Seeds, 3400–3404.

86. Laura Ann Twagira, "Robot Farmers' and Cosmopolitan Workers: Technological Masculinity and Agricultural Development in the French Soudan (Mali), 1945–68," *Gender & History* 26, no. 3 (2014): 469.

87. The literature on gender and economic history in West Africa is substantial. For issues related to oil palms, see Shields, "Palm Oil and Power;" Maier, "Precolonial Palm Oil;" Gloria Chuku, *Igbo Women and Economic Transformation in Southeastern Nigeria, 1900–1960* (London: Routledge, 2005); Marjorie Keniston McIntosh, *Yoruba Women, Work, and Social Change* (Bloomington: Indiana University Press, 2009); Chima J. Korie, "The Invisible Farmer? Women, Gender, and Colonial Agricultural Policy in the Igbo Region of Nigeria, c. 1913–1954," *African Economic History*, no. 29 (2001): 117–62. For a broader discussion of gender dynamics in colonial and post-colonial West African economies, see Judith A. Byfield, *The Bluest Hands: A Social and Economic History of Women Dyers in Abeokuta (Nigeria), 1890–1940* (Portsmouth, NH: Heinemann, 2002); Emily Lynn Osborn, *Our New Husbands Are Here: Households, Gender, and Politics in a West African State from the Slave Trade to Colonial Rule* (Athens, OH: Ohio University Press, 2011).

88. A. C. Barnes, *Mechanical Processes for the Extraction of Oil* (Lagos: Government Printer, 1925), 67.

89. *Proceedings of the First West African Agricultural Conference* (Ibadan: Government Printer, 1927), 45.

90. Committee on Edible and Oil-Producing Nuts and Seeds, *Minutes of Evidence*, 30.

91. Agricultural Department Report for 1916, PRAAD-Accra: ADM 5/1/73. See also Martin, *Palm Oil and Protest*, 64.

92. The Esuman-Gwira machine made 2.6 to 3.3 imperial gallons per man/woman-day, compared to 1.12 to 1.7 gallons/woman-day for manual methods. William L. Miller, "An Economic Analysis of Oil Palm Fruit Processing in Eastern Nigeria" (PhD diss., Michigan State University, 1965), 38.

93. Agricultural Report for 1936–37, PRAAD-Accra: ADM 5/1/94.

94. Agricultural Department Annual Report, 1922–1923, PRAAD-Accra: ADM 5/1/79; Maier, "Precolonial Palm Oil," 22.

95. "Extract from Mr. Dyke's report on the Nigerian palm oil industry," 1928, The National Archives (TNA hereafter): Colonial Office: CO 583/15514; report originally published in *Nigerian Gazette*, no. 24, 10 May 1928.

96. Committee on Improved and Increased Production of Palm Oil and Palm Kernels in West Africa, *Palm Oil and Palm Kernels. Report of a Committee Appointed by the Secretary of State for the Colonies, September, 1923, to Consider the Best Means of Securing Improved and Increased Production*, Colonial No. 10 (London: H.M. Stationery Office, 1925); see also Ayodeji Olukoju, "The United Kingdom and the Political Economy of the Global Oils and Fats Business during the 1930s," *Journal of Global History* 4, no. 1 (2009): 105–125.

97. "Report by The Hon. W. G. A. Ormsby-Gore, MP, on his visit to West Africa during the year 1926," 106, Cmd 2744, PRAAD-Accra: ADM 5/3/24.

98. K. Dike Nworah, "The Politics of Lever's West African Concessions, 1907–1913," *The International Journal of African Historical Studies* 5, no. 2 (1972): 248–64; Anne Phillips, *The Enigma of Colonialism: British Policy in West Africa* (London: Currey, 1989); D. K. Fieldhouse, *Unilever Overseas: The Anatomy of a Multinational, 1895–1965* (Stanford: Hoover Institution Press, 1978); Ukegbu, "Nigerian Palm Oil Industry," chap. 5; see also Richard H. Grove and Toyin Falola, "Chiefs, Boundaries, and Sacred Woodlands: Early Nationalism and the Defeat of Colonial Conservationism in the Gold Coast and Nigeria, 1870–1916," *African Economic History* 24 (1996): 1–23.

99. Gov. Clifford to Sec State, 21 April 1913, no. 20, Confidential Print—African (West) no 1023. Correspondence relating to Palm Oil Grants in West Africa, 9 Dec 1912–31 March 1915, TNA: Colonial Office: CO 879/115/8.

100. W. S. Tudhope, "The Development of Oil Palm Products by Communal or Co-Operative Power-driven Factories," trade supplement to the *Gold Coast Gazette*, 1922, PRAAD-Accra: ADM 6/142.

101. Ayodeji Olukoju, *The "Liverpool" of West Africa: The Dynamics and Impact of Maritime Trade in Lagos, 1900–1950* (Trenton: Africa World Press, Inc., 2004), 182; Martin, *Palm Oil and Protest*, 65.

102. "Report by The Hon. W. G. A. Ormsby-Gore, MP, on his visit to West Africa during the year 1926," 106, Cmd 2744, PRAAD-Accra: ADM 5/3/24.

103. Gov. Nigeria to Sec. of State for the Colonies, 5 Feb. 1932, TNA: Colonial Office: CO 554/90/5.

104. Slater to Amery, 28 Sept 1925, TNA: Colonial Office: CO 267/631/13.

105. Report, enclosed in Slater to Amery, 28 Sept 1925, TNA: Colonial Office: CO 267/631/13.

106. Dyke's report on the Nigerian palm oil industry, TNA: Colonial Office: CO 583/15514.

107. W. O. G. to Mr. Flood, 18 January 1927, minute, "Palm Oil Industry," TNA: Colonial Office: CO 96/670/4.

108. Correspondence and memorandums, "Sierra Leone Oil Palm Industry, 1927," TNA: Colonial Office: CO 267/619/6; "Report on the Eastern Province of the Gold Coast Colony for 1937–38," 264, Provincial Development Book (Eastern Province), PRAAD-Accra: ADM 29/5/2; Kaniki, "Economic Technology," 276; Agricultural Department report for 1930–31, PRAAD-Accra: ADM 5/1/92; Enclosures and correspondence, 1929, TNA: Colonial Office: CO 96/690/15; Slater to Lord Passfield, 6 Sept. 1929, TNA: CO 96/690/15.

109. The *konor* saw himself as an improving monarch, and had complained to an agricultural inspector as early as 1908 that Krobo farmers were too "illiterate" to improve their "primitive, laborious, and wasteful" systems. Letter from Mate Kole, 21 September 1908, enclosed in A. E. Evans, untitled report, PRAAD-Accra: ADM 11/1/1144. See also correspondence in PRAAD-Accra: Mate Kole papers, SC 17 and ADM 11/1/1144.

110. C. Y. Shephard, *Report on the Economics of Peasant Agriculture in the Gold Coast* (Accra: Government Printing Department, 1936), 78.

111. The Masanki scheme was abandoned in 1941. Agricultural Department report for 1937–38, PRAAD-Accra: ADM 5/1/101; Gov. to Sec. State, 8 October 1940, TNA: CSO 267/675/4.

112. See David Meredith, "Government and the Decline of the Nigerian Oil-Palm Export Industry, 1919–1939," *The Journal of African History* 25, no. 3 (1984): 311–29.

113. Benoît Henriët, "'Elusive Natives': Escaping Colonial Control in the Lever-ville Oil Palm Concession, Belgian Congo, 1923–1941," *Canadian Journal of African Studies* 49, no. 2 (2015): 339–61.

114. Correspondence, 1934–35, TNA: Colonial Office: CO 267/623/4.

115. D. A. Low and J. M. Lonsdale, "Introduction: Towards the New Order 1945–63," in *History of East Africa*, ed. D. A. Low and A. Smith, vol. III (Oxford: Clarendon Press, 1976), 1–63; Frederick Cooper, "Africa and the World Economy," in *Confronting Historical Paradigms: Peasants, Labor, and the Capitalist World System in Africa and Latin America*, ed. Cooper et al. (Madison: University of Wisconsin Press, 1993), 84–201.

116. Colonial Office, *Report of the Mission Appointed to Enquire into the Production and Transport of Vegetable Oils and Oil Seeds Produced in the West African Colonies.*, Colonial No. 211 (London: HMSO, 1947), 8. Anne Martin's 1956 study of

Ibibio farmers was intended to refute this claim, showing that farmers did increase production with appropriate price incentives. Martin, *Oil Palm Economy*.

117. A. Richards to Lord Trenchard, 28 September 1944, TNA: Colonial Office: CO 852/604/1.

118. Minute, G. H. C. Amos, 21 June 1946, "Oils and fats—long term plans for expansion," TNA: Ministry of Food: MAF 83/2195.

119. See Joseph Morgan Hodge, *Triumph of the Expert: Agrarian Doctrines of Development and the Legacies of British Colonialism* (Athens, OH: Ohio University Press, 2007); The 1948 Oilseeds Commission praised the Tanganyika groundnut scheme as a model for the rest of Africa, though its report acknowledged that palm oil posed special challenges. They warned it "would not be morally proper to disturb existing agricultural communities until experimentation has established the lines on which mechanisation could be successfully applied to their farming operations." Great Britain and Colonial Office, *Report of West African Oilseeds Mission*. (London: H.M.S.O., 1948), 5.

120. UAC, "The Future of the Nigerian Oil Industry," September 1944, TNA: Colonial Office: CO 852/604/1.

121. United Africa Company, "The Future of the Nigerian Oil Industry," *African Affairs* 47, no. 186 (1948): 41–51.

122. Ukegbu, "Nigerian Palm Oil Industry," 377–82; Robert L. Tignor, *Capitalism and Nationalism at the End of Empire: State and Business in Decolonizing Egypt, Nigeria, and Kenya, 1945–1963* (Princeton: Princeton University Press, 1998), chap. 6.

123. SM Taylor to Webster, 1 August 1950, TNA: Colonial Office: CO 852/1156/7.

124. The government hoped to avoid a repeat of the 1929 "Women's War" in southeastern Nigeria by preserving women's access to kernels. Report from Nigerian Governor to Stanley, Sec State for Colonies, 3 April 1945, TNA: Colonial Office: CO 852/604/2.

125. Nina Emma Mba, *Nigerian Women Mobilized: Women's Political Activity in Southern Nigeria, 1900–1965* (Berkeley: University of California, Berkeley, Institute of International Studies, 1982), 107–8; see also John Oriji, "Igbo Women, Technological Changes and Protests (1946–1953)," *Moebius* 1, no. 1 (2003): 11–21.

126. Oriji, "Igbo Women," 17; Aghalino, "British Colonial Policies," 28.

127. Extract, "'Proposals for the Expansion of the Department of Commerce and Industries, Nigeria," 1949, TNA: Colonial Office: CO 852/1156/7.

128. Oriji, "Igbo Women," 20.

129. Aghalino, "British Colonial Policies," 29.

130. Toyin Falola, *Economic Reforms and Modernization in Nigeria, 1945–1965* (Kent, OH: Kent State University Press, 2004), 124; see also Allister E. Hinds, "Government Policy and the Nigerian Palm Oil Export Industry, 1939–49," *The Journal of African History* 38, no. 3 (1997): 459–78; Allister Hinds, "Chiefs and the Making of Industrial Policy in Nigeria," in *Agency and Action in Colonial Africa: Essays for John E. Flint*, ed. Chris Youé and Stapleton (Basingstoke: Palgrave, 2001), 141–55.

131. The Stork press did not fare well against its competitors; it could extract more oil from fruit than a screw press but it was large, costly, and required too much maintenance. Miller, "Economic Analysis," 62.

132. Miller, "Economic Analysis," 80–81. Miller used a five-year depreciation schedule for machinery in his efficiency calculations, which strikes this author as unnecessarily pessimistic. For a discussion of machinery lifespans in Africa, see Committee on Edible and Oil-Producing Nuts and Seeds, *Minutes of Evidence*, 33.

133. Miller, "Economic Analysis," 47.

134. Report, Agricultural Investigation Station, Cape Coast, 21 Sept 1936, PRAAD-Accra: ADM 31/1/11.

135. Figures given are based on the 1937 Lagos export price of £13.4/ton (about 4s. 4d. for a tin). Martin, *Palm Oil and Protest*, 65, 146. The farmgate price was lower than the export price, of course.

136. Colonial Office, *Report of the Mission Appointed to Enquire into the Production and Transport of Vegetable Oils and Oil Seeds Produced in the West African Colonies*.

137. See Martin, *Oil Palm Economy*; Martin, *Palm Oil and Protest*, 64–66; for a discussion of population growth and technological adoption, see Ralph A. Austen and Daniel Headrick, "The Role of Technology in the African Past," *African Studies Review* 26, no. 3–4 (September 1983): 171.

138. Minute by J. E. W. Flood, 9 May 1927, TNA: Colonial Office: CO 583/146/9.

139. Report by Mr Ayensu, Asst Registrar of Cooperative Societies, Cape Coast, 7 June 1947, Axim-Nzima Economic Survey, PRAAD-Accra: RG 4/2/159.

140. Azu Mate Kole, "Ten Year Plan for Manya Krobo State," 1945, PRAAD-Accra: CSO 21/22/181. Nothing came of Azu Mate Kole's plan; the palm oil industry continued to decline after Ghanaian independence. Ghana is currently a net importer of palm oil, mostly from southeast Asian plantation producers. In 2010, Ghana exported 11,634 MT of palm oil, and imported 49,740 MT. F. Angelucci, "Analysis of Incentives and Disincentives for Palm Oil in Ghana," *Technical Note Series* (Rome: MAFAP, FAO, 2013), 11. In the 1970s, the government attempted to finance new palm oil mills, but met with little success. ("Inventory of Prospective Technical and Capital Aid Projects," Consultative Group Meeting, Paris, December 15–20 1970. Addendum to Ghana government/IBRD Project List," PRAAD-Accra: RG 4/1/40.)

141. Gold Coast Agricultural Development Corporation, *Mensah the Oil Palm Farmer* (Accra, 1956).

142. O. E. Tagoe, "Kaku and Cudjoe's Oil Palm Farm," *Ghana Farmer* 2, no. 4 (1958): 135–38.

143. Poku, *Small-Scale Palm Oil Processing in Africa*, 36.

144. FAOSTAT database.

145. Small producers account for 60 percent of domestic consumption according to Osei-Amponsah et al., "Processing Practices of Small-Scale Palm Oil Producers in the Kwaebibirem District, Ghana," 80 percent according to Betty Adjei, "The Making of Quality: A Technography Study of Small Scale Palm Oil Processing in Ghana" (University of Wageningen, 2014). I am grateful to Paul Richards for drawing my attention to the issue of taste.

146. The major change was in how the pressing plate worked. Instead of relying on a top bar to hold a traveling screw which pushed the plate downward, the Duchscher press plate moved down a screw fixed to the base of the machine. This design eliminated several parts of traditional presses that were costly and prone to breaking.

147. Austen and Headrick, "Role of Technology," 175.

148. Kaniki, "Economical Technology," 273.

149. Gerald K. Helleiner, "The Fiscal Role of Marketing Boards in Nigerian Economic Development, 1947–1961," in *Growth and Development of the Nigerian Economy*, ed. Carl Eicher and Carl Liedholm (Lansing: Michigan State University Press, 1970), 119–55; Peter Kilby, "The Nigerian Palm Oil Industry," *Food Research Institute Studies* 7, no. 2 (1967): 177–203.

150. Mba argues that women finally accepted the Pioneer Mill model because of the opportunities offered by cassava and trading, which overtook the profits to be had in kernel-cracking. Mba, *Nigerian Women Mobilized*, 113. Floyd argued that in southeastern Nigeria, dependency on household oil palm was in fact a sign of poverty: successful farmers with more land had diversified or moved to the cities. Barry Floyd, *Eastern Nigeria: A Geographical Review* (New York: Praeger, 1969), 191.

151. Gyasi, "Oil Palm Belt."

152. Margaret J. Field, "Many Krobo Land Affairs," 11, 1940–1941, PRAAD-Accra: CSO 21/22/177.

153. Miller, "Economic Analysis," 37–38; Martin, *Oil Palm Economy*; see also Martin, *Palm Oil and Protest*, 139.

154. Miller, "Economic Analysis;" Kilby, "Nigerian Oil Palm Industry;" C. K. Laurent, *Investment in Nigerian Tree Crops: Smallholder Production*, Consortium for the Study of Nigerian Rural Development, CSNRD-18 (Ibadan and East Lansing: NISER/CSNRD, 1968).

155. Mbanefoh, *Adoption of Sustainable Palm Oil Mini-Processing Technology in Nigeria*.

156. Adjei, "Making of Quality."

157. Poku, *Small-Scale Palm Oil Processing in Africa*, sec. 4.2; African Training and Research Centre for Women, *Traditional Palm Oil Processing*; Mbanefoh, *Adoption of Sustainable Palm Oil Mini-Processing Technology in Nigeria*.

158. Cyril Kofie Daddieh, "Contract Farming and Palm Oil Production in Cote d'Ivoire and Ghana," in *Living Under Contract: Contract Farming and Agrarian Transformation in Sub-Saharan Africa* (Madison: University of Wisconsin Press, 1994), 188–215; Paul S. Huddleston, "Contract Farming in Oil Palm: The Case of Ghana and the Philippines" (PhD diss., University of Western Australia, 2006).