RESEARCH

Economic potentials of artisanal food processing microenterprises in West Africa: case of "atta" production in Cotonou (Benin)

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Abstract

Rapid population growth and urbanization in West Africa have led to profound changes in the lifestyles and diets of urban dwellers. These changes are marked by greater preference for healthier and more nutritious foods, easy to prepare and to consume while saving time. Hence, the development of small-scale food processing and catering activities in the cities. However, despite its importance, the urban food industry still faces several constraints, mainly the lack of equipment that would save cooking time and increase the nutritional quality of final products for consumers. Promoting optimum food processing technologies and business processes has therefore become a major concern for research and policy-makers. This study was conducted as part of the ICOWPEA research project aimed at assessing the economic and sales potential of artisanal food processing microenterprises that produce "atta," a cowpea fritter or snack, in the city of Cotonou. A sample of twenty-seven women-headed microenterprises was randomly selected from a list of 125 recorded in 22 streets distributed across 13 districts of the city. They were interviewed using a structured questionnaire. The survey allowed us to assess how they function, their production costs, and financial performance. The surveyed microenterprises belonged to woman artisans, average age 45, who ran their own businesses. Microenterprises allow many young family members to enter the informal job market. While knowledge is mostly transmitted from mother to daughter and based on learning by doing, very simple processing tools are used. Although mechanical milling is used at some stages of cowpea processing, overall, artisanal "atta" production is a low-profitability business with a return rate of only 11.7%. However, it contributes to feeding the family and rewards family labor that accounts for up to 27.6% of total production cost. In addition to creating jobs for low-income female youth, the activity accounts for a remarkable share of the urban food business sector in Cotonou. Technological upgrading and business empowerment are required for these women to become real entrepreneurs and to overcome the key constraints they face, including the lack of access to credit and absence of improved technologies, training and government recognition. In that respect, appropriate policies are needed to take them out of poverty and make

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Benin the emerging economy it aspires to be. In particular, a dedicated investment and business development support scheme is required to better meet the growing domestic urban food demand and, in the near future, to envisage the export of stabilized and safer finished cowpea products.

Keywords: Cowpea, "Atta" snacks, Female artisans, Microenterprises, Women, Food processing, Economic performance, Urban poverty reduction

Introduction

Rapid urbanization and population growth have led to profound changes in the lifestyles and diets of West African populations (Honfoga et al. 2018). Urban food demand has increased in parallel, thereby exerting strong pressure on infrastructure and transport that is already inadequate and in poor condition. The situation is forcing many urban dwellers to turn to outdoor catering (Staatz and Hollinger 2016; Agli et al. 2004). Households are increasingly buying from markets and are turning to more diversified diets, but also to easy-to-cook and highly palatable meals (Allen et al. 2018). These developments, which affect all countries of the sub-region as well as all income groups, have increased the consumption of processed, high value-added foods derived from perishable agricultural products (Reardon 2015; Staatz and Hollinger 2016; Allen and Heinrigs 2016). Hence, the development of small-scale food processing and catering activities, referred to as "street food," "snacks," or "popular restaurants" (Allen et al. 2018, Bendech 2013; FAO 1997), together defined as the "sector producing food and beverages ready for consumption, prepared and/or sold by vendors, especially in the streets and other similar public places" (FAO 1997).

The food economy is the largest employer in the West African region and will continue to offer many opportunities with increasing population and urbanization, and rising incomes. In seven West African countries (Ghana, Burkina Faso, Mali, Nigeria, Niger, Ivory Coast, Senegal), the share of women's employment is on average 51% throughout the economy but significantly higher, reaching 83% in the food processing and 88% in catering sectors (Allen et al. 2018). Food processing is dominated by artisanal food and concerns all food groups including cereals, roots and tubers, legumes, oilseeds, fruits, meat and fish, dairy products, and condiments. In cities, it plays an important role in the daily lives of thousands of people, both as a means of food security and as a source of employment and income (Allen et al. 2018; Broutin and Rouyat 2008, Agli et al. 2004). It helps increase food availability by processing raw farm products, making it possible to reduce postharvest losses and prolong food shelf life (Bricas and Broutin 2008). It also enables a supply of low-cost food and income flows to the urban poor.

The development of the food economy, and more particularly that of small-scale food processing, is quite recent in West Africa. For a long time, food processing was only based on empirical knowledge and know-how, most often in the form of non-mechanized and non-standardized processing by rural households for their own consumption (Trèche et al. 2002). Despite its importance in the urban economy, artisanal food processing still faces several constraints: activities in the sector are not recognized as "real businesses" and are therefore not taken into account in public policies. Family labor accounts for a large proportion of total labor costs in these informal and

unrecognized economic activities, but are not recorded by peasant/small-scale farmers in their farm budgets or operating accounts (Mayer and Glabe 2008), or by the producers of processed foods themselves. More strikingly, the depreciation of equipment used in low-productivity artisanal food processing is simply ignored by woman artisans when they assess the profit of their microenterprises.

The artisanal food sector also faces structural problems, including limited professional structuring, very low investment capacity, and poor food hygiene (Dossou et al. 2017, Bricas and Broutin 2008, Broutin and Rouyat 2008, Agli et al. 2004). Artisanal food processing is mostly informal and plagued by poverty. Targeted policies are required to address these constraints in order to increase the sector's added value to the countries' economy and to bring it into the line with its high contribution to employment.

Here, we investigate artisanal cowpea-processing microenterprises in Cotonou, the capital of Benin, with a focus on the production of "atta", a cowpea fritter, or deep-fried dumpling also called "Akara" in Nigeria or "Koose" in Ghana (Madode et al. 2011). It is one of the most widespread forms of cowpea consumption in West Africa (Robinson et al. 2014; Madode 2012; CESAO-PRN 2009; Doka 2010). It is a traditional snack resembling "Acarajé" in Brazil, but its texture is thinner, and its size is smaller like meatballs. In Cotonou and many urban centers, it is sold to consumers in smaller portions that cost between two and five US dollar cents each.

To date, artisanal cowpea-based products, as well as other processed foods sold in local markets, are ignored in policy debates and studies on the topic are rare in the literature. Yet, it is hypothesized that the production of "atta" and other cowpea-derived products could boost the development of cowpea value chains, as has been the case with other local food crops undergoing artisanal food processing.

Although "atta" production has already been shown to be an important source of income for hundreds of microenterprises run by women in Cotonou, its profitability and overall performance remain to be demonstrated. The aim of this study was thus to assess the economic performance (production cost, added value, and profitability) of these microenterprises and their potential to provide employment and an income for female youth in Benin. From the perspective of becoming an emerging economy to which Benin aspires, we also discuss the capacity of these craftswomen to emerge from a subsistence and poverty reproduction business, in order to capture rapidly evolving urban markets. These markets are characterized by increasing demand for quality food, time-saving meal preparation and consumption, and growing competition from imported manufactured products. Honfoga et al. (2018) pointed out that modern or improved processing technologies are key to generating quality food products and tend to drive urban consumers' preferences for imported/introduced foods over traditional foods.

Methodology
Data collection
The study was conducted in 22 streets, representing 15% of the 144 streets that make up Cotonou city (Fig. 1). This sampling ratio was applied to each of the 13 boroughs in the city to determine the number of streets to be selected. In each borough, the streets were chosen randomly. The unit of observation and analysis is one "atta" production microenterprise.
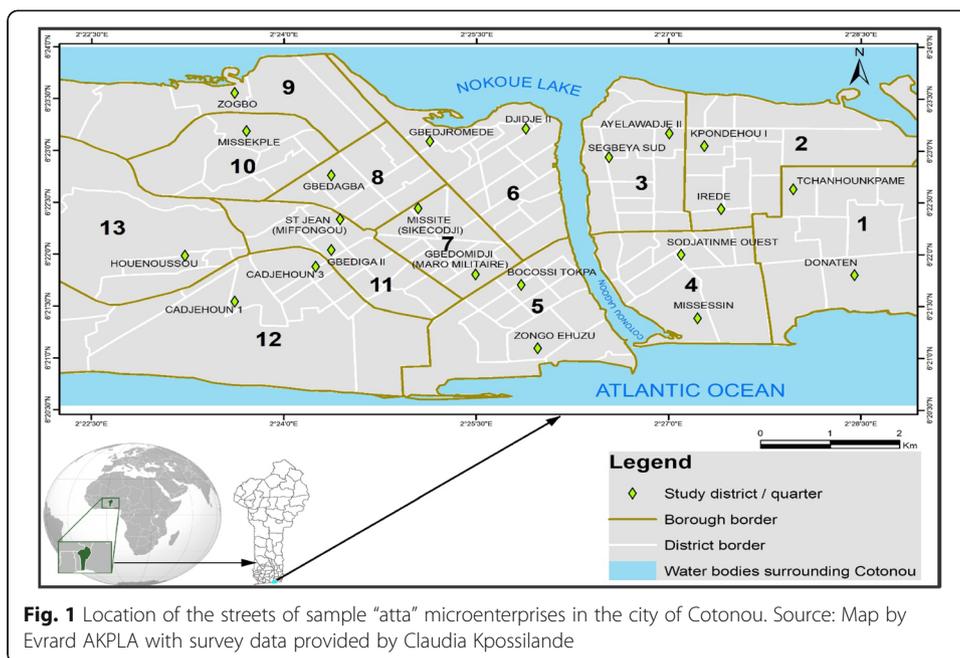
Fig. 1 Location of the streets of sample "atta" microenterprises in the city of Cotonou. Source: Map by Evrard AKPLA with survey data provided by Claudia Kpossilande

Data were collected in two stages between September and December 2017. During the first exploratory stage, all cowpea processing units that produce "atta" in the 22 selected streets were identified. Using semi-structured interview guides, group discussions and interviews were conducted with a few woman artisans and other resource persons. The second stage consisted of an interview using a detailed questionnaire with 27 woman artisans randomly selected from a census list of 125 processing microenterprises. The sampling ratio was therefore 21.6%. Streets with no respondents means no cowpea-processing women were available (Table 1). The data collected include socio-economic characteristics of the leader of the food microenterprise, work organization and supply of raw materials, information on labor use, the cost of raw materials and intermediate inputs, and the sales price of the final product.

Data processing and analysis

Quantitative data collected were entered using Microsoft ACCESS software. They were processed and analyzed using *Minitab* software and the *Statistical Package for the Social Science (SPSS)*. The microenterprises were characterized by computing and interpreting descriptive statistics (frequencies, means, standard deviations) and methods (crosstabs, charts), and financial performance indicators. The analysis of the contents of the qualitative data collected during the exploratory phase (individual and group interviews) was used to describe the processing and marketing operations of the "atta" production microenterprises.

The financial indicators used to assess their economic performance included added value (AV), net operating income (NOI), financial rate of return, and rate of family labor turnover.

Added value (AV) was calculated as the difference between gross revenue (R) and the cost of intermediate inputs (IC).

Table 1 Geographical distribution and degree of concentration of "atta" production microenterprises in the city of Cotonou

Zone	Borough no.	Street name	NA	NE	N	Ratio N/NA
Residential area	1	Donaten	5	0	2579	516
	1	Tchanhounkpame	6	2	3894	649
	2	Irede	6	1	4464	744
	2	Kpondehou I	9	0	7233	804
	3	Segbeya South	12	1	6279	523
	3	Ayelawadje II	4	0	7792	1948
	4	Sodjatinme West	4	0	2070	518
	4	Missessin	7	2	2319	331
	6	Gbedjromede	7	3	3255	465
	6	Djidje II	6	1	6588	1098
	8	Gbedagba	8	0	5806	726
	9	Zogbo	5	2	7733	1547
	10	Missekple	5	1	4724	945
	13	Houenoussou	3	2	1266	422
Commercial zone	5	Zongo ehuzu	4	0	1796	449
	5	Bocossi tokpa	5	3	1154	231
	7	Gbedomidji (Military Maro)	4	3	3188	797
	7	Missite (SIkecodji)	6	0	3466	578
Service area	11	Gbediga II	6	0	1454	242
	11	St. Jean (Miffongou)	3	3	3298	1099
	12	Cadjehoun I	7	3	3459	494
	12	Cadjehoun III	5	0	1672	334
Total			125	27	85,489	684
Percentage (%)			100	21.6	–	–

Source: Survey results, September to December 2017
NA total number of "atta" processing microenterprises counted, *NE* number of "atta" processing microenterprises surveyed in the study, **N** population of the street, "–" not relevant

$$\text{Added value (AV)} = \text{gross revenue } (R) - \text{intermediate input cost (IC)} \qquad (1)$$

Intermediate inputs consisted of raw materials, ingredients used in processing, fuel, packaging (bags, paper, and disposable packages), transport costs, and sales expenses.

Total operating costs included intermediate inputs (IC), occasionally hired labor and family labor cost (LC), financial costs (FC), taxes (TX), and depreciation (D).

Net operating income (NOI) or profit (P) is the income from sales (R) minus total operating cost (TC):

$$P = R - \text{TC} = R - \text{IC} - (\text{LC} + \text{FC} + \text{TX} + D) \qquad (2)$$

$$P = \text{AV} - (\text{LC} + \text{FC} + \text{TX} + D) \qquad (3)$$

Profit is the monetary gain (or loss) left to a businessman or agent, after payment of all current operating expenses (Fabre 1994). In other words, it represents the net operating income once all the operating costs are deducted from the gross revenue or annual value of production (see Eq. 3). In standard accounting, the profit of a firm (formally registered business) comprised shareholders' dividends, the statutory annual

provision for the founder/creator, and the firm's societal reserve or provision for the firm's expansion or liquidation. Informal women's artisanal microenterprises in Benin are not there yet. Mayer and Glabe (2008) clarified the differences between a strict business accounting procedure to establish profits or losses and the procedure that peasants use to evaluate the profitability of cash crops and subsistence crops in Peru. They concluded that money plays an important but perverse role as it cycles through the market and households. They observed that farmers ignore important cash expenses that are necessary to produce subsistence crops whereas they wrongly incorporate government subsidies when evaluating profits from cash crops.

In the present study, we paid particular attention to estimating labor costs when calculating profits. Two types of labor force are used in the artisanal production of "atta": family labor and occasionally hired labor. Family labor is the most frequently used labor force in the majority of cowpea-processing microenterprises. Occasionally hired labor is only used by 3% of microenterprises. The cost of occasionally hired labor was calculated as the daily wage rate declared by the women who ran the microenterprise we interviewed, whereas family labor cost was estimated as an opportunity cost. The latter was calculated as the declared quantity of that labor force (in man-days) multiplied by the average daily labor wage in the artisanal food processing sector. Opportunity cost and how it was estimated in this study are detailed below.

The opportunity cost corresponds to the remuneration that a self-supplied factor of production would have received if, instead of being devoted to the activity for which it was used, it was used for another activity (Bergmann 1985). It is the reward that would have been gained from the best alternative activity abandoned to undertake it. Based on these definitions, the average opportunity cost of daily family labor in the sector was estimated by referring to recent works in the food economy sector in Benin and neighboring countries.

Yabi et al. (2014) reported that the annual income from agri-food shea processing in north Benin was on average 173,218 FCFA accruing from family labor provided by 4.93 people. The annual income in other activities was 109,319 FCFA. Thus, for 52 weeks/ year and 6 workdays/week, the average remuneration of family labor would be 112.6 FCFA/man-day in shea butter processing and 91.8 FCFA/man-day for all agricultural activities considered together. If we consider the high population density in Cotonou (8593 inhabitants/km^2 in 2013) compared to Parakou (577 inhabitants/km^2)[1] resulting in a higher demand for processed products like "atta" than in the north, the family labor opportunity cost would accordingly be higher. Yet, not everyone in Cotonou consumes traditional food snacks like "atta." We therefore considered the demand for "atta" in Cotonou to be much lower and deliberately estimated the family labor opportunity cost in atta production to be at least 5 times the northern average, i.e., 5×91.8 FCFA = *459 FCFA/man-day*.

This value is closer to the average labor cost of 428 FCFA/day estimated by Hessanon and Sodssinour (2009) for peeling and washing cassava (470.5 FCFA), pressing (311.4 FCFA), and cooking (502 FCFA) to produce *gari* in southeastern Benin. It is also comparable to wages uneducated and poor women receive in Cotonou. These women are either involved in petty trade, earning usually 200–500 FCFA as daily profit in the city's suburbs or are employed as a domestic helper and paid an average of 12,500 FCFA/

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[1]Source : https://www.ancb-benin.org/Document_pdf/Densite_de_population.

month, i.e., about 416.7 FCFA/day. But these jobs are not readily available. Recently, in an analysis of cassava value chains in Côte d'Ivoire, (Coulibaly et al. 2014) estimated the monthly remuneration a worker received in 2013 in an "attiéké" cassava-processing enterprise at US$24.4. If we consider that the company works 6 days a week, the daily remuneration would be US$24.4/24 = US$1.02, i.e., 485.33 FCFA at an exchange rate of US$1 = 475.82 (December 31, 2013). However, the cost of living in Côte d'Ivoire is higher than in Benin, while producing "attiéké" requires harder work than "atta". Therefore, a lower wage rate should be used. In any case, the average (443.3) of the last three values (470.5, 416.7, 485.3) is closer to the value of *459 FCFA/man-day* we estimated earlier based on Yabi et al. (2014). This value was thus used here as the opportunity cost of family labor for the production of "atta" in Cotonou.

The total number of family workers (FW) in man-equivalents was calculated using a formula from Arouna and Afomasse (2005) as follows:

$$\text{FW} = (\text{number of adult men}) + 0.75 \times (\text{number of adult women}) + 0.50 \\ \times (\text{number of children aged 6 - 14}) \tag{4}$$

This formula was adapted from Tshibaka et al. (1992) and Tshibaka (1989) who provided a complete table for calculating the volume of agricultural labor according to gender and to the age categories of workers. We used it, based on the assumption that the realities of the artisanal food processing sector in Cotonou are similar.

The total amount of family labor (AFL in man-days) was calculated by multiplying the number of family workers (FW) by the total duration (Td) of operations (in hours) divided by 8 (number of hours in a workday according to official labor regulations in Benin):

$$\text{AFL} = \text{FW} \times (\text{Td}/8) \tag{5}$$

The rate of return (Ω) is then determined as the ratio of net operating income (NOI) to total cost (TC).

$$\Omega \ (\%) = 100 \times \text{NOI}/\text{TC} = 100 \times P/\text{TC} \tag{6}$$

The performance indicators (AV, *P*, and Ω) of the "atta"-producing microenterprises were calculated using data on costs and revenues provided by the interviewees for five one-day production cycles. For each cost item, the unit production costs per kilogram of cowpea (per cost item and total) were derived by dividing the weekly costs by the quantity of cowpea processed in a week.

Results and discussion

The economic analysis of "atta" production by artisanal cowpea-processing microenterprises was performed in three stages: (i) assessment of the concentration of cowpea-processing microenterprises in the city, (ii) assessment of the functional characteristics (sites, production systems, work organization, socio-economic characteristics) of the processing units/microenterprises, and (iii) analysis of their financial performance.

Location of "atta" production in the city of Cotonou

Our survey identified 125 "atta" production microenterprises in 22 selected streets in Cotonou, i.e., an average of six microenterprises per street. The locations of these units

were examined with respect to the type of location of the street food sales (commercial area, public service area, or residential area), as identified by Agli et al. (2004). Public service and commercial areas are located in the heart of the city while residential areas are located on the outskirts (Agli et al. 2004). The first two zones are areas of high economic activity. The third one is not strictly speaking a "residential area"[2], in the sense that it does not only comprise luxury dwellings, which is usually the case of a residential area. In this study, it differs from the first two by its high population density and the fact that quite important economic activities take place there too (Table 1).

Comparing the three areas to calculate the average number of workers per "atta" production microenterprise revealed that there is no significant difference between them. This can be explained by the nature of the food, which is a very popular snack consumed in the afternoon break, and its cultural roots in the study environment. Another possible explanation is the intense economic activity in the city, even in areas that are purportedly residential areas. This result is consistent with that of Agli et al. (2004) who found that street food businesses are highly developed in areas of high economic activity with a high population density. However, Madode et al. (2012) found that people with higher incomes, who often live in "real" residential areas, may consume more meat and less cowpea as a source of protein. In addition, the difference in the consumption of cowpea dishes between urban and rural areas may result from the digestive discomfort caused by consuming cowpeas. Therefore, a sharp difference in "atta" business development should have been observed between high-income residential areas and the so-called residential areas in Cotonou. Moreover, the processed foods sold in urban areas are not always produced in adequate hygienic conditions. For example, on the campus of the University of Abomey-Calavi (20 km north of Cotonou), only 50% of "street restaurants" in the commercial center complied with food hygiene and quality requirements (Honfoga et al. 2019).

Regarding the density of "atta" businesses and job creation, population census data for the study area (Table 1) revealed one "atta" production unit/microenterprise for 684 inhabitants. This made it possible to estimate the number of woman artisans/microenterprises producing atta in the city of Cotonou at more than 3500[3]. The number of jobs created is hypothesized to be at least double (7000). It is also worth noting that the market to be satisfied by these atta-producing microenterprises is not limited to Cotonou city residents but also includes the mass of people in the city's suburbs and/or neighboring towns (Abomey, Ouidah, Sème-Kpodji, Porto-Novo, etc.) who come to the city every day for work or other activities.

Functional characteristics of "atta" production cowpea-processing microenterprises

In this section, we present the characteristics of production and sales, the work organization and supply of inputs and/or equipment, and finally the marketing strategies of "atta" production cowpea-processing microenterprises.

Characteristics of production and sales locations

"Atta" are often produced in front of the home of the woman who runs the processing microenterprise, near road junctions, or next to public/private institutions (ministries, health centers, schools, university campuses, etc.). The same location is used to sell the

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[2]Geographers define residential suburbs as usually having comfortable individual houses.
[3]This number of craftswomen was estimated for a population of 2,401,067 inhabitants in the urban area of Cotonou.

product. Nevertheless, some women whose work volume is higher, thanks to high demand, do all their preparation up to frying at home, while frying and sales are done outdoors. The small round or oval "atta" are prepared and served directly at the point of sale while they are still hot.

The criteria for choosing the location vary from one processing microenterprise to another. But the most important criteria are either of the commercial nature of the location (flows of consumers, proximity to a public place) or its organizational position (near the promotor's home, near a mill). Production sites most often take the form of makeshift shelters, consisting of small huts built with improvised materials (sheets, wooden racks, bamboo, etc.). Sometimes, craftswomen simply shelter under umbrellas or sheets that can be folded away at the end of the day. Open retail sites with no shelter at all, where trees and house roof extensions serve as shade for them and their customers fall into this category. The second form includes shelters built of durable materials (cement blocks, sheets of metal, etc.), most often rented or owned shops. This category is no less widespread than the first.

Work organization

Production systems The surveyed cowpea processing microenterprises are headed by women and employ mainly female labor. Almost all processing steps are manual, except cowpea milling, which is done by independent mills installed in the streets or city markets. "Atta" is always sold together with other local dishes. In this production system, cowpea processing is often a secondary activity. Only 27% of the surveyed microenterprises considered "atta" production to be their main activity. Selling a range of different food products is a risk reduction strategy, to cope with possible losses in the sale of such a highly perishable product as "atta." Another possible reason is that "atta" is consumed more as a snack and does not require a whole day to prepare. Generally, the product diversification practice aims to offset the impact of sale losses of some products with the profit made from others.

Techniques and strategies of "atta" production and division of labor Generally, the technology used by atta-producing microenterprises comprises artisanal equipment and meticulous know-how that guarantees the quality of the final product. The women interviewed told us they needed between 100 and 200 min to process 1 kg of white cowpeas. The time likely depends on the women's know-how and the kind of equipment or tools they use. It is clearly a low-productivity activity with only about 70 pieces of "atta" dough produced from 1 kg of white cowpea flour. Although the crushing and milling of cowpeas are already mechanized, mixing also requires mechanization to reduce its time which currently represents 30% of the total "atta" production time. Improved techniques are required to reduce the length of the whole process (Table 2).

Two groups of atta production strategies can be distinguished: organizing operations/ tasks and organizing the workforce. Cowpea processing usually begins in the morning with the tasks required before mixing and frying, which are done where the final product is sold. Sometimes the cowpeas are sorted the day before. Atta are sold between 4 and 6 o'clock in the afternoon. Where preparation takes place depends on the

microenterprise, such as the distance between the woman's home and the sales location. Generally, "atta" is prepared on the spot, but two variations were observed. The first one is when all operations, except crushing and grinding/milling, are performed at the sales location. This is the case when the women live far from where they produce and sell their atta. The second variation is when the first processing steps, from sorting until soaking of cowpea cotyledons, are performed at home.

"Atta" production microenterprises primarily use family labor. This was the case for 87% of the surveyed microenterprises. In addition to the woman who heads the microenterprise herself, the family labor force is mostly made up of her own children or those placed under her guardianship.

The socio-economic characteristics of surveyed artisans are presented in the "Socio-economic characteristics of surveyed women who run the microenterprise" section. The remaining 3% employs only occasional workers, on average one worker per microenterprise; but some employ up to three workers. These employees are paid daily. They are recruited through recommendations from family, friends, or other social relations with the owner of the microenterprise, the ability to perform kitchen duties, etc.

Finally, the tasks are shared according to the skills and status of each person (worker versus boss; new versus old) in the processing microenterprise. Preparation, for example, is often carried out by the owner. This involves sensitive operations that require great care such as soaking, kneading/mixing, and frying and are done by the owner herself or under her strict supervision if the work requires too much physical effort.

Socio-economic characteristics of surveyed women who run the microenterprise

Entry into the profession of "atta" production requires basic know-how and is most often acquired from a parent (mother, aunt, guardian, etc.). The process of learning is

Table 2 Duration of cowpea processing steps in artisanal "atta" production

Steps	Equipment or tools used	Time required (in minutes) for 1 kg of cowpeas
Sorting cowpeas	Sieve, plate/bowl/plastic or aluminum tray	10–20
Crushing cowpeas	Mortar, mechanical mill or grinding wheel	5–30
Soaking crushed cowpeas	Plastic or aluminum bowl	5–10
Skinning	Plastic or aluminum bowl	10–15
Washing of cotyledons	Plastic or aluminum bowl	5
Soaking cotyledons	Plastic or aluminum bowl	20–30
Draining	Plastic or aluminum colander, basket	5–10
Seasoning		5
Milling	Mechanical mill	5–10
Mixing	Plastic or aluminum bowl, spatula	30–60
Frying	Spoon, skimmer, aluminum pan, coal or fagot stoves or litter, gas stoves	10–15
Draining	Aluminum strainer, aluminum basket, bowl, or plate	10
All processing steps		**100–200**

Source: Survey results, September to December 2017

progressive and takes place within the confines of the parent-trainer's processing microenterprise. The current woman artisans started learning the operations when they were very young. It is an informal training process that spans several years during which the youngest acquires skills from experienced craftswomen in her family (Trèche et al. 2002; Soule et al. 2004). Today, there is no other way for these young girls to acquire such skills.

According to the women we interviewed, the main reasons for their entry into that business included the need to have an income-generating activity to avoid unemployment and poverty, the legacy of parent's skills, or the failure of other activities (Fig. 2). Like other artisanal activities in the food sector, the production of "atta" perpetuates an ancestral culinary tradition that is transmitted from generation to generation in West Africa (Konan et al. 2017).

The average age of the surveyed women was 46 (std = 9.86), giving evidence that the business is not practiced by young people. This state of affairs may be explained by the patience and meticulousness required by the production of "atta." Further, the profit to be made may not be sufficient to attract young women. This hypothesis is confirmed in the "Financial analysis" section on financial performance. Finally, the majority of women (95%) were married. They had a relatively low level of formal education: 43.3% had no education, and the remaining (56.7%) had only primary education or barely attended secondary school (Table 3). Only 37% of them had access to credit through formal microfinance institutions (ALIDE, CLCAM, COMUBA, FNM, PADME, PAPME, etc.) or informal institutions (tontines, social groups). They receive no support from public organizations or NGOs. The lack of professional organization and the atomization of the food processing micro-business in Cotonou city make it very difficult to disseminate information and to dialog with the public authorities. Current public policies concerning the sector are non-existent or not effective. Sometimes instead, repressive public measures are implemented, leading to misunderstandings and to the refusal of government development initiatives by very vulnerable populations.

Finally, it is important to note that changes have occurred in the practices of woman artisans over the last 10 years. For example, glass cases that preserve the quality and safety of food are now used. This new practice originates from the Ministry of Health

Fig. 2 Motivation for "atta" production handicraft. Source: Survey results, November to December 2017
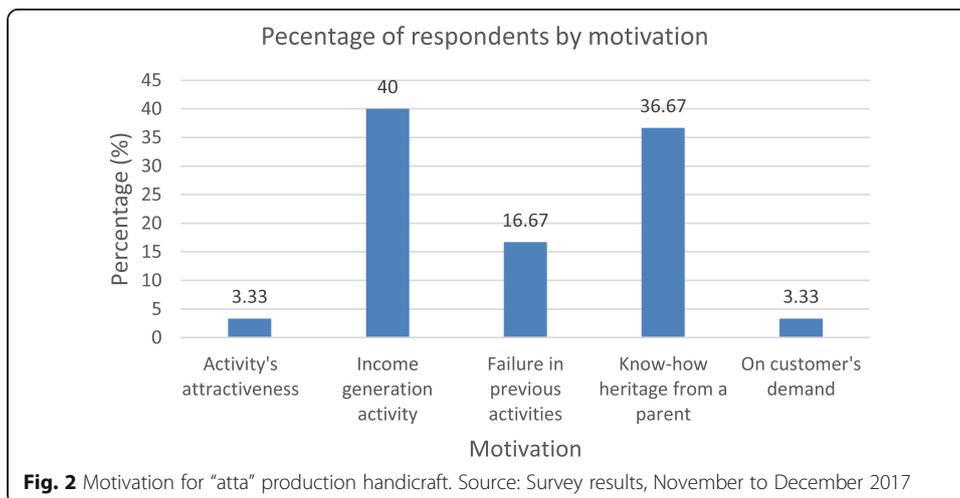
awareness-raising concerning food hygiene. However, most of the artisans surveyed did not use glass cases, hot "atta" dumplings are being purchased by consumers as soon they are fried. Indeed, the glass cases are not well ventilated, which could lead to product deterioration by the end of the day.

Supply of raw materials, equipment, and other consumables

The supply of raw materials is exclusively organized by the women themselves. The frequency of cowpea supply varies considerably, but 63.33% of craftswomen preferred several small supplies per week, which they purchased from cowpea retailers in urban markets (Fig. 3). This may be to avoid possible cowpea deterioration and losses during storage. However, the lack of cash/capital for bulk purchase is likely the main reason, as is the case of many petty traders in the city. The quantities of white cowpeas purchased ranged from 5 to 11 kg per week, giving a total of 292.5 kg for the 27 surveyed women. Purchasing cowpeas in the market remains advantageous because they benefit from competition, i.e., they can compare prices and pay the best price. Dantokpa is the biggest raw foods market in the country and the main cowpea supply market. More than half the women (55.17%) said they bought cowpeas from the same one or two suppliers. This loyalty may be based on a social relationship (friendship, kinship, etc.) between sellers and customers, or emerge gradually after several satisfactory transactions in terms of quality of the product. Despite these relationships, most craftswomen prefer to pay cash for the raw material to avoid accumulating debt and to be able to predict their income. Other consumables (manufactured inputs, packaging materials, fuel, etc.) are also purchased in the market and, to a lesser extent, in the neighborhood. Work equipment and tools are purchased from tradesmen and craftsmen (blacksmiths, carpenters, welders, etc.) in the city.

Table 3 Socio-demographic characteristics of the woman artisans surveyed

Characteristics		Values
Sex (%)	Male	0
	Female	100
Age (years)	Minimum	23
	1st quartile	40
	2nd quartile	46
	3rd quartile	52
	Maximum	63
	Average	45.57 (9.86)
Level of formal education (%)	None	43.33
	Primary	33.33
	Secondary	23.33
Marital status (%)	Married	95.4
	Divorced/separated	3.67
	Widowed	0.93
Household size		3.2 (1.4)

Standard deviations are in parentheses
Source: Survey results, November to December 2017

**SP: Self-procurement from cowpea traders, DM: Dantokpa market; OM: Others markets; SM: Street market

Fig. 3 Type of cowpea providers and supply markets. Source: Survey results, November to December 2017
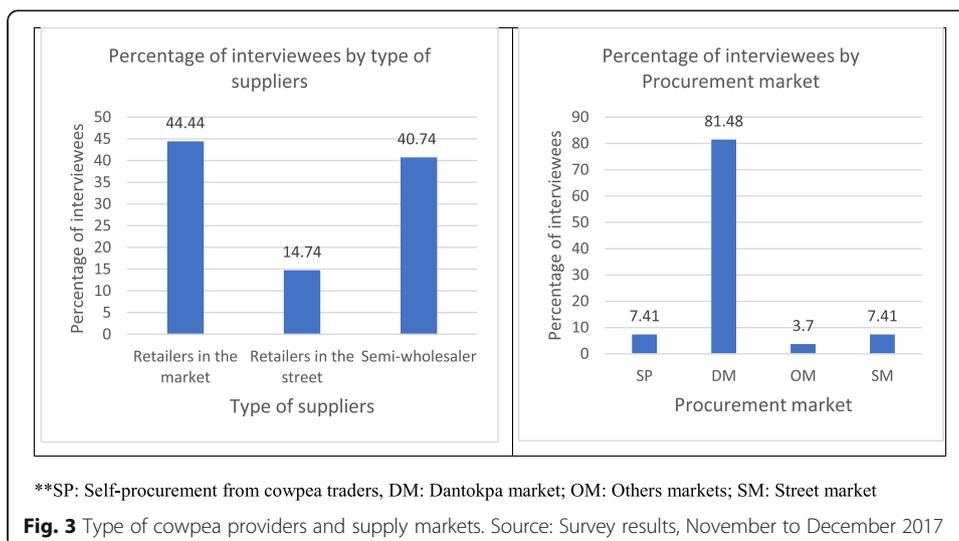
Consumption patterns and distribution and sales strategies

In Cotonou city, atta (fried dumplings made of cowpeas) are usually consumed together with fermented or unfermented porridges made from corn, sorghum, rice, or corn or wheat pasta (macaroni) and/or associated with other fried products (yams, sweet potatoes, banana fritters called "talé-talé", etc.). These results are consistent with those of N' Bessa (1995) and Agli et al. (2004) who found that in Cotonou, consumers of cowpea atta eat them with yam fries. Eating atta with starchy products is a food habit in southern Benin. Indeed, legumes and other protein-rich food products are often consumed together with cereal- or tuber-derived foods.

Here, we briefly present the marketing strategies of atta producers according to the 4Ps of marketing (product, price, place, promotion). Sales of atta match the above-mentioned food consumption habits. The woman artisans carefully survey the technical process to ensure the processed product tastes good. Obviously, customers want good tasting warm or hot atta. Cowpea dough is fried in small batches. However, if not well controlled, this practice can lead to degradation of dough quality and production losses. Atta are sold on the spot immediately after being fried. Small round or oval atta are sold for 10 FCFA (1.8 cents, US$) or 25 FCFA (4.5 cents US$) each, the latter price being the mostly widespread. Extra atta are given for free to customers who purchase a large quantity. Woman artisans who operate in markets like Dantokpa employ itinerant saleswomen who are paid a commission according to the quantity sold. Finally, the product is advertised, with slogans such as "hot atta" and "still hot" launched from time to time to attract potential customers' attention.

The above prices represent 1/20th of the daily remuneration of family labor in artisanal food processing (less than US$1/person/day) or 1/20th of the daily wage of uneducated women employed in occasional domestic housework. It is clear that artisanal production of "atta" is a time-consuming and badly paid business.

Financial analysis

Production costs of atta

The production costs of atta include the costs of raw material and ingredients (chili, garlic, pepper, ginger, salt, oil, etc.), energy (electricity and fuel), family labor and occasionally hired labor, transport of inputs, depreciation of equipment, and external milling service. Across the sample of 27 women surveyed, the average production cost per kilogram of processed white cowpea was 1633.9 FCFA, standard deviation 434.2 CFA (Table 4). This represents the arithmetic mean of the unit cost variable "cost per week/quantity of cowpeas processed in a week," calculated directly for the sample of 27 women. It differs slightly from the ratio (1480.1 FCFA) of the average quantity of cowpea processed in a week per craftswoman (10.83 kg) to the average cost per week (16,029.7 FCFA). The difference is usually due to the unequal number of observations of the top and bottom variables that make up a quotient variable.

Intermediate inputs, i.e., raw material (cowpeas) and ingredients, represent 90.4% of the total production cost. The raw material alone accounts for 39.1% and ingredients 23%, making the bulk (62.1%) of the total cost of production. Indeed, cowpeas are expensive in urban markets, particularly in Cotonou. Family labor ranks fourth among production costs. It is the main workforce used by cowpea-processing microenterprises. However, the overestimation of the use of this workforce was noted during the survey. Therefore, the remuneration of family labor is considered here as a net operating income obtained when the family labor opportunity cost is excluded. Equipment depreciation, occasionally hired labor, and water account together for less than 3% of total production cost, which attests of the artisanal, poorly equipped nature of the microenterprises.

Table 4 Production costs of atta made from white cowpeas

Cost items	Average cost per kilogram of processed cowpeas* (FCFA)	Percentage
Cowpeas (raw material)	589.8 (99.8)	39.1
Ingredients	412.5 (238.7)	23.0
Transport	57.1 (56.5)	3.0
Water	20.2 (19.3)	1.1
Fuel	108 (51.5)	6.3
Packaging	43.7 (20.6)	2.6
Milling	195.4 (26.3)	12.5
Rent	40.1 (105.3)	2.6
Intermediate inputs	*1466.8 (372.1)*	*90.4*
Occasionally hired labor	15 (47.7)	1.8
Family labor	144.8 (115.3)	7.5
Depreciation	7.3 (8.8)	0.4
Total cost	1633.9 (434.2)	100.0
Total cost without family labor	**1369.2**	-

Source: Survey results, November to December 2017
*This is the arithmetic mean of the unit cost variable "cost per week/quantity of cowpea processed in a week," for the sample of 27 craftswomen. Standard deviations are in parentheses. The average quantity of cowpeas processed in a week by each woman was 10.83 kg, and the average cost per week was 16,029.7 FCFA

Financial performance of artisanal "atta" production microenterprises

The ratio of added value to the cost of intermediate inputs (AV/IC) is 24.6%, which indicates that 100 FCFA invested by the women in atta production generates about 25 additional FCFA as wealth created. The average profit is 159.4 CFA per kilogram of cowpea and represents 49% of the wealth created per kilogram of processed cowpea. This corresponds to a return rate of 11.7% on the total production cost. Knowing that the return on capital in the country's microfinance institutions ranges between 18 and 24% per year, artisanal production of atta is therefore barely profitable, if all production costs, including family labor opportunity cost, are taken into account. Although access to credit is generally difficult for farmers and for artisanal food processing women in Benin, the above comparison is nevertheless appropriate. Indeed, farmers, woman artisans, and petty traders quite often turn to microfinance institutions for short-term loans, which they get at fairly expensive interest rates of up to 24% per year. Nevertheless, microfinance institutions are the least harmful, because existing alternatives (intermediaries and loan sharks) are just as expensive, even ruinous. To be considered really profitable in Benin today, the rate of return on the investment in an agricultural or food processing activity should exceed 24%, which is far from the case for atta production.

Hessanon and Sodssinour (2009) found that cassava activities provide producers with an average annual income of 112,605 FCFA at an average annual cost of 78,500 FCFA. The corresponding figures for processors are 635,844 FCFA and 180,421 FCFA. These correspond to return rates of 43.4% and 252.4%, respectively. However, it is important to note that cassava processing is mechanized, especially milling and pressing, hence the very high return rate. Gandji (2015) estimated the return rate for artisanal palm oil production at 24.7% and 82.5% during high production and low production periods, respectively. All these figures show that the profitability (11.7%) of artisanal atta production is really very low compared to similar microenterprises (Table 5). Agli et al. (2004) already found that artisanal cowpea processing was a low-profitability business. Meanwhile, woman artisans involved in this activity are likely under the illusion of good profitability (27.13%) as they usually do not include the family labor opportunity cost, self-consumption, and depreciation of processing equipment in their production costs. This return rate is slightly higher than the return rate on capital borrowed from microfinance institutions in the country. This is undoubtedly the reason why atta production is still underway on many street corners in Cotonou. The high demand for this snack continues to drive production despite overall low profitability.

Conclusion

This study investigated the economic performance of the production of atta (deep-fried cowpea snacks), a high-demand artisanal food processing activity undertaken by low-income women in Cotonou, Benin. The results showed that the women's microenterprises have a specific structure of their own, a training system anchored in cultural knowledge transmission from mother to daughter (from generation to generation), but an overall low profitability, whether family labor is taken into account or not. These microenterprises seem to have some potential for economic development considering the activity's attractiveness for these women and the early "employment" opportunity for female youth in that stratum of the urban society. However, women involved in artisanal food processing need technological upgrading and business empowerment to

Table 5 Aggregate operating account of "atta" production from white cowpea

Items	Average cost per processor for 1 kg of cowpea (FCFA)	Performance indicators
Gross revenue (R)	1793 (546)	
Intermediate inputs cost (IC)	1466.8 (372.1)	
Total operating cost (TC)	1643.3	
Operating cost without family labor	1369.20	
Added value (AV)		**326.5 (488.5)**
Net operating income or profit (P)		**159.4 (477.7)**
Net operating income without family labor cost		**371.48**
AV/IC ratio (%)		**24.6 (0.33)**
Rate of return, Ω (%)		**11.74 (0.28)**
Rate of family labor remuneration (%)		**27.13**

Standard deviations are in parentheses. The main financial performance indicators are in bold
$N = 27$ artisanal microenterprises
Source: Survey results, November to December 2017

become real entrepreneurs. Indeed, if health risks and nutrition are addressed and local tastes are valued to keep technophile consumers on board, a rapid rise in urban demand for processed food is likely to occur, inasmuch as new technologies bring innovative products to consumers (Coppola and Verneau 2014). In that perspective, the women would need to be able to overcome the key constraints their microenterprises are facing, including low access to credit, no training, and no government recognition. Chiwaula et al. (2018) found similar constraints, especially low resource base, education, and market access, among female solar tent fish dryers in Malawi.

In that respect and considering that Benin's population is today more than 50% female (most of whom are poor), appropriate policies are needed to take them out of poverty and to create the emerging economy to which the country aspires. In particular, dedicated investment and business development support should be provided to these women to meet the growing domestic urban demand for atta and to envisage in the near future, the export of stabilized and safer cowpea finished products.

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