

Business plan for the establishment of a sweet potato (*Ipomoea batatas* L.) processing plant in Delicias, Chihuahua, Mexico

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ABSTRACT

Objective: To develop a business plan aimed to create a processing plant in Delicias, Chihuahua, considering that local farmers obtain a low price for their sweet potato harvest, although the cultivation of this tubercle in the state has increased in recent years.

Design/Methodology/Approach: A market study was carried out in three municipalities. The Malhotra methodology was used to determine market segmentation, while the FIRCO guide was employed to analyze financial indicators.

Results: The market study showed that 77% of the sampled population consumes the tubercle in question. Out of this percentage, 85% is willing to consume the products offered by the company, particularly jamoncillo (candy) (24%), followed by candied sweet potato (20%) and chips (18%). A 5-year projection (with a 12% update rate) establish the profitability of the net present value (NPV) of \$1,610,875.34, an internal rate of return (IRR) of 79%, and benefit-cost relation (BCR) of \$1.16. The initial investment is recovered with a positive flow after the third year, with a \$463,079.91 Mexican pesos profit.

Study Limitations/Implications: Obtaining the full amount of the initial credit for the business would be a limitation. The owners would pay the fixed and variable costs.

Findings/Conclusions: The producer can establish his factory with an initial investment of \$422,472 pesos, increasing his profits, adding value to the crop, and eliminating middlemen.

Keywords: Profitability, investment, production process, agrifood production.

Citation: Montes-Sierra, V. A., Uranga-Valencia, L. P., Palacios-Monárrez, A., Ortega-Montes, F. I., & Macías-López; M. G. (2023). Business plan for the establishment of a sweet potato (*Ipomoea batatas* L.) processing plant in Delicias, Chihuahua, Mexico. *Agro Productividad*. <https://doi.org/10.32854/agrop.v15i4.2458>

Academic Editors: Jorge Cadena Iñiguez and Libia Iris Trejo Téllez

Received: December 17, 2022.

Accepted: March 12, 2023.

Published on-line: June 21, 2023.

Agro Productividad, 16(5). May. 2023. pp: 107-113.

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INTRODUCTION

Sweet potato (*Ipomea batatas* L.) is a horticultural tubercle that has been grown in Mexico since ancient times (Vibrans, 2009) [1]. It is mainly grown in the central-southern zone of the coast of the Gulf of Mexico, in the Bajío region, and in some areas of the Pacific Ocean coast. It is also grown in several municipalities of the states of Chihuahua and Tamaulipas



(Basurto, 2018) [2]. According to the Servicio de Información Agroalimentaria y Pesquera (SIAP) (SIAP, 2019) [3], sweet potato production has recorded a positive trend over the course of the last three decades, as a consequence of greater yield per surface unit. During the same period, sweet potato was grown in 3,201.28 ha per year. Chihuahua holds the third place nationwide: 18.57% of the sweet potato produced is sold in the state's Irrigation District 05 (SNIIM, 2021) [4]. This percentage has increased in a yearly basis, generating a rise in the offer and few sale opportunities. Consequently, the creation of a sweet potato processing plant will provide sale opportunities at fair prices for the producers, avoiding the participation of middlemen, exploiting the crop at a regional level, and adding a value to the said product.

MATERIALS AND METHODS

The company will be established in the La Merced ejido, municipality of Delicias, close to the source of raw material. The sample was obtained in the municipalities of Delicias, Rosales, and Meoquí; in total, 1,155 potential consumers were interviewed. A probabilistic sampling method was applied using Malhotra's methodology for the market segmentation process (2008) [5]. The size of the sample was determined with a 95% confidence interval. The agribusiness diagram included in the FIRCO guide was used for the financial feasibility analysis.

RESULTS AND DISCUSSION

Market study

Seventy-eight percent of the 1,155 persons interviewed in the three municipalities consumes sweet potato. Out of that percentage, 85% is willing to taste snacks made from processed sweet potato. Several individuals have on their own or at some point in their lives, consumed and enjoyed sweet potato prepared in the traditional style and are willing to taste new products made from that tubercle. Fifty-one percent of the interviewees prefer to buy the products from corner stores, because they consider that it is a more practical and quicker way to satisfy a whim. This information will help to determine which sale distribution channels are more likely to be successful. Likewise, 55% of the polled persons prefer to find information through Facebook, which will help to define marketing techniques. The following type of products were chosen for the survey: *jamoncillo* with nuts and peanuts, jam, candied sweet potato, chips, cookies, and bread. The interviewees preferred the following products: an individual 60-g *jamoncillo* with nuts and peanuts package (24%), an individual 458-g chip package (20%), and a one-piece candied sweet potato package (18.5%).

Productive process

Jamoncillo with nuts and peanuts

Sweetening and adding nuts and peanuts is a traditional process that can provide added value to sweet potato. In order to prepare this recipe, roast the sweet potatoes with their skin; after that, remove the skin and mash the pulp into a purée. In a copper pot, pour water and sugar and cook it at medium heat in order to prepare a caramel. Add the purée

to the caramel, then add the nuts and the peanuts to the mixture. Remove the pot from the heat, let it cool and, once the mixture is cold, shape it into *jamoncillos* and put them into their packages. The following tools are usually used for this process: a spit roaster, a propane tank, and a copper pot. The ingredients for the recipe are sweet potatoes, water, sugar, nuts, peanuts, icing sugar, wraps, and labels.

Chips

The objective of the process is to prepare a healthy snack, preserving the nutrients of sweet potato. The ingredients and materials required for this production are sweet potatoes, sea salt, water, packages, and labels. To prepare the snacks, put the sweet potatoes through a washer-peeler, slicing them with slicer. Then wash them again with water to remove most of the starch. Season the slices with sea salt and introduce the slices into a dehydrator. Once the slices are ready, put them into the packages.

Candied sweet potato

This process is the longest, since the product cannot be packaged before ten days have passed. The ingredients and materials required are sweet potatoes, food grade quicklime, water, sugar, clove, cinnamon, packages, and labels. First, wash and peel the sweet potatoes, then slice them and let them rest in water and quicklime for 24 h. Afterwards, remove the slices from the mixture and wash them. Subsequently, pierce the sweet potatoes and let them boil with cinnamon, clove, and sugar for an hour. The following five days, the sweet potatoes must boil for another hour. Then, remove the sweet potatoes from the sugar and put them on a cooling grill for five days. Finally, the sweet potatoes are ready to be packaged.

Evaluation of the investment project

Investment

The investment budget included the machinery and equipment required to produce the three products (*jamoncillo* with nuts and peanuts, chips, and candied sweet potato), as well as the delivery equipment and office supplies; therefore, an initial \$422,472 investment is required to start this business. The investment information was provided by the Santander bank. Table 1 shows the detailed budget.

Estimated production and sale cost by pieces and per month for the sweet potato processing plant

In order to establish the number of packages that would be produced from November to April, the capacity of the production machinery and equipment were considered. The results were as follows: *jamoncillo*, 16,500 pieces (pcs); chips, 14,200 pcs; and candied sweet potato, 16,200 pcs. From May to October, production falls by 25%. The local population usually consumes sweet potato during the cold months, and this could reduce the consumption of the processed products during the warmer months. The sale costs of the products are candied sweet potato, \$5.30 per pc, *jamoncillo*, \$5.00 per pc, and chips, \$5.45 per pc.

Table 1. Investment budget for a sweet potato processing plant.

Concept	Unit	Amount	Unit Cost	Amount	Total
Fixed Asset					
Washer and Peeler	Piece	1	\$20,409	\$20,409	\$20,409
Cutter	Piece	1	\$6,489	\$6,489	\$6,489
Dehydrator	Piece	1	\$43,000	\$43,000	\$43,000
Sealer	Piece	1	\$4,491	\$4,491	\$4,491
Mini Split	Piece	1	\$6,400	\$6,400	\$6,400
100 liter gas tank	Piece	1	\$24,903	\$24,903	\$24,903
Oven	Piece	1	\$11,500	\$11,500	\$11,500
Copper cooking pot	Piece	2	\$4,000	\$8,000	\$8,000
Large stainless steel spoon	Piece	2	\$1,015	\$2,030	\$2,030
Table with stainless steel top	Piece	2	\$2,790	\$5,580	\$5,580
Gas burner	Piece	2	\$624	\$1,248	\$1,248
Base for saucepan	Piece	2	\$1,200	\$2,400	\$2,400
Grills 5 packages of \$285	Piece	1	\$1,425	\$1,425	\$1,425
Containers	Piece	1	\$2,757	\$2,757	\$2,757
Tables and office items	Piece	1	\$3,000	\$3,000	\$3,000
Computer	Piece	1	\$12,000	\$12,000	\$12,000
Tag printer	Piece	1	\$6,180	\$6,180	\$6,180
Phone	Piece	1	\$660	\$660	\$660
Delivery van	Piece	1	\$250,000	\$250,000	\$250,000
Deferred assets					
Installation costs			\$10,000	\$10,000	\$10,000
Total				\$422,472	\$422,472

The projection of the annual income included a 12% increase, as a consequence of the annual inflation rate (Table 2).

Production costs

For production, raw material, and indirect manufacturing costs a total of \$873,096 variable costs and \$1,407,600 fixed costs were obtained. The total cost for the first year would amount to \$2,280,696.

A 12% annual inflation rate was included in the total 5-year projection cost (Table 3).

The analysis of the financial profitability of the company considered the 12% update rate provided by the bank and a 12% annual inflation increase. The cash flow is positive

Table 2. Annual Income Projection.

Product	Year 1	Year 2	Year 3	Year 4	Year 5
Sweet Potato Products	\$2,580,375	\$2,890,020	\$3,236,822	\$3,625,241	\$4,060,270
Total revenue	\$2,580,375	\$2,890,020	\$3,236,822	\$3,625,241	\$4,060,270

Table 3. Annual operation cost of the project.

Concept/month	Year 1	Year 2	Year 3	Year 4	Year 5
Variable costs					
Raw material	639,135.00	715,831.20	801,730.94	897,938.66	1,005,691.30
Electric power	45,000.00	50,400.00	56,448.00	63,221.76	70,808.37
Gas	69,408.00	77,736.96	87,065.40	97,513.24	109,214.83
Packing	68,553.00	76,779.36	85,992.88	96,312.03	107,869.47
Gasoline	51,000.00	57,120.00	63,974.40	71,651.33	80,249.49
Subtotal	873,096.00	960,405.60	1,056,446.16	1,162,090.78	1,278,299.85
Fixed costs					
Concept/month	Year 1	Year 2	Year 3	Year 4	Year 5
Administration	432,000.00	483,840.00	541,900.80	606,928.90	679,760.36
Labour	672,000.00	752,640.00	842,956.80	944,111.62	1,057,405.01
Water	9,600.00	10,752.00	12,042.24	13,487.31	15,105.79
Rent	60,000.00	67,200.00	75,264.00	84,295.68	94,411.16
Internet and phone	6,000.00	6,720.00	7,526.40	8,429.57	9,441.12
Advertising	216,000.00	241,920.00	270,950.40	303,464.45	339,880.18
Office supplies	12,000.00	13,440.00	15,052.80	16,859.14	18,882.23
SUBTOTAL	1,407,600.00	1,548,360.00	1,703,196.00	1,873,515.60	2,060,867.16
Total cost	2,280,696.00	2,508,765.60	2,759,642.16	3,035,606.38	3,339,167.01

from the second year on; however, the initial investment is recovered only on the third year. Table 4 shows favorable incomes, with a cash surplus.

The project is considered viable according to the evaluation of the indicators. The following values were obtained: $a > 0$ NPV, an IRR higher than the update rate, and $a > 1$ BCR. Therefore, the project will obtain profits per peso, as can be seen in Table 5.

Following the guidelines of the Shared Risk Trust Fund (FIRCO) (FIRCO, 2002) [6], the organizational structure of the new company will have a hierarchical order (Figure 1).

Table 4. Profitability analysis of the project.

Year	Income	Costs	Cash flow	Rate	Updated income	Updated expenses
0		\$422,472.00	\$422,472.00	1.000		
1	\$2,580,375.00	\$ 2,333,055.46	-\$175,152.46	0.893	\$2,303,906.25	\$2,083,085.23
2	\$2,890,020.00	\$2,543,120.12	\$ 346,899.88	0.797	\$2,303,906.25	\$2,027,359.79
3	\$3,236,822.40	\$2,773,742.49	\$463,079.91	0.712	\$2,303,906.25	\$1,974,295.12
4	\$3,625,241.09	\$3,035,606.38	\$589,634.71	0.636	\$2,303,906.25	\$1,929,182.73
5	\$4,060,270.02	\$3,339,167.01	\$721,103.00	0.567	\$2,303,906.25	\$1,894,733.04
Total	\$16,392,728.51	\$14,447,163.46	\$2,368,037.04		\$11,519,531.25	\$9,908,655.91

Table 5. Financial indicators of the profitability analysis of the project.

NPV	IRR	BCR
\$1,610,875.34	79%	\$1.16

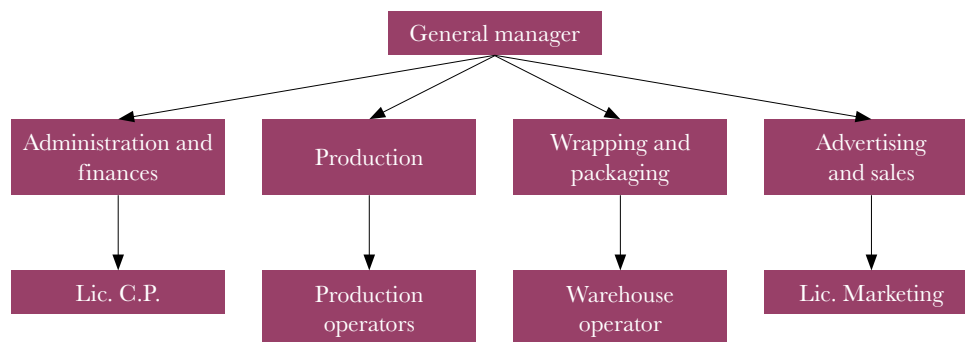


Figure 1. Organizational structure of the company.

The budget, planning, production, and equipment activities included in the process will be assigned to the appropriate department.

As a consequence of its characteristics, the company will be registered in the entrepreneurial regime as a physical person.

This study determined that the production of sweet potato snacks is financially profitable and, therefore, it is an option to increase the income of the producers, avoiding the current middlemen structure. Similar results were reported by Álvarez-Gonzaga (2013) [7]. The objective of that study was to evaluate the feasibility of founding a sweet potato snacks micro business in Loja, Ecuador. The study obtained favorable results with a USD\$178,006.19 required investment. The financial results were feasible and profitable from the third year on, just like in our study. The study also complied with the financial evaluation criteria and highlighted the nutrients of sweet potato for human consumption and the economic benefits for producers. Meanwhile, Kuncar and Talledo (2017) [8] researched the feasibility of installing a sweet potato flour paste production plant in Peru. They also highlighted the nutrient value of the product. The authors obtained positive financial results; however, they pointed out that 40% of the initial investment must be provided by independent investors, while the remaining 60% must be provided by a financial institution, to guarantee its feasibility and a positive cash flow from the second year on. Unlike this case, our study completely depends on a bank. Sweet potato is a nutritive food for humans, which nevertheless can also be beneficial for the animal food transformation industry. Orozco-Lepe (2014) [9] studied the profitability of purple sweet potato flour for livestock nutrition in Quintana Roo. The results obtained were positive, according to the financial evaluation: the net cash flow resulted in a \$46,664.57 NPV (the benefit once the investment ends), a 239% IRR, and a \$9.01 BCR. During the first year, the numbers were positive: \$66,215.76. Sweet potato is full of nutrients and has many economic advantages, providing added value to several products through its transformation.

CONCLUSIONS

Producers can obtain higher profits from sweet potato through the transformation of this tubercle into snacks and sweets. Its nutrient properties can turn it into a healthy alternative for the diet of Mexicans —*i.e.*, adding value to the crop. Sweet potato is a versatile tubercle

that can be transformed and industrialized. Consequently, this is an opportunity to drive sweet potato cultivation. However —and despite the sweet potato production increase in Chihuahua during the last decade—, there are no strategies aimed to give added value to its production and, as in most parts of the country, the middlemen still obtain the highest profits. The market segmentation in this research shows that there is a great potential (78% of the interviewees) for the consumption of products derived from sweet potato. The minimum initial investment to purchase machinery and tools is \$422,472. From the third year on, the profit could reach \$463,079.91. The results of the profitability indicators — obtained through a 5-year projection, with a 12% update rate— shows that the creation of this type of companies is feasible, considering that, in Mexico, the companies are usually managed by a family. This proposal can allow families to obtain higher economic benefits from their crops, having already established sale points, packages preferences, and marketing strategies that must be carried out in order to achieve the goal.

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