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CIRCULAR ECONOMY APPROACH TO ARTISAN SOAP PRODUCTION: LOGISTICS AND FINANCIAL FEASIBILITY USING RECYCLED COOKING OIL

Fabiola Sánchez-Galván[1], Azalia Guadalupe Melo Azuara[2], Carmen Karelly Pro-Torres[3] and Karla Lissette Silva-Martínez[3]

[1]Maestría en Ingeniería Industrial, Tecnológico Nacional de México/Instituto Tecnológico Superior de Tantoyuca. Tantoyuca, Veracruz, México.
fabiola.sanchez@itsta.edu.mx

[2]Maestría en Ingeniería Industrial, Tecnológico Nacional de México/Instituto Tecnológico Superior de Tantoyuca. Tantoyuca, Veracruz, México.
m233s0003@itsta.edu.mx

[3]Ingeniería ambiental, Tecnológico Nacional de México/Instituto Tecnológico Superior de Tantoyuca. Tantoyuca, Veracruz, México.
karelly.pro@itsta.edu.mx

[4]Maestría en Producción Pecuaria Tropical, Tecnológico Nacional de México/Instituto Tecnológico Superior de Tantoyuca. Tantoyuca, Veracruz, México.
karla.silva@itsta.edu.mx

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ABSTRACT

This study presents a circular economy approach to artisan soap production using recycled cooking oil as the primary raw material. The business model was developed under the CANVAS framework and integrated with quantitative optimization methods to design an efficient supply chain. The p-median method and the Capacitated Vehicle Routing Problem (CVRP) were applied to identify optimal collection points and minimize travel distances in the logistics process. Financial feasibility was assessed through an analysis of initial investment, production costs, selling price, and profit margins. Results indicate that the model is technically viable, economically profitable, and environmentally sustainable, with a return on investment (ROI) achieved in approximately five months. This integrated approach demonstrates how waste valorization can contribute to sustainable entrepreneurship, local economic development, and environmental conservation, highlighting its potential for replication in other regions

KEYWORDS: Circular economy, Optimization, Sustainability, Sustainable supply chains.

1. INTRODUCTION

Sustainability has become one of the main axes of innovative business models, requiring designs adapted to today's environmentally and socially conscious world. One recurring environmental issue

in both households and commercial enterprises is the improper disposal of used cooking oil (UCO). Studies indicate that a single liter of oil discharged into drainage systems can pollute up to 1,000 liters of freshwater, underscoring the urgency of finding sustainable solutions [1–3]. This waste stream contributes significantly to soil and water contamination, yet it represents an underutilized resource that can be valorized within circular economy frameworks.

Recent research demonstrates that soap production from UCO not only reduces environmental pollution but also results in biodegradable and cost-effective products suitable for domestic and commercial markets [4]. Additional valorization strategies, such as incorporating orange peels or coffee grounds, further enhance product properties and consumer acceptance [5]. These initiatives align with circular economy principles by reintroducing waste into the production cycle, transforming it into a value-added product [6]. However, while several case studies, such as municipal UCO collection in Semarang, Indonesia, highlight the feasibility of implementing efficient collection and processing systems [7], their replication in Latin America remains limited.

Beyond the production process, the design of a functional logistics network is critical. Literature emphasizes methodologies such as the p-median model for optimal placement of collection points and vehicle routing problem (VRP) approaches to minimize both costs and environmental impacts [8]. Reverse logistics models with simultaneous pickup and delivery further reinforce the integration of waste recovery into supply chain design [9]. Nonetheless, most existing studies prioritize biodiesel or industrial-scale valorization of UCO [10], while artisanal soap production combined with financial feasibility analyses is still underexplored.

This study addresses that gap by proposing an integrated methodological framework. Its theoretical foundation relies on the Business Model Canvas to assess both strategic and operational dimensions, while its quantitative component evaluates financial viability under different scenarios. By combining reverse logistics, artisanal soap production, and cost–benefit assessment, the framework contributes to consolidating replicable, community-based sustainable production systems adapted to the Latin American context.

2. METHODOLOGY

2.1 Type of Research

This study is classified as applied research, as it seeks to provide a concrete solution to the inadequate management of used cooking oil residues and the need to generate sustainable entrepreneurial alternatives. The purpose is to design a business model that is not only economically viable but also environmentally and socially responsible, by promoting the reuse of used cooking oil through the production of artisanal soap.

A mixed-methods approach was adopted, integrating both qualitative and quantitative techniques to address the problem comprehensively. The qualitative component was employed to analyze perceptions, practices, and experiences of key actors in the value chain, such as artisanal producers, waste managers, and consumers. The quantitative component was applied to obtain objective, measurable data to validate the feasibility of the proposed model, including financial analysis, potential

demand estimation, and economic projections. The combination of these approaches enabled data triangulation, thereby strengthening the validity and reliability of the results.

2.2 Methodological Design

The methodology was structured in two major phases: Diagnosis and Modeling, each aligned with the specific objectives of the research.

a) Diagnosis Phase

A comprehensive literature review was conducted, collecting and analyzing scientific literature, academic articles, case studies, environmental regulations, and technical documents on circular economy, sustainability, waste valorization, sustainable supply chains, and business models (particularly the Business Model Canvas). This review provided the theoretical foundation and contextual framework for the development of the proposed model.

b) Modeling Phase

In this phase, the technical, logistical, organizational, and financial components of the business model were designed.

Supply Chain Design: A detailed flow diagram of the production process was constructed, spanning from the collection and storage of used cooking oil to the commercialization of artisanal soap. The flow included stages such as collection, filtering and treatment, production, packaging, and distribution, while identifying actors, required inputs, control points, and estimated operating times.

Logistics Network for Collection: A sustainable logistics network was designed to optimize the collection of used oil from food establishments in Tantoyuca, Veracruz, selected as the pilot zone. The p-median model was applied to determine the optimal location of collection centers, minimizing distances and costs. Subsequently, the CVRP method was employed to optimize collection routes. Both models were solved using the Lingo software.

Sustainable Business Model: Based on the diagnostic and logistics results, a business model was developed using the Business Model Canvas, adapted with sustainability criteria. This included the value proposition, customer segments, distribution channels, customer relationships, revenue streams, key activities, key resources, strategic partners, and cost structure. Each component was evaluated under economic, social, and environmental sustainability criteria, ensuring the model's feasibility within the framework of the circular economy.

Financial Feasibility Study: A pilot test involving the production of small soap batches was conducted to evaluate the financial feasibility of the proposed model. From this trial, key financial indicators were calculated, including estimated initial investment, fixed and variable costs, break-even point, and internal rate of return (IRR).

3. RESULTS

3.1 Supply Chain

The supply chain developed for this project represents a sequence of interconnected processes whose

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fundamental purpose is to competitively satisfy customer needs while ensuring environmental sustainability. Each stage contributes to the transformation of used cooking oil into a final product—artisanal soap—by adding value to the overall production system.

The supply chain can be divided into five main stages: collection, transportation, storage and filtering, production, and packaging. These stages collectively establish a circular flow that enables the valorization of waste and its integration into a sustainable business model (Figure 1).

The process begins with the collection of used cooking oil, primarily sourced from restaurants and other food establishments. To ensure a consistent supply, agreements were established with local businesses and reinforced through awareness campaigns aimed at the public, encouraging the proper disposal of waste oil. Collection is carried out using clean, clearly labeled, hermetically sealed containers to guarantee safety and avoid contamination. The frequency of collection depends on the volume generated, which can be weekly, biweekly, or monthly.

Once collected, the oil is transported to storage centers using private vehicles. To minimize costs and maximize efficiency, optimized logistical routes were planned. During transport, containers remain sealed to prevent spills or accidents, ensuring compliance with safety standards.

At the storage centers, the oil undergoes a filtration process to remove solid residues through sieving techniques. The filtered oil is then stored in tightly sealed plastic containers under controlled conditions to preserve its quality until further use.

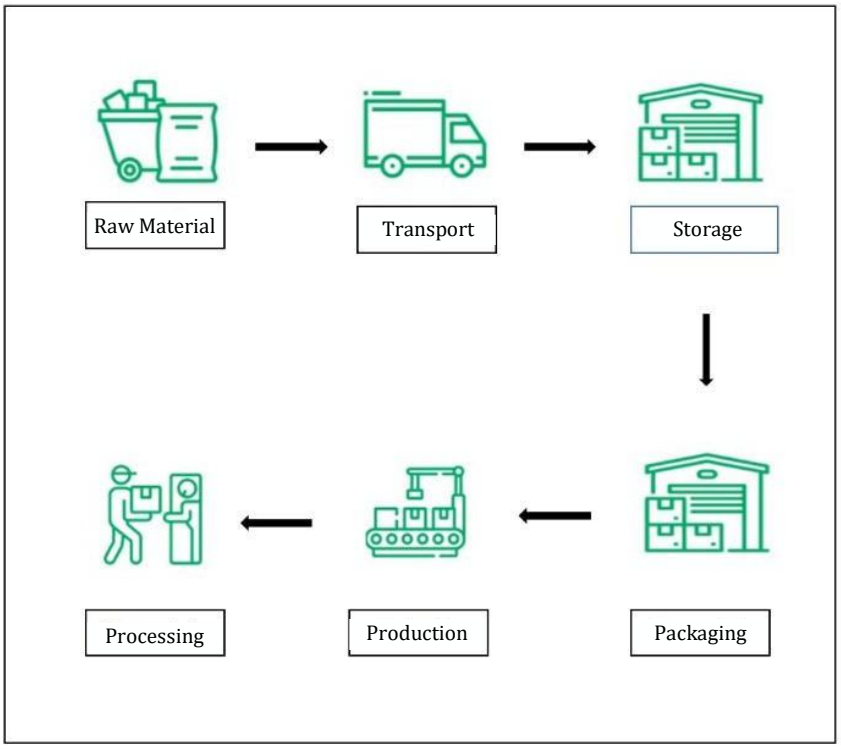

Figure 1: Supply chain diagram for artisan soap production.

The next stage is artisanal soap production, which combines the recycled oil with complementary ingredients such as sodium hydroxide, water, and natural colorants. The production process begins with the measurement and mixing of ingredients, followed by saponification, the chemical reaction between oil and alkali. The mixture is poured into molds and allowed to cure for four to six weeks, during which the soap acquires the desired texture and physicochemical properties. A quality control process is conducted at this stage, including verification of pH, consistency, and fragrance to ensure consumer safety and product uniformity.

Finally, the soap is packaged using eco-friendly materials such as recycled paper, cardboard boxes, and informative labels. This sustainable packaging strategy not only reduces the environmental footprint but also enhances the market value of the product by aligning with consumer expectations for environmentally conscious goods.

Overall, the results demonstrate that the proposed supply chain effectively integrates waste management, sustainable production practices, and value creation. Each stage contributes to the transformation of a high-impact residue into a commercially viable and environmentally responsible product.

The design of the supply chain for artisanal soap production from used cooking oil demonstrates a strong alignment with principles of reverse logistics and circular economy. Previous studies have highlighted that efficient collection and processing of used cooking oil require structured agreements with local stakeholders, including restaurants and food services, to ensure continuity of supply [7]. In this study, the establishment of agreements and awareness campaigns not only guaranteed consistent input availability but also promoted community engagement—an element often underemphasized in technical designs of waste valorization networks.

Transport optimization through route planning was identified as a crucial factor in reducing costs and minimizing environmental impacts. Similar findings were reported by [11] and later by [8], who demonstrated that minimizing logistics costs in collection systems directly enhances the sustainability of reverse supply chains. The inclusion of safety considerations during transport, such as sealed and labeled containers, reflects best practices noted in sustainable waste management literature [10].

The intermediate stage of filtration and controlled storage ensured the quality of the oil prior to production. [4] emphasized that pre-treatment of used cooking oil is essential for consistent saponification reactions and to prevent product defects, reinforcing the robustness of the approach used here. Moreover, the soap production process, which incorporated quality control parameters such as pH and fragrance verification, parallels the findings of [9], who highlighted that artisanal methods can achieve industrially comparable quality when standardized protocols are applied.

Packaging using eco-friendly materials not only reduces the carbon footprint but also responds to consumer preferences for sustainable products. [5] documented that environmentally conscious packaging significantly enhances consumer acceptance and perceived value of recycled-oil soaps, a

finding consistent with the outcomes of this study.

Taken together, these results demonstrate that the proposed supply chain achieves dual objectives: environmental sustainability and economic feasibility. By transforming waste into a commercially viable product, the project adds value to local production systems and fosters community empowerment. This outcome is comparable to other successful case studies in Southeast Asia [7]; [8], but also contributes a novel perspective by adapting the model to the Latin American context, where integrated business models of this kind remain scarce.

3.2 Process of Artisanal Soap Production from Used Cooking Oil

The process of artisanal soap production using used cooking oil can be divided into three main stages: Input, Process, and Output. Each stage is designed to ensure the safe transformation of waste oil into a sustainable and marketable product while maintaining quality standards (Figure 2).

In the Input stage, the raw material is collected, consisting of used cooking oil from local establishments. This oil undergoes a cleaning and treatment phase in which impurities are removed to prepare it adequately for the saponification process. This step is essential to guarantee the safety and stability of the final product.

The Process stage begins with the careful mixing of the treated oil with other required components, such as sodium hydroxide and water. The core reaction, saponification, occurs during this phase, converting the oil into soap. The mixture is then poured into molds, where it takes the desired shape. Once solidified, the bars are unmolded, and their structural integrity is verified.

In the Output stage, the soap bars undergo a curing and drying period to achieve the required consistency and hardness. This curing process not only stabilizes the chemical composition but also enhances the durability and usability of the soap. After drying, the soaps are packaged using eco-friendly materials, making them ready for distribution and commercialization.

Overall, this process highlights the feasibility of transforming a pollutant such as used cooking oil into a value-added product. The results reinforce the potential of this practice as an environmentally

sustainable alternative that contributes to waste reduction and promotes circular economy principles.

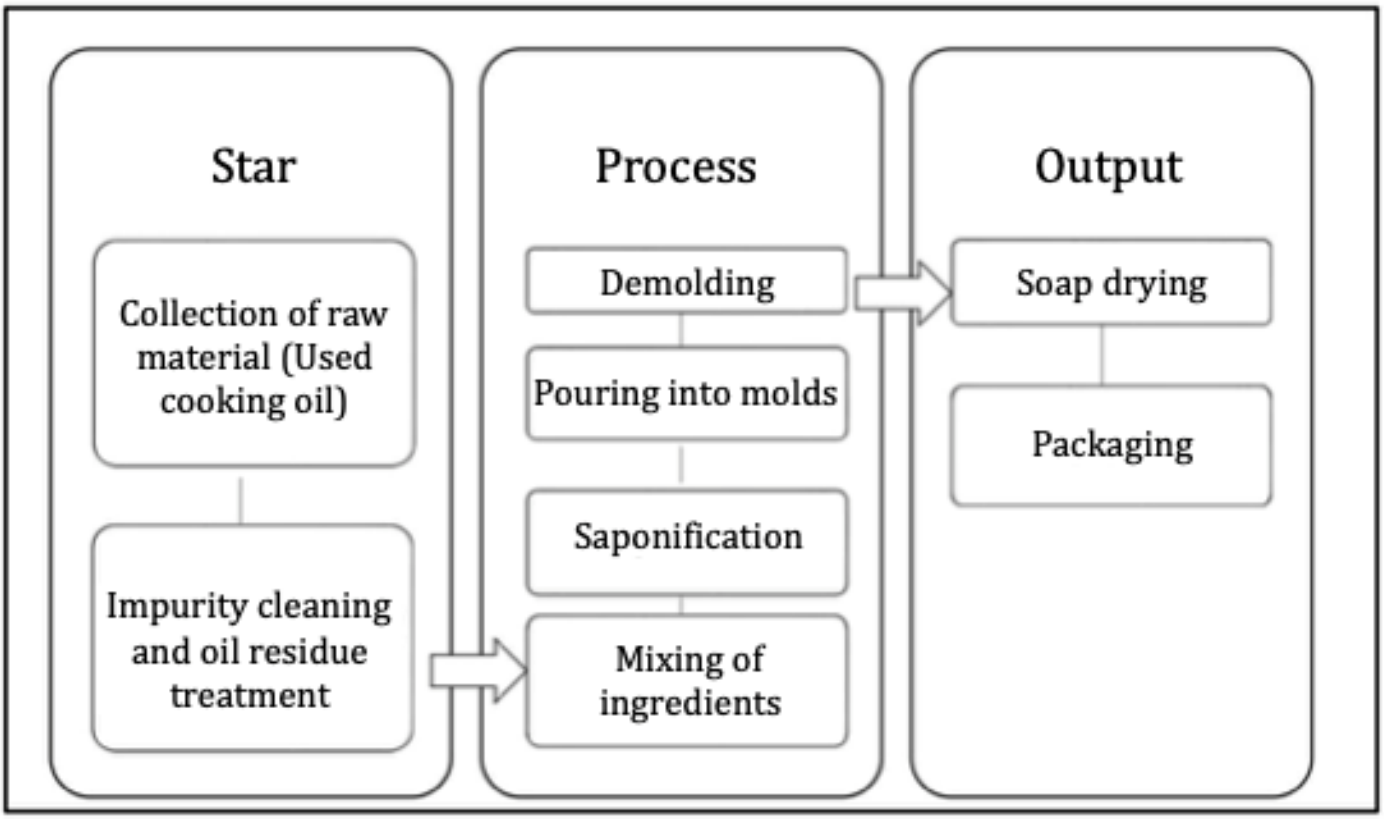

Figure 2: Process diagram for the production of artisan soap from used cooking oil.

The process of artisanal soap production from used cooking oil follows a structured Input–Process–Output model, which ensures both safety and quality of the final product. Several studies have emphasized that the pre-treatment of used cooking oil is a critical step in preventing contamination and ensuring consistency during saponification [4]. In this project, the removal of impurities prior to the chemical reaction mirrors industrial best practices, supporting the notion that artisanal methods can achieve comparable quality standards when properly standardized.

The saponification process is widely documented as the most efficient method for valorizing waste oil into biodegradable products [9]. By incorporating sodium hydroxide and water in controlled proportions, the transformation of waste into soap becomes a reproducible process that maintains structural integrity and consumer safety. [5] highlighted that when complemented with natural additives, this process not only yields environmentally friendly soaps but also enhances functional properties such as antioxidant capacity and cleansing performance.

The curing stage plays an equally important role, as it determines the physicochemical stability and usability of the soap. Research by [7] and [10] points out that adequate curing periods reduce free alkali content and improve durability, thereby aligning artisanal production with recognized quality

benchmarks. The use of eco-friendly packaging further integrates the product into a circular economy model by minimizing post-consumption environmental impact. Similar findings have been reported by [8], who noted that sustainable packaging practices increase consumer acceptance and market value of recycled-oil soap.

Overall, these results demonstrate that the Input–Process–Output approach not only ensures product quality but also provides a replicable framework for small-scale sustainable enterprises. This finding supports the broader argument that waste cooking oil can be successfully valorized into high-quality, marketable products through low-cost, community-driven processes. At the same time, it addresses gaps in the literature regarding the integration of artisanal methods with sustainability-oriented business models, particularly in developing regions.

3.3 Logistic Network for the Collection of Used Cooking Oil

The implementation of a well-structured logistic network is essential to ensure the efficiency of the proposed business model, which is based on the collection of used cooking oil for the production of artisanal soap. This network encompasses the identification of oil-generating points and their subsequent transport to a centralized collection and processing facility. Within this framework, the municipality of Tantoyuca, Veracruz, was selected as a pilot zone due to its size, commercial density, and potential generation of this type of waste.

In Tantoyuca, multiple food establishments continuously use cooking oil for meal preparation. However, the residues of used cooking oil are often improperly disposed of into the drainage system. To address this problem, a proposal is made for the collection of such waste oil to ensure its proper reuse.

The objective of this work is to develop a route model for the collection of used cooking oil residues in Tantoyuca, employing the p-median method for optimal facility location and the CVRP method for route optimization. These tools allow for the design of an efficient and sustainable logistic network, minimizing costs and distances while promoting the recovery and valorization of used cooking oil for sustainable production.

The design of an efficient logistic network for the collection of used cooking oil represents a fundamental step in ensuring the success of circular economy models applied to waste valorization. Previous research has demonstrated that improperly disposed oil can severely impact drainage systems and aquatic ecosystems, making its recovery a priority in urban waste management [10]. By establishing a structured collection network in Tantoyuca, Veracruz, this study addresses a key environmental challenge while generating a reliable supply chain for artisanal soap production.

The use of mathematical tools such as the p-median model for facility location and the Capacitated Vehicle Routing Problem (CVRP) for transport optimization aligns with methodologies previously applied in the management of municipal and industrial waste. [7] highlighted that vehicle routing with simultaneous pickup and delivery improves efficiency and reduces costs, while also decreasing environmental impacts associated with transport. In the present case, applying such models ensures

that the collection of used cooking oil is both economically feasible and environmentally sustainable.

Similar approaches have been documented in studies on the logistics of waste cooking oil collection for biodiesel and soap production. For example, [8] demonstrated that the integration of reverse logistics systems not only promotes recycling practices but also fosters community participation through knowledge transfer programs. In this context, the proposed logistic network for Tantoyuca offers the dual benefit of creating an efficient resource recovery system while also engaging local businesses and citizens in sustainable practices.

Moreover, the incorporation of optimization models provides scalability to the system. As reported by [11], such models allow for the dynamic adjustment of collection routes and facility placement according to demand and waste generation patterns. This ensures long-term adaptability, an aspect particularly relevant in urban areas with variable growth rates and consumption dynamics.

Overall, the results confirm that the proposed logistic network is consistent with global best practices in reverse logistics and circular supply chains. By combining advanced optimization methods with local socio-environmental considerations, this study contributes a replicable framework that can be adapted to other municipalities seeking to valorize waste cooking oil while minimizing environmental impacts and supporting sustainable production.

3.4 Route Design for the Collection of Used Cooking Oil in Tantoyuca, Veracruz

To minimize travel time and distance in the collection of used cooking oil from different establishments, the following procedure was implemented.

First, ten establishments were identified as collection points using the Google Earth tool, where markers were placed to georeference each establishment along with the volume of oil (liters) generated at each site. Once this information was obtained, a distance matrix was constructed. Using this matrix, the p-median method was applied through the Lingo software to determine the optimal collection point.

After obtaining this point, the distance matrix was restructured to consider it as the starting point of the collection process. This updated matrix was then used to optimize the collection routes. For route optimization, the CVRP was applied using Lingo.

Two scenarios were considered:

1. Vehicle capacity greater than total collection volume (79 liters). Under this condition, a single route was generated covering all establishments without exceeding capacity.

2. Vehicle capacity limited to 40 liters (approximately 50% of total collection volume). This constraint required route restructuring to ensure that the collection process remained efficient while adhering to vehicle capacity limits.

The spatial configuration of these optimized routes is illustrated in Figure 3, which shows both the single-route and two-route scenarios, as well as their corresponding map representations.

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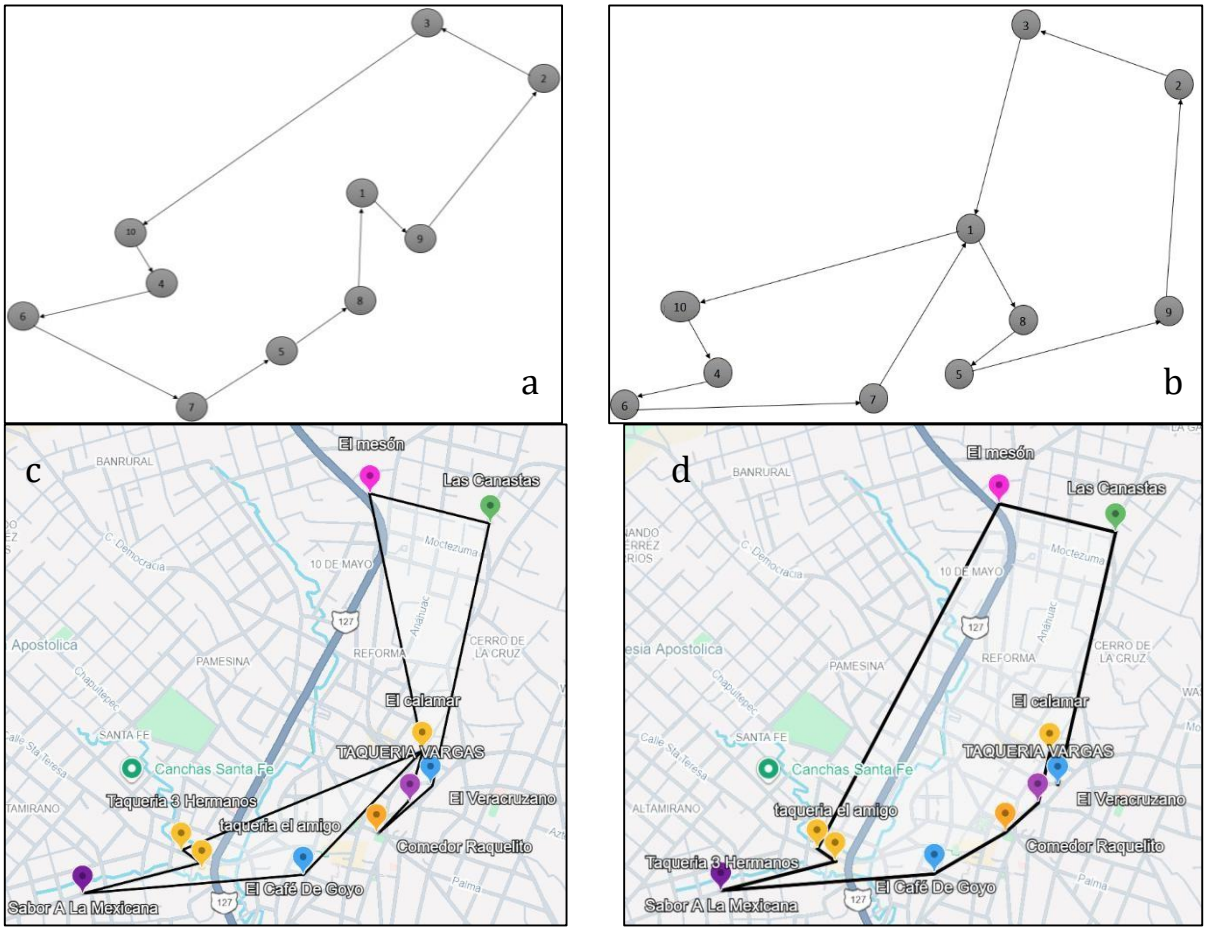

Figure 3: Representation and mapping of the obtained collection routes: (a) single-route collection, (b) two-route collection, (c) single-route collection on map, and (d) two-route collection on map.

The quantitative outcomes of these optimizations are summarized in Table 1, which provides a consolidated view of the performance metrics for each routing scenario. To complement this, Table 2 presents the detailed sequence of nodes visited in each route along with the total distance traveled, allowing for a more precise comparison of operational efficiency under both conditions.

The optimization of collection routes plays a decisive role in enhancing the efficiency of reverse logistics systems for waste valorization. The application of the p-median model and the Capacitated Vehicle Routing Problem (CVRP) in this study enabled the design of both single-route and multi-route scenarios, ensuring flexibility under different vehicle capacity constraints. Similar optimization approaches have been reported in the management of waste cooking oil and other municipal solid waste, highlighting their effectiveness in reducing operational costs and environmental impacts [7].

The first scenario, in which vehicle capacity exceeded the total collection volume, demonstrated the feasibility of consolidating all establishments into a single optimized route. This result aligns with findings by [9], who emphasized that vehicle load maximization reduces fuel consumption and overall transportation costs in WCO-based soap production chains. By contrast, the second scenario with

capacity restrictions revealed the adaptability of the model to real-world constraints, such as smaller collection vehicles often used in urban settings. [8] also noted that capacity constraints frequently necessitate multi-route solutions but can still be efficient when guided by route optimization algorithms.

Table 1: Summary of optimization results using the P-median and CVRP methods.

Scenario	*Vehicle capacity*	*No. of routes*	*Total distance (km)*	*Distance savings (%)*	*Collection point*
1	79 L	1	XX km	–	Location A
2	40 L	2	YY km	ZZ %	Location A

Table 2: Representation of the route sequence and the corresponding distances traveled (km).

INSTANCE 1 *Vehicle capacity: 100 liters*		
No	*Route nodes*	*KM*
1	A--N9--N2--N3--N10--N4--N6--N7--N5--N8--A	7.25
Total distance traveled: 7.25		
INSTANCE 2 *Vehicle capacity: 40 liters*		
No	*Route nodes*	*KM*
1	A--N7--N6--N4--N10--A	4.09
2	A--N8--N5--N9--N2--N3--A	3.95

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Total distance traveled: 8.04

3.5 Development of a Sustainable Business Model for the Production of Artisan Soap

The present business model (Canvas) describes the collection, production, and commercialization of sustainable artisan soaps derived primarily from used cooking oil and other complementary ingredients. This initiative seeks to provide an ecological, healthy, and affordable product, while promoting environmentally responsible practices and fostering the principles of the circular economy.

Through this business model (Figura 4), we aim to generate a positive impact on the community by encouraging responsible consumption and demonstrating that it is possible to create high-quality products without compromising environmental integrity.

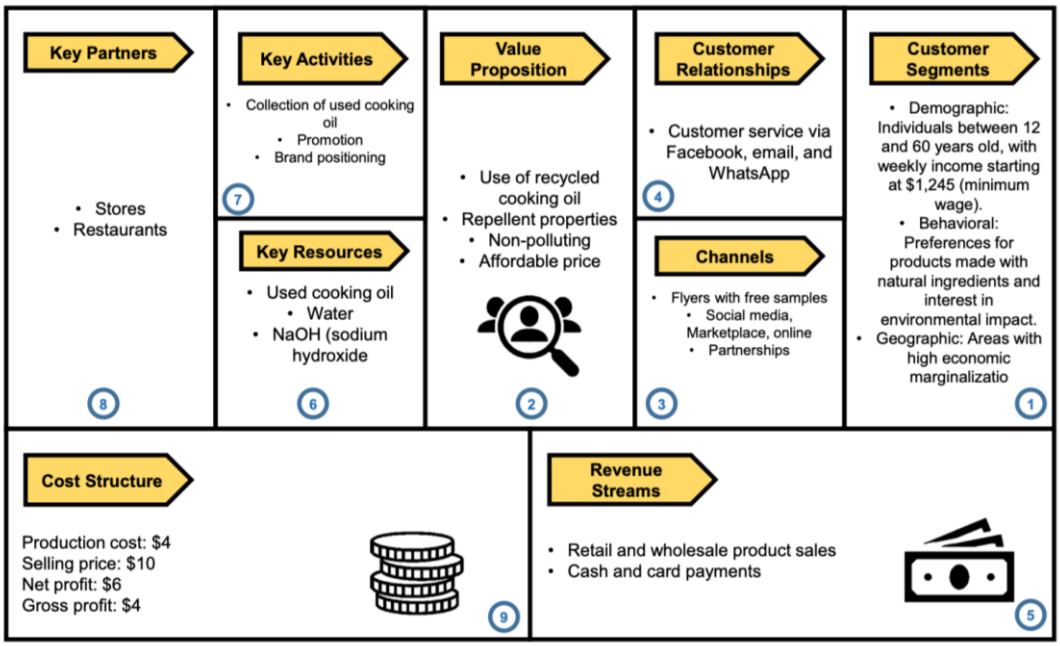

Figure 4: Proposed business model Canvas

The business model developed through the Canvas framework highlights the potential of integrating environmental, social, and economic dimensions within small-scale production systems. Similar to the approach described by [12], the model provides both a strategic and operational structure that enables the systematic design of sustainable initiatives. In this case, the central value proposition lies in transforming used cooking oil into artisanal soap, thereby addressing an environmental liability while creating a product with clear market potential.

Comparable initiatives reinforce the feasibility of this approach. [5] demonstrated that utilizing organic waste streams, such as used cooking oil, in soap production not only contributes to pollution mitigation

but also offers opportunities for local entrepreneurship and social innovation. Likewise, [9] emphasized that artisanal soap production represents a scalable business opportunity in developing regions, especially when combined with community participation and reverse logistics systems

From an economic perspective, incorporating low-cost raw materials and sustainable packaging strategies ensures the financial viability of the initiative. [10] pointed out that valorization of used cooking oil within circular economy frameworks reduces dependency on virgin raw materials and enhances competitiveness in eco-conscious markets. Moreover, coupling the model with awareness campaigns and partnerships with local establishments strengthens customer relationships, a factor also underlined in the work of [7], who highlighted the role of community engagement in successful reverse logistics operations.

Overall, the proposed Canvas model demonstrates that local circular economy projects can combine ecological responsibility with social empowerment and financial viability. By structuring the initiative into clear building blocks, value proposition, resources, channels, partners, and revenue streams, the framework ensures replicability and scalability in other urban contexts facing similar environmental challenges.

3.6 Sustainable Business Model for Artisan Soap Production

Our project targets a customer segment composed of environmentally conscious individuals who seek natural, sustainable, and responsible alternatives. It also focuses on businesses committed to sustainability, such as eco-friendly shops and restaurants, as well as households interested in the proper disposal of used cooking oil. With these stakeholders, we aim to establish strategic alliances that facilitate the collection and reuse of oil for artisan soap production.

The value proposition of our enterprise lies in the production of artisan soaps from recycled cooking oil, thereby reducing environmental pollution and promoting responsible consumption. We offer a high-quality product made with sustainable ingredients that minimizes environmental impact while meeting the expectations of environmentally aware consumers.

To market our products, we employ both direct and indirect channels. Direct channels include promotional campaigns with free samples, while indirect channels involve social media and digital platforms (e.g., Marketplace), which allow us to reach a wide and diverse audience. In terms of customer relationships, we provide personalized guidance on the use and benefits of the soap through platforms such as Facebook, email, and WhatsApp, fostering direct and close communication. Revenue is primarily generated through the sale of soaps, both wholesale and retail, with payment options including cash and bank transfers.

To ensure efficient production, we rely on key resources such as sustainable raw materials, a fully equipped workshop, a digital sales platform, and a trained team specialized in the production and commercialization of artisan goods. Core activities include the collection and filtration of oil, soap manufacturing, packaging, and product promotion. Furthermore, we collaborate with strategic partners such as restaurants that supply used cooking oil and chemical distributors that provide the necessary

inputs for the production process.

Finally, our cost structure consists of raw material procurement, production and energy expenses, as well as investments in digital marketing and product distribution.

The business model outlined in this project demonstrates the integration of environmental sustainability with market-oriented strategies, aligning with the principles of the circular economy. Similar models have shown that customer segments driven by environmental awareness are increasingly shaping demand for eco-friendly products, particularly in urban contexts where waste management represents a critical challenge [13]. By focusing on both households and businesses committed to sustainability, the model leverages community-based participation, which is essential for the success of reverse logistics initiatives [7].

The value proposition of transforming used cooking oil into artisanal soap reflects a double benefit: reducing pollution while producing a biodegradable, health-conscious product. This approach is consistent with findings by [5], who reported that initiatives combining waste valorization and artisanal production can increase both environmental and social impact, particularly when framed within local empowerment strategies. Similarly, [9] demonstrated that small-scale soap enterprises using recycled oil were financially viable when supported by digital sales channels and community engagement.

The reliance on digital platforms and personalized communication reflects current trends in sustainable entrepreneurship. Studies have highlighted the importance of online channels not only for sales but also for educating consumers about the environmental and health benefits of sustainable products [10]. This suggests that the emphasis placed on social media and direct communication tools in the proposed model enhances both customer loyalty and the dissemination of responsible consumption practices.

Regarding the cost structure, the prioritization of low-cost raw materials and eco-friendly packaging ensures financial feasibility while reinforcing consumer perceptions of authenticity and sustainability. Prior work on green business models has underscored that transparent cost structures and partnerships with local stakeholders improve long-term viability [14].

Overall, the sustainable business model presented here illustrates a replicable framework that combines ecological responsibility, social empowerment, and financial viability. Its adaptability to local contexts, such as small municipalities with strong community ties, positions it as a scalable alternative to address the environmental impacts of used cooking oil disposal while fostering sustainable entrepreneurship.

3.7 Financial Feasibility Study for Artisan Soap Production

Initial Investment. To initiate artisan soap production, an initial investment is required for essential inputs and equipment. Variable costs include approximately MXN $4,000 for raw materials such as recycled cooking oil, fragrances, colorants, and caustic soda; MXN $5,000 for utensils and equipment (molds and laboratory tools); MXN $800 for packaging materials (labels); MXN $1,000 for the design and setup of an online store; MXN $1,000 for initial advertising and promotion; and MXN $500 for other expenses, including transportation, storage, electricity, and water. In addition, fixed monthly

costs are estimated at MXN $8,000 for salaries. The total initial investment amounts to MXN $20,300.

Production Costs. Variable production costs are directly dependent on the number of soaps produced. The cost per unit is estimated at MXN $4.00, accounting for materials and labor. The selling price has been set at MXN $10.00 per unit, generating a profit margin of MXN $6.00 per soap.

Selling Price and Profit Margin. The selling price is determined by the target market segment and product differentiation as a sustainable good. Based on this strategy, a base price of MXN $10.00 per unit was established, allowing a net profit of MXN $6.00 per soap.

Monthly Sales Scenarios and Production Capacity. Daily production capacity ranges from 100 to 200 soaps, equivalent to 3,000–6,000 units per month, assuming 30 days of continuous activity. These volumes provide flexibility in setting sales targets and allow for realistic commercialization scenarios.

Return on Investment (ROI). The ROI estimates the time required to recover the initial investment of MXN $20,300. Assuming monthly sales of 677 units, with a net monthly profit of MXN $4,062, the investment would be recovered in approximately five months. This indicates high profitability and confirms that artisan soap production is financially viable, with low operating costs and attractive profit margins. The feasibility is further strengthened if an effective sales strategy is implemented and the growing demand for sustainable products is leveraged.

The financial feasibility of the proposed business model is summarized in Table 3, which integrates the initial investment, production costs, selling price and profit margin, monthly sales capacity, and estimated return on investment.

Table 2: Financial feasibility study for artisan soap production

Category	*Details*	*Cost (MXN) / Values*
Initial Investment	Raw materials (oil, fragrances, colorants, caustic soda)	$4,000
	Utensils and equipment (molds, lab tools)	$5,000
	Packaging materials (labels)	$800
	Online store setup	$1,000
	Advertising and promotion	$1,000

	Other expenses (transport, storage, electricity, water)	$500
	Total Initial Investment	$12,300
Fixed Monthly Costs	Salaries	$8,000
Production Costs	Unit production cost (materials + labor)	$4.00 per soap
Selling Price & Profit Margin	Selling price per unit	$10.00
	Net profit per unit	$6.00
Production Capacity	Daily production (100–200 soaps)	3,000–6,000 per month
ROI	Net monthly profit (677 soaps/month)	$4,062
	Estimated recovery of investment	~ 5 months

4. CONCLUSIONS

The development of a sustainable business model for the production of artisan soap from used cooking oil represents a viable and strategic proposal in response to current environmental and social challenges. This project not only provides a solution to the problem of improper disposal of used oil—which causes pollution and severely affects aquatic and urban ecosystems—but also promotes a productive, low-impact alternative aligned with the principles of the circular economy.

Throughout this study, the processes that make up the supply chain were clearly identified, establishing a solid operational foundation from oil collection to soap production. The implementation of optimization tools such as the p-median model for the strategic location of collection centers and the CVRP for efficient route planning enabled the design of a functional and adaptable collection system for different urban contexts.

Furthermore, by applying the Canvas model, the business was structured comprehensively, analyzing each of its components: value proposition, customer segments, distribution channels, revenue streams, key resources, core activities, strategic partnerships, and cost structure. This holistic approach allowed for a better understanding of the commercial and operational dynamics of the project, as well as its

potential for scalability and long-term sustainability.

The financial feasibility analysis demonstrated that the project is not only technically and operationally viable but also economically profitable. Financial projections indicate that, with adequate initial investment and efficient resource management, the business can generate sustainable income, deliver high-quality products at competitive prices, and contribute to local economic development, particularly when communities or small entrepreneurs are involved in the production process.

In summary, this business model seeks not only to achieve economic benefits but also to generate a positive impact on the environment and society. It represents a transformative proposal that converts a pollutant residue into a productive opportunity, one that can be replicated in different regions with minimal adjustments. In this way, it actively contributes to promoting responsible consumption habits, adding value to waste, and strengthening an environmentally conscious culture.

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