

## RESEARCH ARTICLE

### Value Chain analysis of underutilized economically potential plants in Sri Lanka: A special reference to *Moringa oleifera*


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#### ABSTRACT

*Although Moringa oleifera is identified as a nutrient-dense, superfood with increasing demand in the international market, it is recognized as an underutilized plant in Sri Lanka with vast potential to improve rural income. Thus, the objective of this study is to identify the existing potential of the plant, to act as an income generator. Value chain analysis was done qualitatively, in order to map the existing value and to identify main actors, channels and constraints along value chains. Dry and intermediate ecological zones were selected and a total of 47 participants were drawn purposively, and interviewed through face-to-face interviews and telephone conversations in order to gather primary data needed. Two value chain maps were identified related to leaf and pod – based products and exporters add a considerably higher amount of value to products. Leaf collector was identified as an actor who arbitrary gains higher profits with a little value addition. It is concluded that even though there is a high potential and return for M. oleifera based products, the communication gap among actors in the value chain and lack of awareness among local consumers hinder the possible income generation.*

**Keywords:** Actors, Mapping, Moringa, Value addition, Value chain

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#### INTRODUCTION

The World Health Organization (WHO) has identified traditional medicines as one of the major approaches for solving the health issues of expanding coverage of health services in 21<sup>st</sup> century (WHO, 2019). Thus the rising awareness of the therapeutic value of Moringa-based products and the increasing demand for dietary supplements have projected to expand the Moringa market size to USD 9.4 billion, growing at a CAGR of 8.9 % by 2027 (MRFR, 2021).

*Moringa oleifera*, which is commonly known as “The Miracle Tree or The Tree of Life” is a nutrient-dense, superfood due to the existence of a variety of essential phytochemicals in its pods, leaves, bark, roots and seeds. Moringa leaves are a rich source of minerals like potassium, calcium, iron, copper, zinc and magnesium. Vitamins like A ( $\beta$  carotene), B (folic and nicotinic acid), C, D, E,

phytochemicals like sterols, tannings, alkaloids, flavonoids, anti-cancerous agents like glucosinolates and isothiocyanates also present in *M. oleifera* leaves. Moringa pods are an excellent source of dietary fiber, potassium, magnesium, and vitamin B<sub>6</sub> and C. Thus, *M. oleifera* is an effective remedy for malnutrition (Gopalakrishnan *et al.*, 2016).

*M. oleifera* has been identified as a remedy for more than 300 diseases including diabetes, cancers, anemia, neutralize free radicals and enhance lactation. It has the ability to reduce the acidity in gastric ulcers by 85.13 % to 86.15 % hence, can be utilized as an antiulcer agent. Generally, herbalists recommend the HIV patients to include Moringa in their diet in order to boost their immunity (Gopalakrishnan *et al.*, 2016). Further, according to the studies, seeds of *M. oleifera* have been identified as an effective antibacterial agent and has the ability to fight against bacteria like *Vibrio cholera*, *Bacillus subtilis* and *Staphylococcus aureus* and do water purification (Viera *et al.*, 2010).

Sri Lankans have used Moringa since ancient times and thus, is not new for Sri Lankans as for the rest of the world. As Sri Lanka has the ideal temperature (25°C – 35°C), altitude and soil type for the optimum growth of *M. oleifera*, Sri Lanka is regarded as one of the world's finest suppliers of Moringa (MTO, 2021). Despite the vast economic potential and usefulness of *M. oleifera*, research into its utilization and commercialization opportunities in Sri Lanka is limited. The recent expansion in Moringa value-added commodities indicates the necessity of examining its value chain for potential industrial developments.

Value chain refers to the whole spectrum of operations and actors engaged directly or indirectly in moving agricultural commodities from input suppliers to farmers' fields, and eventually to the consumer's plate. Value chain analysis aid in identifying the relationships between chain players and the manner in which trade occurs. The value chain approach provides a clear picture of the value creation process. The value chain map demonstrates how commodities move from farm to fork as well as how the industry operates (Kavithambika *et al.*, 2020). Thus, value chain analysis and mapping are useful for stakeholders who are involved in it, in decision making.

The underlying objectives of this study were to identify the existing potential of Moringa as an underutilized medicinal crop, to identify the actors involved in the value chain of *M. oleifera* in Sri Lanka and to map and identify the channels as it is not done in Sri Lanka yet, amount of value added and margins gain by each actor along the value chain process. Further, this study focused on identifying the gaps, constraints and mismatches along the existing linkages of the value chain in order to recommend effective and efficient ways of strengthening it.

## MATERIALS AND METHODS

### Selection of the Study Area

Moringa is known to be well established in dry and dry parts of the intermediate climatic zones with temperature of 25°C to 35°C and up to 1000m elevation from mean sea level (MTO, 2021). The predominant soil types in these areas include Reddish Brown Earth, Low Humic Glay and Regosols soil. Thus, the study was carried out in North Central, Central, Uva, North and Western provinces capturing the commercial and household level farmers and all the other stakeholders in the value chain who were engaged with Moringa leaves and pods products.

### Selection of Sample and Data Collection

As this study includes a qualitative approach of Value Chain Mapping on Moringa, a total of 47 actors were constituted in the study. The actors were drawn purposively including 11 commercial level farmers, 08 household level farmers, 05 collectors, 06 processors, 04 wholesalers, 07 retailers, 04 exporters and 02 experts from Department of Agriculture (DoA). Consumers were excluded because the main concern of the study was to identify the value added by each stakeholder along the value chain up to consumer.

The study relied on primary data. Semi structured open-end questionnaires were used to gather information needed from each actor in the value chain. After preparing the first set of questions, a pilot study was conducted in Western province with the aim of identifying the feasibility of the study and in order to omit errors and to modify the questionnaire. After the modification, face-to-face interviews and telephone conversations were carried out to gather primary data from the sample respondents. Experts from DoA were also interviewed additional to the main actors in the value chain in order to identify the support from the supporting channels. The collected primary data include: cost of production, revenue generated, quantity of products produced and constraints and opportunities in the market.

### Data Analysis

The processes in the value chain were represented using a flow chart and the actors involved, core processes and product flow were determined. Cost-benefit analysis was done in order to determine the amount of value added by each actor along the value chain. MS Excel was used to compute the value addition and gross profit percentages. The amount of value addition was measured by,

$$VA \left( \frac{Rs}{kg} \right) = \text{Selling Price} - \text{Unit Cost} \quad (1)$$

Additionally, the percentage of gross profit margin was calculated as follows.

$$GPM\% = \frac{TR_i - TVC_i}{TR_i} \times 100 \quad (2)$$

Where, GPM is the gross profit margin percentages of actors,  $TR_i$  is the total revenue of actors (Rs/kg),  $TVC_i$  is the total variable cost of actors (Rs/kg) and  $i$  denotes  $n$  actors in the value chain.

## RESULTS AND DISCUSSION

### Value Chain Map (VCM)

Figure 01 illustrates the value chain map for Moringa leaves. *M. oleifera* leaf cultivation is significantly done at commercial level but, a small number of household level farmers are also engaged in it. Generally, most of the farmers sell their production directly to the processors or sell to the intermediaries like collectors in order to move towards value additions. But some farmers sell their fresh leaves directly to retailers or to the intermediaries like wholesalers and collectors in the local market.

There are different levels of processors in the value chain such as primary and high-end processors. Some of these high-end processors buy processed raw materials from primary processors, rather than buying fresh leaves directly from farmers or collectors and add more value to the product. There are different types of value-added products in the market like Moringa powder, herbal/green tea, capsules, dried leaves, and string hopper flour.

They use simple or complex technologies like encapsulation, driers, sieving and mixing machines to produce these products. Processed products move towards retailers or to exporters. Fresh leaves are sold by the retailers in the fair and grocery stores and the value additions are moving towards the retailers like supermarkets, pharmacies, grocery stores and trade shops conducted by Spice Board. There's an increasing demand for *M. oleifera* based cosmetic and micro-encapsules but exporters couldn't cater to it yet due to a lack of investment and the high cost of production. Further, the study implies that most of the farmers have started leaf farming under the influence of enabling actors like SAPP and Modernization projects.

According to the studies carried out throughout the provinces, 08 marketing channels were identified related to Moringa leaf-based products in Sri Lanka.

Channel 01: Input suppliers – Farmers – Retailers –Consumers.

Channel 02: Input suppliers – Farmers – Wholesalers – Retailers – Consumers.

Channel 03: Input suppliers – Farmers – Collector – Wholesalers – Retailers – Consumers.

Channel 04: Input suppliers – Farmers – Processor – Exporter – Consumer.

Channel 05: Input suppliers – Farmers – Processor – Retailers – Consumers.

Channel 06: Input suppliers – Farmers – Collectors – Processors – Exporters.

Channel 07: Input suppliers – Farmers – Primary processors – High-end processors – Retailers – Consumers.

Channel 08: Input suppliers – Farmers – Primary processors – High-end processors – Exporters.

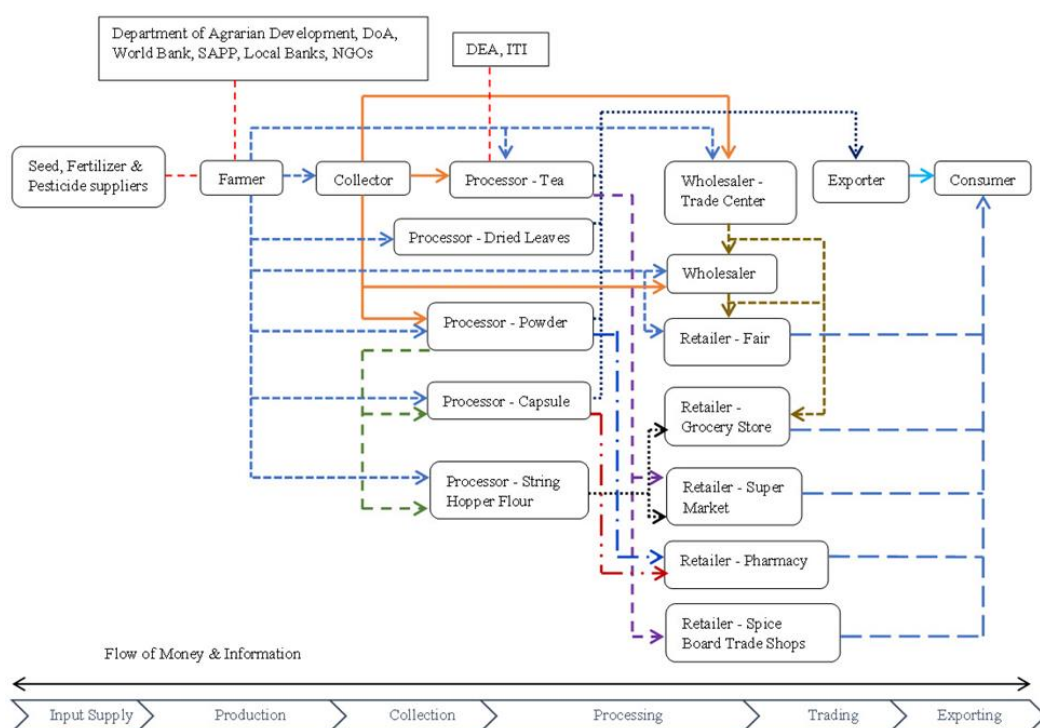


Figure 1: Value chain map of *M. oleifera* leaves

Figure 02 illustrates the value chain map for Moringa pods. Moringa pods cultivation is done mainly focusing the local market. Due to the seasonality of the crop, actors cannot engage in income generation throughout the year.

Even though most of the farmers engage in the production in commercial level, there are considerably high amount of household level farmers who sell pods in

the local market as well. Farmers sell their products directly to retailers or go through the intermediaries in the local market. Number of value-added products that have been engaged with pods are comparatively low and Moringa pods in brine is done as a value addition. Processors mainly export these products to the international market as local consumers prefer fresh pods over processed ones, thus, only a limited amount of brine products can be seen in local market. Support from the enabling actors is limited in Moringa pods cultivation. Farmers in the North province acquire support from the NGOs than farmers in other areas.

There are 05 major channels with related to the *M. oleifera* pods in Sri Lanka.

Channel 01: Input supplier – Farmer – Retailer – Consumer.

Channel 02: Input supplier – Farmer – Wholesaler – Retailer – Consumer.

Channel 03: Input supplier – Farmer – Collector – Wholesaler – Retailer – Consumer.

Channel 04: Input supplier – Farmer – Processor – Exporter – Consumer.

Channel 05: Input supplier – Farmer – Processor – Retailer – Consumer.

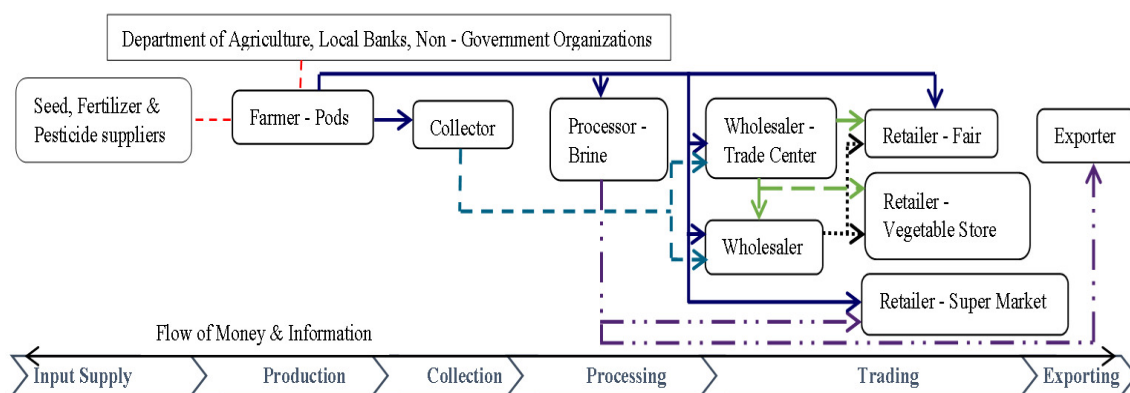


Figure 2: Value chain map of *M. oleifera* pods

### Value Addition and Profitability of Actors in the Value Chain

**Farmers** - Farmer is identified as the initial and one of the most valuable actors in both value chains who added a considerable amount of average value addition to the product. Farmers add average of Rs. 27.25, as value to fresh Moringa leaves. Their Value Addition (VA) varies within a range of Rs. 18.72 to 33.82. Average

Gross Profit Margin (AGPM) is 47.01 % and vary in a range of 41.67% to 53.48%. The deviations in the value addition and profit margins are due to the differences in selling prices and costs that occur in the cultivation.

Due to the seasonality of the crop, prices and the yield of the pods fluctuates throughout the year. Therefore, a sensitivity analysis was done considering highest and lowest prices and quantities of pods gain by the farmers.

Table 1. AVA & AGPM% of pods farmers resulted by the sensitivity analysis

	HP : HQ	HP : LQ	LP : HQ	LP : LQ
AVA	232.82	230.17	47.81	45.16
AGPM	89.5	88.46	45.78	41.32

AVA: Average Value Addition (Rs/kg), AGPM%: Average gross profit margin%, H: High, L: Low, P: Price, Q: Quantity

According to the analysis, AVA varies from Rs. 45.16 to 232.82 in a VA range of Rs. 4.75 to 242.94. AGPM varies from 41.32% to 89.5 % at a range of 9.82 % - 90.64%.

**Collectors** - According to the computed value addition, collectors who deal with the local market add Rs. 276 as AVA for 1kg of fresh leaves and gain 78.86% as AGPM. Collectors who connect with processors get Rs.27.83 AVA in a range of Rs. 12.66 to 43.33 and gain 35.91% of AGPM. AVA of pod collectors has resulted in Rs. 99.8, with a 28.51% AGPM. Thus, leaf collectors in the local market gain the highest profit and pods collectors gain lower profit than others.

**Processors** - As actor who changes the form of fresh leaves, processors' AVA of Moringa tea is Rs. 398 and AGPM is 24.05%. Moringa powder processors do Rs. 450 as AVA, and gain 45% AGPM. Dried leaves processors add Rs. 325 AVA, and have 25% AGPM. In capsulation, AVA is Rs. 370 and AGPM is 31.62%. String hopper processors do Rs. 40 of AVA, and have 16.67% of AGPM. AVA of a Moringa pods in brine is about Rs. 46.67. AGPM of the processors are around 9.09%. When comparing the value additions related to *M. oleifera*, highest value addition and gross profit can be seen in Moringa leaf powdering.

**Wholesalers** - Wholesalers add average of Rs. 75 as value to the fresh leaves. Thus, they gain 22.91% of AGPM from it. Wholesalers buy highest quantity of pods when the price is low. AVA is around Rs. 10.79 and AGPM is 12.55%. Though, AVA is high when price is high and buying quantity is low (Rs. 52.2), AGPM is low at that time compared to when price is low (7.57%). Thus, wholesalers gain highest return at the *M. oleifera* season, even the amount of VA is low when compared to that at off season.

**Retailers** - Retailers at fair add Rs.100 as AVA to the fresh leaves sell in the local market. Thus, they gain a 20% of AGPM from it. Pharmacists gain 10% of AGPM from both *M. oleifera* leaf powder and capsules while adding AVA of Rs. 320 and Rs. 130 respectively. Supermarkets gain 30% AGPM from both string

hopper flour and tea while adding Rs. 120 and Rs.600 AVA to it. Grocery stores add Rs. 100 of AVA and gain 25% of AGPM from string hopper flour. When price is high and buying quantity is low, pods retailers at fair add Rs. 80 AVA and gain 28.57% AGPM while grocery stores add Rs. 182.5 AVA and gain 19.77% AGPM. When price is low and quantity is high, AVA of fair is around Rs. 50 and AGPM is 33.33% while at grocery stores, those values are Rs. 40 and 32.63%.

**Exporters** - In most cases, exporters done a dual role as processors and exporters. They add Rs. 2798 AVA and gain 70.82% AGPM from tea exportation. Exporters do Rs.1900 AVA for leaf powder and gain 74.44% AGPM. AVA of capsule is Rs. 3500 and AGPM can be seen as 77.78%. Pods processors add Rs. 233.33 AVA and gain 33.33% of AGPM from brine. These margins may be fluctuated due to the price and quality requirements of buyers.

Figure 3 and 4 show a summary of average value addition and average gross profit margins obtain by each actor in both value chains. Even though the values might be biased as data is collected on selective mode with only 47 participants, it is giving a general idea on how value is divided among the actors. It was difficult to the actors to calculate their depreciations, opportunity cost and etc. Further some actors might have been biased on answering the questions such as about loans, opportunity costs, inflation, technological and environmental impact and etc. Thus, gross margins were calculated instead of net margins.

According to figure 3, exporters add the highest average value through Moringa leaf capsules. Leaf collectors gain arbitrary higher profit margins even with a little value addition. Leaf farmers gain a considerable higher amount of gross profit margin for the value addition they do.

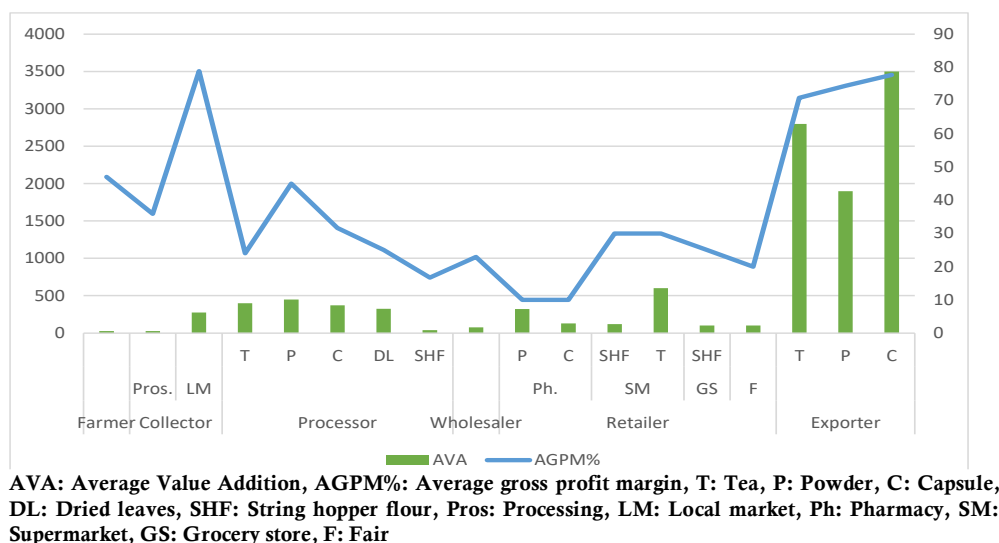
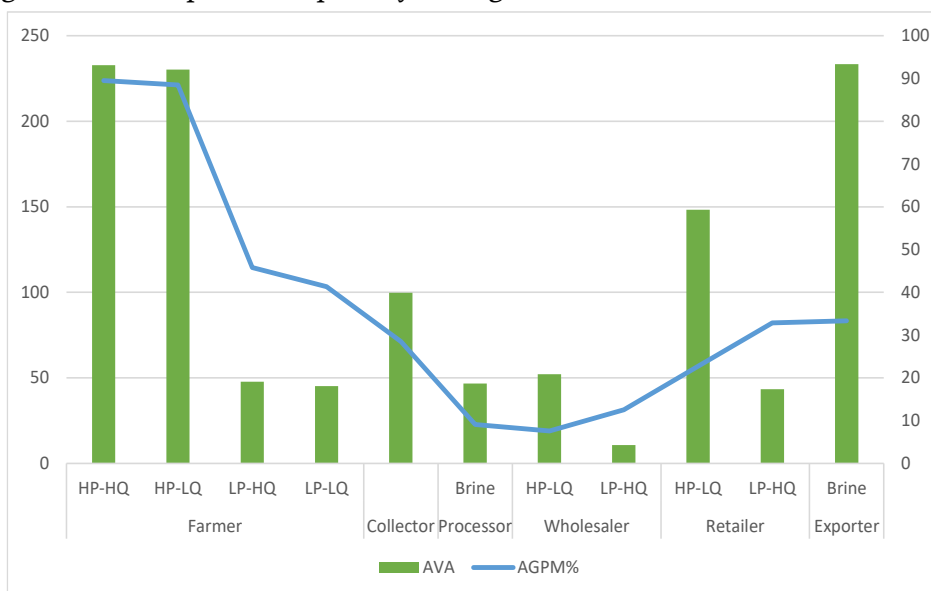


Figure 1. AVA & AGPM% of each actor in *M. oleifera* leaf value chain



According to the figure 04, exporters add the highest average value through brine production. Farmers add the highest average value and gain highest gross profit margin when both price and quantity are high.



AVA: Average value addition (Rs/kg), AGPM%: Average gross profit margin%, H: High, L: Low, P: Price, Q: Quantity

Figure 2: AVA & AGPM% of each actor in *M. oleifera* pods value chain

### Shortcomings and Constraints

Due to the scarcity of buyers and improper price mechanisms, farmers face difficulties in selling leaves. Most of the farmers at ground level face difficulties while obtaining the inputs needed such as fertilizer and water irrigation due to the limitation of these inputs in their specific areas. Lack of communication among actors was identified as a major drawback in the leaf value chain as most of the farmers didn't aware of other buyers in the area even though they were able to provide more output, thus, they were concentrated on one buyer. On the other hand, even though processors need more input for production, they were restricted as they did not have enough supply and they were unaware of other farmers in the area. Another factor is that, the leaf collectors in the local market arbitrary gain a higher margin than the others in the value chain. The overall support provides by the government bodies is considerably low compared to other crops.

Although most of the processors prefer to move towards new value additions, there is a limitation in investment. Exporters face difficulties regarding pricing as

countries like India auction value additions at a lower price to the international market. But, due to the higher cost of production, Sri Lankan exporters couldn't offer products at a lower price. The awareness among local consumers related to the nutritional and medicinal properties of *M. oleifera* is considerably low. Moreover, as the income level of local consumers is relatively low, processors face difficulties when introducing new products to the local market.

## CONCLUSION

Analyzed data implies that exporters add the highest value in both value chains. Leaf farmers gain a considerable amount of profit margin referring to the value they add thus *M. oleifera* leaf farming can be identified as an advantageous cultivation. Therefore, although *M. oleifera* is identified as an underutilized medicinal crop, there is a massive potential for income and employment generation. As leaf collectors in the local market arbitrarily gain higher profits even with a minimum amount of value addition, proper price mechanisms should be implemented to overcome this. All the stakeholders, public and private institutions should be collaboratively engaged in value chain, in order to reduce the communication gap and enhance the value chain activities. As studies on Moringa are less in Sri Lanka, further studies should be done on consumer perception and awareness on *M. oleifera* based products in order to enhance the *M. oleifera* value chain.

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