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THE ENTREPRENEURSHIP POTENTIAL OF RURAL AREAS: SOAP PRODUCTION AS A SIDE BUSINESS FOR TANZANIAN RICE FARMERS

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ABSTRACT
Purpose: This study examines soap production's entrepreneurship potential and profitability as a supplementary business for rural rice farmers in Tanzania to promote their economic independence.
Design/ Methodology/ Approach: We randomly sampled and interviewed about ten small-scale soap manufacturers in urban Tanzania gathered from 2019-2021 to develop a soap production business strategy for rural farmers at a similar scale. Considering the Voronoi theory, we calculated the distance from the rural areas to urban centres to determine the transportation costs, which particularly burden rural farmers. Soap production costs and profitability were determined based on transportation costs and raw material prices.
Findings: Rural farmers would incur high transportation costs, given the high average distance to the nearest urban centre (sometimes > 100 km). Nevertheless, producing their rice bran oil, valuable raw material for soap production, would give them a competitive advantage over urban producers.
Research Limitation: The study's proposed strategy can be applied to similar contexts to reduce the urban-rural entrepreneurship divide.
Practical Implication: Soaps made using rice bran oil help farmers reuse agricultural waste. Their active ingredients also increase their marketability as high-end cosmetic products, providing farmers with additional income.
Social Implication: Commercializing agricultural residues such as rice bran increases farmers' revenues and reduces CO_2 emissions by preventing the residues' incineration; this creates a virtuous cycle in society.
Originality/ Value: This study presents a more realistic business strategy for rural Tanzanian farmers, as, unlike previous studies, it considers not only direct costs but also transportation costs.
Keywords: *Entrepreneurship. farmers. production. rice. soap*

INTRODUCTION
Similar to many developing countries worldwide, the economic gap between urban and rural areas is widening in Tanzania. In urban Tanzania, the household electrification rate rapidly rose from 65.3% in 2016 to 73.2% in 2019; conversely, the rural electrification rate remained stagnant at 24.5% in 2019 (The United Republic of Tanzania, 2020). Many farmers can access

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the grid power but cannot afford it; therefore, electrical appliances are not widely used. Thus, to promote local electrification, farmers must earn sufficient cash income by resorting to a supplementary business that can provide additional income.

Further, according to the National Sample Census of Agriculture (The United Republic of Tanzania, 2021), the total rice cultivation area was reported to be 1,700,701 hectares, the total harvested area was 1,485,125 hectares, and the total production was 3,443,606 tons in Tanzania, including Zanzibar as of 2019/20. The average yield was 2.3 tons/ha in mainland Tanzania and 2.1 tons/ha in Zanzibar. By contrast, for the same periods, Japan's yield of water rice as a staple food was 5.3 tons/ha for brown rice (MAFF, 2020), which, when converted to unhusked rice (paddy), was estimated to be approximately 6.7 tons/ha, reflecting Tanzania's low paddy yield.

Nevertheless, rice is widely cultivated as a staple food in Tanzania, Before being sold in the market, the cultivated rice is threshed and milled, while the removed rice bran is left beside the rice mill. Rice bran can be used as livestock feed, but as it has some oil content, it is desirable to defat it first. Rice bran oil is a valuable food because it contains many trace compounds with proven nutritional benefits, such as gamma-oryzanol, tocotrienol, and tocopherol (Taniguchi et al., 2012; Cheong & Xu, 2019) However, the lipase in rice bran hydrolyses glycerides, which is the main oil component, produces free fatty acids (Kimura, 1960; Champagne, Hron & Abraham, 1992). The quality of fatty acids produced may increase drastically depending on the storage conditions of rice bran. As free fatty acids are not suitable for human consumption, they need to be deacidified to meet food standards (Enochian et al., 1981). However, free fatty acids can be used as a raw material of soap, allowing rice farmers to incorporate soap manufacturing as a side business to gain additional income.

Soap can be manufactured using several methods. It is also possible to produce soap without heat treatment, that is, without using electricity. Further, in Japan, soap made from rice bran oil is marketed as a high-end cosmetic product (Shibata, 2017) because of its valuable compounds, as described earlier. As free fatty acids are a rice by-product that is typically removed from rice bran, soap production does not affect the process of converting rice into food and feed. Thus, soap production is highly advantageous from a resource recycling viewpoint and may contribute to the development of a sustainable society.

Considering the geographical disadvantages suffered by rural areas, this study tries to address the gap between the entrepreneurial potential of urban and rural areas by focusing on how rice farmers could adopt soap manufacturing as a supplementary business. Specifically, examines the profitability of soap production using rice bran oil as a raw material in rural rice-growing areas in Tanzania, using urban areas (where small-scale soap production using sunflower and palm oil is already underway) as a reference. Soap makers from rural areas must often travel to urban centres to procure raw materials and sell their soap; thus, transportation costs are a considerable burden. Therefore, we discuss a business strategy in which soap manufacturer in rural areas can overcome their geographical disadvantages to make their business profitable.

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METHODOLOGY

Benchmark study for small-scale soap manufacturers

Assuming that rice farmers would manually manufacture soap at a small scale (family business or few employees), a benchmark survey was conducted on several small-scale soap manufacturers in urban areas for comparison. These manufacturers were randomly selected from among those who had received entrepreneurship support and technical guidance from the university of Dar es Salaam, Tanzania. All participants provided informed consent before being interviewed between 2019 and 2021 through in-person meetings. Additional information was obtained via email and phone, as needed. Information about the manufacturing process, raw materials, equipment, production capacity, selling prices, and distribution channels were collected onsite. The prices of raw materials and fuels were established based on the actual prices in Fiscal Year (FY) 2021. Based on the information obtained, we assumed that in rural areas soap manufacturing would be conducted using similar methods and scale. In rural areas, transportation costs, which do not need to be considered in urban areas because of their proximity to production sites and markets, were examined in detail, as described in later sections.

Mapping of statistical data

The rice farming areas are suitable areas for soap production. This is because the main raw material, rice bran oil, can be procured from rice bran, an agricultural residue. To identify sites for the case study, we consulted the 2020 agricultural statistical data published by the Tanzania Bureau of Statistics (The United Republic of Tanzania, 2021). Thereafter, we extracted and imported the regional paddy yield data in mainland Tanzania into a geographic information system (GIS) to visualise the distribution of paddy fields on a map.

Rice farmers must be able to access urban areas to procure non-oil raw materials and sell their products. This distance to the urban areas is a significant burden when considering business feasibility. We used publicly available data from Africapolis (2021) to identify the urban distribution and distance to African urban areas, defined as areas having a population of 10,000 or more as of 2015. The extracted data were imported into a GIS and reconstructed such that these urban areas could be visualised.

Estimation of average travel distance

An ordinary Voronoi diagram (Kobayashi & Sugihara, 2002) was used to calculate the shortest travel distance from the rice farmers' locations to the nearest city, expressed by the following equation where the distance function is d and the finite subset is $V(p_i)$ in the distance space, which is similar for cities with over 10,000 residents as the base point.

$$V(p_i) = \{p / d(p_i, p_i) \leq d(p, p_j), j \neq i\} \quad (1)$$

As the map does not show several unpaved roads in Tanzania, it is difficult to determine and visualise the road network. The distance to the nearest urban area was therefore calculated as a straight line.

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RESULTS AND DISCUSSION

Results of the interviews with small-scale urban soap manufacturers

Table 1 provides an overview of the information obtained from the interviews.

Table 1 Results of interviews with small-scale soap manufacturers in urban areas

No.	Location	Employees	Production method	Ingredients	Machinery	Productivity	Products & Prices
1	Dar es Salaam	18	Cold Process	Caustic soda Mise oil Glycerine Sodium silicate Colour Aloe vera	No machinery	40,000 pcs per month (1pc = 100g)	·Normal bar soap TZS1,500-2,000/pc ·Bathing bar soap TZS2,400/pc
2	Dar es Salaam	11	Cold Process	Caustic soda Mise oil Palm oil	No machinery	860 pcs per month (1pc = 100g)	·Body soap TZS2,000/pc
3	Dar es Salaam	9	Hot Process	Caustic soda Palm oil Perfume Colour	Blender		·Laundry soap TZS100/pc
4	Dar es Salaam	4	Hot Process	Caustic soda Palm oil Perfume Colour	Blender	800 pcs per month (1pc = 100g)	·Body soap TZS500/pc
5	Dar es Salaam	3	Hot Process	Caustic soda Palm oil	Blender		·Laundry soap TZS300-500/pc
6	Dar es Salaam	1	Cold Process	Caustic soda Palm oil Perfume Colour	No machinery		
7	Mwanza	11	Hot Process	Caustic soda Oil Yellow kaolin Gums	Blender	24,000 pcs per month (1pc = 500g)	·Multipurpose soap TZS1,000-1,200/pc
8	Arusha	10	Cold Process	Caustic soda Oil (Vegetable, Sunflower, Coconut)	No machinery	500 pcs per month (1pc = 100g)	·Baby soap ·Turmeric soap ·Moringa soap each TZS5,000/pc
9	Kigoma	5	Cold Process	Caustic soda Kernel oil Glycerine Perfume Colour Lemon, Honey, etc	No machinery	20,000 pcs per month (1pc = 100g)	·Multipurpose soap TZS1,500/pc

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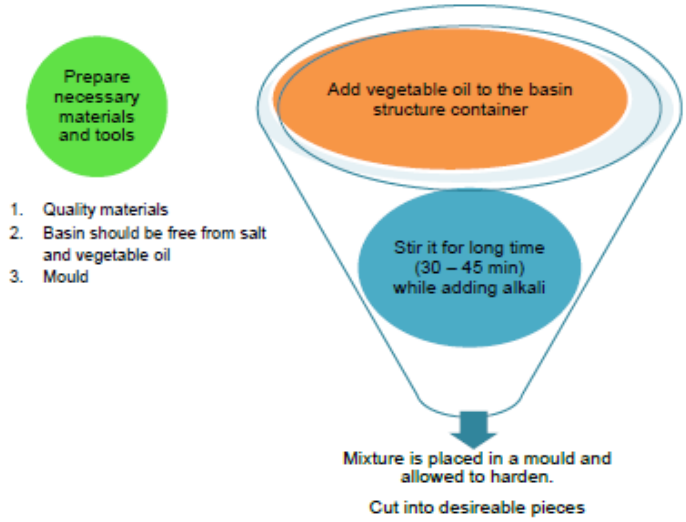

Figure 1: Flowchart of soap production by cold process

In Dar es Salaam, the hot process method is often used because of its efficiency and the availability of grid electricity. However, in rural areas, the cold process method, which does not require heating, would be more suitable. As shown in fig. 1, the cold method involves pouring vegetable oil into a basin-like container and stirring it for a long time while adding alkali to it. After stirring, the mixture is placed in a mould and allowed to harden, and then cut into the desired size. Although stirring the mixture requires significant physical labour, this method can be performed without special machinery, making it suitable as a side job for farmers.

The interviewees reported that the most commonly used oils for soap production are sunflower oil (also called mise oil) and palm oil, which are the most widely distributed vegetable oils in Tanzania, and, therefore, easy to obtain. In addition to oil, caustic soda (a highly alkaline substance) is essential, while colourants and scents may also be added. These ingredients are readily available in urban centres.

Further, in urban areas, most soap makers sold their soaps directly at nearby stores. In some cases, the delivery location was more than 100 km away, but public transportation was available. The selling price of soap varied from TZS 100 to 5,000 per piece (100 g), depending on the manufacturer.

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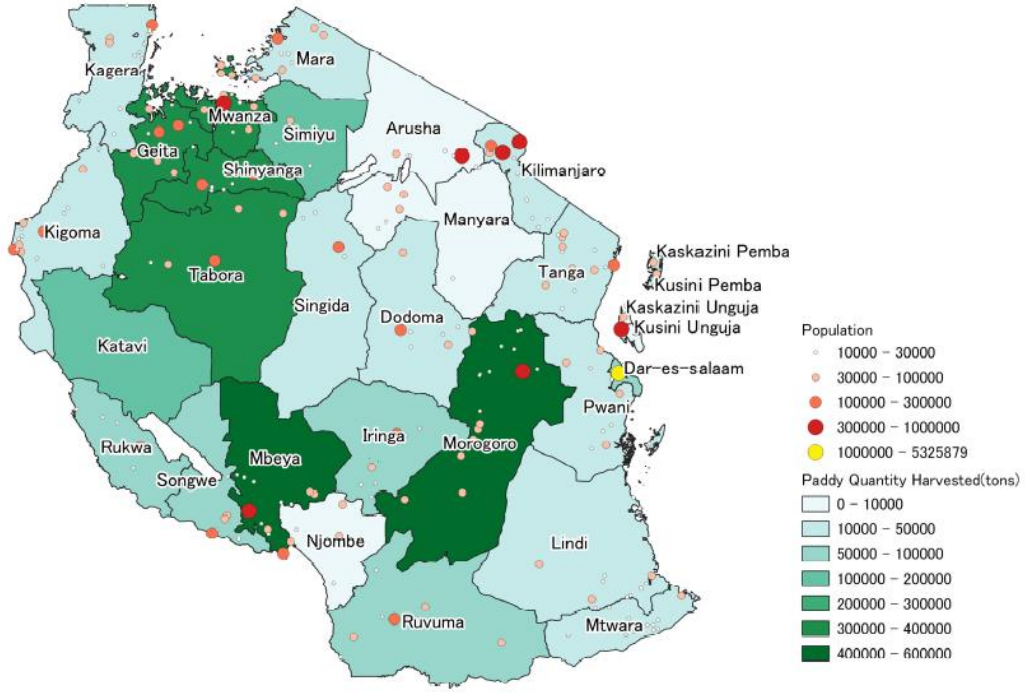

Figure 2: Location of paddy-harvested areas and urban areas

Location of urban areas and rice-growing rural areas

The results of mapping paddy yield data from the Agricultural Census by region (The United Republic of Tanzania, 2021) are shown in figure 2. Although not very popular in Arusha and Manyara, rice cultivation is carried out throughout Tanzania, with Morogoro, Mbeya, and Tabora, being the areas with the highest paddy yields.

The population distribution data from Africapolis was imported into a GIS, as shown in figure 2. As Wineman et al. (2020) point out, the classification of cities is fluid, so it may not be accurate to classify cities based on population data alone. Further, both population size and urbanisation are rapidly increasing in Tanzania; thus, the 2015 statistics may not accurately reflect the current situation.

Most of the soap manufacturers included in the benchmark study were in cities with a population of at least 10,000 people, according to the Africapolis classification. The interviews confirm that raw materials for soap production can be easily procured and sold in the city.

Average travel distance between rural and urban areas

In the case of soap manufacturing in rural areas, farmers must procure raw materials other than rice bran oil from urban areas. The average distance to the nearest city was calculated using the Voronoi diagram for Morogoro and Mbeya regions, which have the highest rice production.

A 1 km mesh was created on the map to cover the target regions (Figure 3a); a Voronoi division was performed using cities with a population of more than 10,000 as the base point (Figure 3b), and the target areas were divided by the straight-line distance to the nearest city point (Figure,

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3c).

Figure 4 shows the colour-coded distribution map of the areas closest to a particular city in the targeted regions. Histograms of the average travel distances for the Morogoro and Mbeya regions are shown in Figure 5.

Morogoro is a relatively urbanised state, with a high frequency of urban centres within a 50 km radius. The most frequent distance category is 25–30 km, and there are few cases where the distance to an urban centre exceeds 100 km. The average distance travelled by rice farmers to the nearest urban centre in the Morogoro region was 42 ± 26 km, and the standard deviation indicated no significant variation in the distance travelled to cities from any point in the Morogoro region.

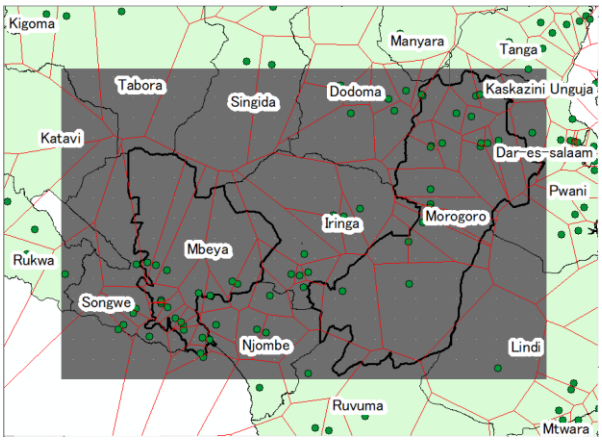

Figure 3a: Overlay 1km mesh on the map

Figure 3b: Voronoi division based on citie

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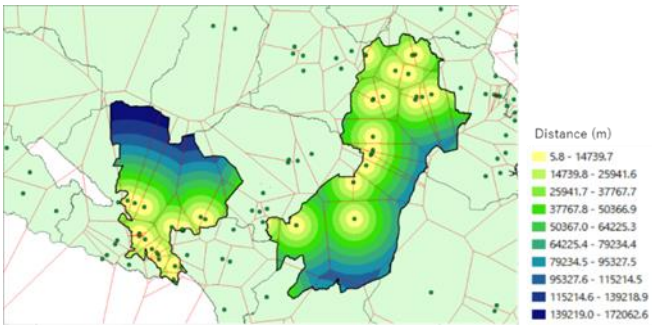

Figure 3c: Linear distance between each mesh and the nearest city.

In Mbeya, the burden of urban travel is expected to be extremely high depending on the location. This is because there are only a few urban centres with a population of at least 10,000 people, which are scattered across the southern part of the province, with none in the neighbouring provinces. In the Mbeya region, the average distance travelled was 61 ± 45 km, indicating a vast difference depending on the location as depicted in figure 4. The histogram shows that the maximum distribution was in the 10–20 km distance range, but the frequency was relatively low, while the distance travelled was up to 170 km in some cases as shown in figure 5.

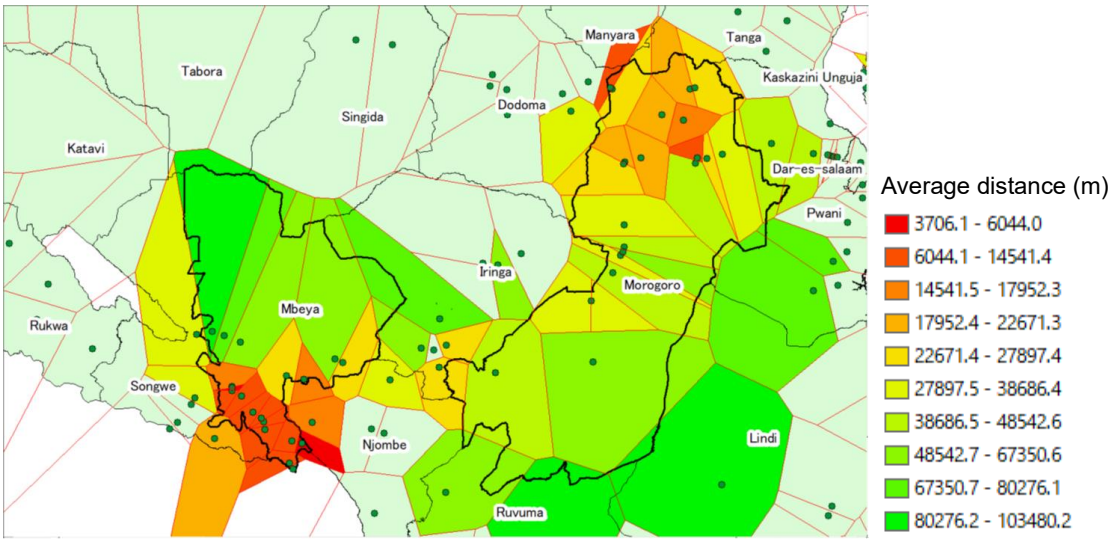

Figure 4: Distance distribution using Voronoi diagram

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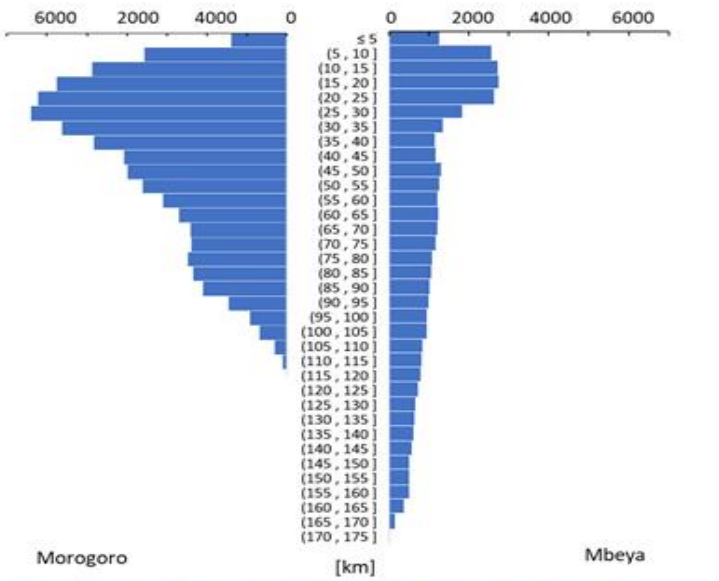

Figure 5 Histogram of distance distribution

Cost estimation for soap production in rural rice cultivation areas

The change in the weight of rice during hulling and milling, and due to the lipid content of rice bran were examined through actual gravimetric measurements. The lipid content was quantified by acidolysis. Although Africa has several brands of rice, we considered the widely distributed New Rice for Africa (NERICA), which was developed to improve its food situation. This study revealed that brown rice constituted 78.5% of the paddy produced; bran constituted 7.8% of the brown rice and lipid constituted 21.6% of the bran (Table 2).

Table 2 Weight ratio of NERICA paddy

Content ratio [%]			
Paddy rice	Brown rice	Rice bran	Rice bran oil
100	78.5	6.1	1.3

By tracing the cold process of soap production, we found that 86 g of oil and 11 g of caustic soda were required to produce one piece (100 g) of soap. The raw material and fuel prices are summarised in Table 3 for the studied areas (Morogoro and Mbeya), including Dar es Salaam, which was analysed in the benchmark study analysing the small-scale soap production in urban areas.

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Table 3 Materials and fuel prices

Item	Unit	Rural areas		Urban area
		Morogoro	Mbeya	Dar es Salaam
Sunflower oil	TZS/kg (US$/kg)	-	-	6500 (2.8)
Palm oil	TZS/kg (US$/kg)	-	-	2300 – 2800 (1.0-1.2)
Caustic soda	TZS/kg (US$/kg)	3600 – 6000 (1.6-2.6)	4000 – 6500 (1.7-2.8)	1100 (0.5)
Diesel	TZS/kg (US$/kg)	2300 – 2400 (1.0-)	2300 – 2400 (1.0)	-

US$1=TZS2,300 (2022/01/25)

The prices of raw materials and fuels were determined based on market surveys conducted in each region in 2021, and the production volume is assumed to be 20,000 units per month (2 tons), based on the benchmark study. In Dar es Salaam, the price of raw materials is low, indicating that the procurement of raw materials for this industry is advantageous. In Arusha and Mwanza, which are classified as urban areas, the procurement price of sunflower oil was TZS 4,000 – 5,000/L while that of caustic soda was approximately TZS 4,000 – 5,000/kg. We found that business was more lucrative in Dar es Salaam than in the provincial cities.

As the Morogoro region produced 572,884 tons of paddy rice in 2019–2020 (The United Republic of Tanzania, 2021), its oil production capacity is estimated to reach 7,400 tons per year. As it takes approximately 1,700 kg of vegetable oil to manufacture 2 tons of soap, 20 tons of rice bran oil are consumed annually. Thus, we assume that there is sufficient rice bran oil in stock for neighbouring farmers to manufacture soap as a side business.

When rice farmers in the Morogoro region manufacture soap from rice bran oil, they must procure raw materials from the nearest urban centre, where they can also distribute their products to various stores. According to the farmers, a canter truck capable of carrying a 2-ton load was used for transportation, and its fuel consumption was set at 3.25 km/L based on the field hearing (3.0–3.5 km/L). We assume that the soap is transported during the outward trip, and the raw materials for soap are transported during the return trip. Further, the cost of producing 2 tons of soap in the Morogoro area was estimated to be TZS 853,000–1,380,000 (Table 4). All soap production was assumed to be performed manually; thus, equipment and operation costs were not considered.

Similarly, the maximum oil extraction volume from the paddy harvest in Mbeya was estimated to be 3,200 tons. Based on a market survey conducted in Mbeya, the cost of producing 2 tons of soap per month was determined to be TZS 965,000– TZS 1,520,000 (Table 4). Even in the most distant case, with a one-way travel distance of 170 km, the transportation cost is estimated to be TZS 270,000 and the soap production cost is TZS 1,700,000.

For comparison, the cost of soap production in urban areas (Dar es Salaam) is also shown in Table 4. In this case, less expensive palm oil was used as the raw material. Although Dar es Salaam has better access to raw materials, the cost of soap production was relatively high.

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Table 4 Soap production cost

Item	Unit	Rural areas		Urban area
		Morogoro	Mbeya	Dar es Salaam
Palm oil	TZS (US$)	-	-	3900000 (1700)
Caustic soda	TZS (US$)	790000 – 1300000 (340-560)	880000 – 1400000 (380-610)	230000 (100)
Transport (Diesel)	TZS (US$)	61000 (26)	85000 – 89000 (37-39)	-
Production cost	TZS (US$)	850000 – 1400000 (370-610)	970000 – 1500000 (420-660)	4200000 (1800)

US$1 = TZS 2,300 (As of 25th January 2022)

Business strategy for soap manufacturing in rural areas

As shown in Table 4, because the cost of vegetable oil is a dominant production factor, soap production is more profitable for farmers who can produce oil, compared with soap makers from urban areas who must buy it. Even if the profit margin is expected to be 30%, the cost of soap produced at 2 tons per month can be kept below TZS 2,000,000. Although rural soap production is burdened with transportation costs, the unit (1 piece = 100g) cost of soap production is estimated to be TZS 85, which is competitive with the unit cost of soap in urban areas, even when the most disadvantageous geographical conditions in Mbeya were chosen. Similar estimates are valid for many rice-growing areas in south-central Tanzania. In areas where transportation costs are low, such as the Morogoro region, the soap manufacturing business might be even more profitable.

Based on these findings, soap production in rural areas has several advantages, and soap production using rice bran oil is expected to have added value. As rice bran oil contains rare active ingredients, soap made from it can be sold as a high-end cosmetic soap. As most soaps distributed in Tanzania are made from sunflower or palm oil, those derived from rice bran oil may be marketed as a luxury products. In urban areas, people's preference for luxury and health is expected to increase as modernisation progresses, and such a trend may be especially pronounced in the cosmetics industry. Combined with adequate marketing, soap production using rice bran oil constitutes a feasible business model that would ensure profitability for rural rice farmers.

CONCLUSION

In the rice-growing areas of south-central Tanzania, the travel distance to the nearest emerging urban centre was over 100 km in some cases. Thus, for soap production in rural areas, transportation costs associated with procuring raw materials and travelling to urban areas to distribute the product were hypothesised to be a considerable burden. However, as the unit price of raw oil is the dominant factor in soap production, this study found that soap production is profitable even after factoring in transportation costs. Notably, the transportation load needs to be strictly evaluated according to the local infrastructure conditions, given that his study assumed a straight-line distance.

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Rice and oilseeds, the raw material for vegetable oil, are primarily grown in tropical regions, such as Africa and Southeast Asia. As the production of edible oil generates a certain amount of substandard waste, rice bran oil can be procured for producing soap without interfering with the food production process. The present study concludes that the commercialisation of local agricultural residues could be a profitable side business for farmers in developing countries where rice is a staple crop, and not only in rural Tanzania, provided they are equipped with the necessary entrepreneurial skills.

Such utilisation of agricultural residues also contributes to the reduction of CO_2 emissions and is highly valuable in terms of resource recycling thus creating a virtuous cycle in society. Overall, the business strategy proposed in this study can be applied to similar contexts and other products that utilise agricultural waste to improve the entrepreneurship potential of rural areas and reduce the urban-rural divide.

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