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Feasibility of the Production of Traditional Palo Bean Coffee: an Ancestral Vision in Barranco Colorado

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Abstract--The study deals with the recovery of ancestral knowledge of the production of traditional coffee of Palo beans in the rural area Barranco Colorado of the canton 24 de Mayo, to determine its feasibility. Experimental field research was applied as a methodology, through the application of an open interview with the peasant expert, a native of the place and possessor of the ancestral knowledge of the elaboration of Palo bean coffee to rescue traditional knowledge and consequently produce traditional coffee, which served to take data and consequently be able to determine the feasibility of the production of Palo bean coffee, tools such as financial analysis and methods of financial evaluation of the net present value, benefit-cost ratio and internal rate of return was used. The results were the description of the production process of traditional bean coffee, the financial analysis of production, and the feasibility analysis of coffee production that yielded an NPV of 417.65, a B/C ratio of 1.26, and an IRR of 30.29%. According to the indicators obtained, it could be concluded that the recovery of ancestral knowledge to produce traditional Palo bean coffee is viable for its implementation as a business on any scale.

Keywords--ancestral knowledge, feasibility study, palo bean, production, traditional coffee.

Introduction

The Palo bean is also known by its scientific name *Cajanus cajan* belongs to the family of Fabaceae, it is one of the varieties of beans that exist in Latin America, Africa, and Asia, it is exported to the United States and Europe but is native to India and the Near East. The bean is a shrubby legume with alternating trifoliolate leaves, like that of the pea of cream color, light gray, mottled, dotted, or marbled with gray. This shrub is characterized because it can reach up to 3 meters in height, it can have an approximate diameter of 1 to 4 centimeters in its stem (Gonzalez et al., 2016).

The gandul *Cajanus cajan*, occupies the fifth place in importance among the edible legumes of the world, is among the first eight most cultivated legumes worldwide, its protein content of dry grain occupies the third place with 25% of protein, only behind the soy and the lentils that have 38 and 28%. The Palo bean is a plant source that contains proteins, minerals, and nutrients, due to its quality and not its quantity, which gives it an important biological value. The figures for the composition of seeds are prepared in various ways, concerning the nutrient content of the protein varies between 18 and 25% and some can reach up to 32%, since they can use the seeds whole, debarked, or in flour. This plant also provides us with forage and green manure, which can weigh between 41-280 kg, its branches and stems are used as fuel and even adapts to different edaphoclimatic conditions and are undemanding at the time of fertilization (Núñez, 2009).

Cajanus cajan is a shrub legume, which is characterized by its high nutritional value, agronomic versatility, and multiple uses; in addition to contributing to food sustainability in tropical and subtropical regions, its nutritional and medicinal benefits is considered a functional food for humans, has several types of use such as helping to (Carbajal & Martinez, 2016) heal, disinfecting wounds with the cooking of leaves, has medicinal properties that help people antirheumatic, diuretic, hemostatic and astringent, has a great potential for feeding various animals, such as quail since it has a high protein content, its flowers, and young shoots are used for conditions in the pulmonary bronchi (Vasquez, 2017).

Stick beans can be grown in both wet and hot areas, because they are tolerant to heat and grow under conditions of temperatures of 18 to 30 ° C even to temperatures above 35 ° C, in circumstances that are suitable for the fertility of this bean, since it does not withstand icy climates (Vasquez, 2017). Gandul is marketed in different countries with products such as canned whole gandul, canned whole gandul low in salt, ground gandul, gandul flour with different percentages, gandul tortillas, extruded gandul-based products, gandul-based chunky sauce, gandul-based meat sauce, frozen tender gandul, dried gandul, gandul-based soup powder and sweet flan powder based on gandul and these products are marketed globally (Jiménez, 2014).

Coffee, that stimulating and aromatic drink so widespread throughout the world, finds its origin in the lands of Abyssinian, present-day Ethiopia. It is easy to be confused with its true origin since the ancient legends about the crop and the custom of taking it to come from Arabia (Hernandez et al., 2020). Coffee is one of

the main raw materials in the world; more than 80 % of production is destined for international trade, as indicated. (Quinter & Rosales, 2014; Mitchell, 2018) The consumption of coffee is one of the most talked-about conditions since the majority of the population consumes coffee, its cultivation is in tropical countries such as Brazil, which produces more than a third of the world's production. Coffee is one of the main products traded in international markets and in the last decade the value of world coffee exports has only been (Rosero, 2013) surpassed by that of oil. However, their prices on the international market fluctuate irregularly between periods of high and low prices, significantly affecting the economies of 50 producing countries (Santoyo & Renard, 1993).

According to information from the Costa Rican Coffee Institute, it reported the shipment of approximately 130 containers per week between March and April to the main destinations that consume Costa Rican beans. Costa Rica's coffee is in its accelerated behavior due to the covid-19 health emergency, said Executive Director Xinia Chaves, after noting that the pandemic has caused many exporters to need to ship their cargoes expeditiously (Barrantes, 2020).

In Ecuador coffee is produced in 20 of the 22 provinces that our country has, which allows establishing a great socioeconomic contribution of the coffee sector. The National Association of Coffee Exporters evaluates in the coastal region the planting of approximately 112,000 hectares (ha), in the mountains 62,000 ha, in the Amazon region 55,000 ha and in Galapagos with 1,000 ha of coffee produced annually, its commercialization occurs in different varieties that not only comes from coffee but also different dry beans such as beans. This agricultural activity generates a lot of labor activity and jobs for people in the rural and urban sector, most of these farms are family activities where income is generated (Delgado et al., 2002).

Ecuador is one of the smallest countries in the territory and has a large production capacity, exporting all varieties of coffee such as washed Arabica coffee, natural Arabica, and robust. In Manabí in the province of Jipijapa is one of the cantons that most cultivate this coffee bean since 55% of the surface is cultivated by Arabica coffee that can be grown in the mountainous areas from the upper part of Olón, Pedro Pablo Gómez, Paján, May 24, Santa Ana, Pichincha, Junín, Chone, Sucre, Jama, Pedernales and north of Manabí. Arabica coffee is also grown and produced in the western and eastern foothills of the Andes, where the areas of Intag in Imbabura, Puerto Quito, Gualea, Pacto, Mindo, Tandapi in Pichincha, Moraspungo in Cotopaxi, Caluma, Echeandía and Balsapamba in Bolívar, Pallatanga in Chimborazo, Piñas, Zaruma, Balsas, Marcabelí and Las Lajas in El Oro, Alamor, Celica, Chaguarpamba, Olmedo, Paltas, Vilcabamba in Loja, Zumba and Chito in Chinchipe, Yantzatza, Panguí and Centinela del Cóndor in Zamora, Gualaquiza in Morona Santiago, Archidona in Napo (Pozo, 2014). According to the National Coffee Growers Corporation, starting in 1997, coffee production in Ecuador has been decreasing slowly, with production in recent years being less than one million 60-kg bags (COFENAC, 2012).

In Ecuador, the bean is produced under normal weather conditions, due to its high percentages of protein, depending on the variety, this legume is shown as a good option to be used in the preparation of balanced foods, also in human food

to replace the grain. After oil, coffee is the second most traded commodity in the (Columbus & Mejia, 2002; Nuñez, 2009; Beltran, 2020) world.

In the province of Manabí, the cultivation of stick beans is the planting that has developed the most in recent years, it is very profitable to plant it, easy to grow, and is currently exported, so it is an excellent opportunity for entrepreneurship (Gutierrez & Mendoza, 2020). The cultivation of the Palo bean interspersed with corn-popcorn, corn-yucca-Mullan of Palo and corn-bean caupí has gained interest in recent years for being a short-cycle crop, adjuvant in erosion control, productivity, and efficiency in the use of the land on the slopes of the dry tropical forest in Manabí, have made the production of the beans reach an average of 30,315 mallets/ha, an advantage that presents the bean is (Intriago, 2004) to be a species of the highlands with a flowering period in rainy weather, whose vegetative development continues during the dry season and only enter a few days in flowering or weeks after the rainy season has begun, which provides interest in growing throughout the year. Currently worldwide (Bone & Martinez, 2020) it is the legume of greater cultivation in the low tropics, it is mainly used for dried seeds or grains that contain about 23% protein, the consumption of tender seeds has 7% protein, grains contain on average 18% to 25% protein can reach up to 32%, they have a good balance in amino acids except for methionine and cysteine. Gandul also contains trace elements and is a good source of soluble vitamins such as thiamine, riboflavin, niacin, due to its diuretic properties is used for the treatment of diseases such as cystitis, nephritis, and urinary tract infections and improves the quality of the substrate at a nutritional level (Cordova & Gonzalo, 2017; Plus, 2011).

Materials and Methods

Location

The study was in the rural community Barranco Colorado of the canton 24 de mayo, province of Manabí 5.14 km from the cantonal capital of May 24, geographically located at the coordinates 1G 23'44"S and 80G 12'21"W, between 100-500 meters above sea level, as can be seen in Figure 1.



Figure 1. Location of the Barranco Colorado commune

Source: (Andrade, 2015)

Method

To carry out the market study, data from the main shops and supermarkets on the coffee brands of other companies were taken as regards the determination of supply, in terms of the content, sale price, and brand. For the projection of demand, the least-squares method was used, the formula of which is quoted below.

$$Ym = a + bx \quad (1)$$

Where:

$$a = \frac{\sum y}{n} \quad (2)$$

$$b = \frac{\sum xy}{\sum x^2} \quad (3)$$

To recover the ancestral knowledge of the production process of traditional Palo bean coffee, an open interview was conducted with a peasant woman, a native of Barranco Colorado, information with which the flowchart of the production process was made, using the symbols of the International Organization of the work (ILO). To calculate the financial analysis, the Excel spreadsheet was used, with which an established program was used with formulas to yield the required data such as investments and their financing (Pandey et al., 2000; Esquivel & Jimenez, 2012). To determine the feasibility of the investment, the methods of financial evaluation, Net Present Value (VAN), benefit-cost ratio (B/C), and Internal Rate of Return (TIR) were applied.

$$VAN = Beneficios - costos(4)$$

$$BC = B/C \quad (5)$$

$$TIR = TM + \frac{(TM - Tm) * VAN Tm}{(VANM - VANm)} \quad (6)$$

Results and Discussion

According to the objectives of the work, it can be seen that coffee in a 50gr case is marketed in the 3 commercial stores operating in the canton of May 24 whose result of the coffee offered in the canton may 24 is shown in table 2.

Table 2
Product offer in 24 de mayo

Brand	Commercial/ Tienda	Contents (g)	Price (\$)
Coffee "Montubio"	"Chong", comercial "Cedeño" y comercial "celeste"	50	\$ 1,00
Coffee "Pres2"	"Chong", comercial "Cedeño" y comercial "celeste"	50	\$ 1,48

Coffee "Oro"	"Chong", comercial "Cedeño" y comercial "celeste"	50	\$ 1,71
Don Coffee	"Chong", comercial "Cedeño" y comercial "celeste"	50	\$ 1,48
Coffee "Minerva "	"Chong", comercial "Cedeño" y comercial "celeste"	50	\$ 2,45

Source: (Pin et al., 2021)

The highest consumption of coffee in the historical series studied was had in the year 2020, however, in the year 2014, there is a high consumption that falls in 2015. The results of the demand for coffee in the canton, May 24, are shown in Table 3.

Table 3
Demand for coffee in canton 24 de mayo

Years	Consumption coffee covers (50gr)
2014	828
2015	666
2016	650
2017	700
2018	800
2019	874
2020	930

Source: Central Bank of Ecuador

The demand projection was calculated for the next 7 years. The results of this projection are shown in Table 4.

Table 4
Coffee demand projection

Years	Projected coffee consumption
2021	1199
2022	1304
2023	1409
2024	1514
2025	1619
2026	1725
2027	1830

Source: (Pin et al., 2021)

Description of the production process of Palo bean coffee

As a result of applying the interview to the connoisseur of ancestral knowledge, Mrs. Rosa Alejandrina Sancán Alay, the mature and dry pods are collected (Udayana, 2017; Sudiartini et al., 2020). In the case of the mature bean, they are

subjected to sun drying in a tendal for a time between 3 to 4 days approximately so that the bean dries completely. Once the beans are dried, the grain is selected in good condition, separating the mothballed from the good ones proceeding to wash the selected grains and continues with the roasting of the dry grain in the wood oven for approximately 10 minutes, stirring constantly and verifying that all the grains are toasted. After this time, the bean grains obtain a dark color, lets cool the roasted grains to consequently take them to grind in a handheld device, which must be regulated to obtain a very fine texture (DaMatta, 2004; Dong et al., 2017). The coffee powder of stick beans is filled in plastic covers with a content of 50 gr, duly sealed with a manual sealer; the weight is verified on a gram scale, packed in a dispatch paper cover, sealed, and labeled with the handmade brand. The Flow chart of the Palo bean coffee production process shows the sequences of operations that are carried out to obtain the final product. Figure 2 shows the flow.

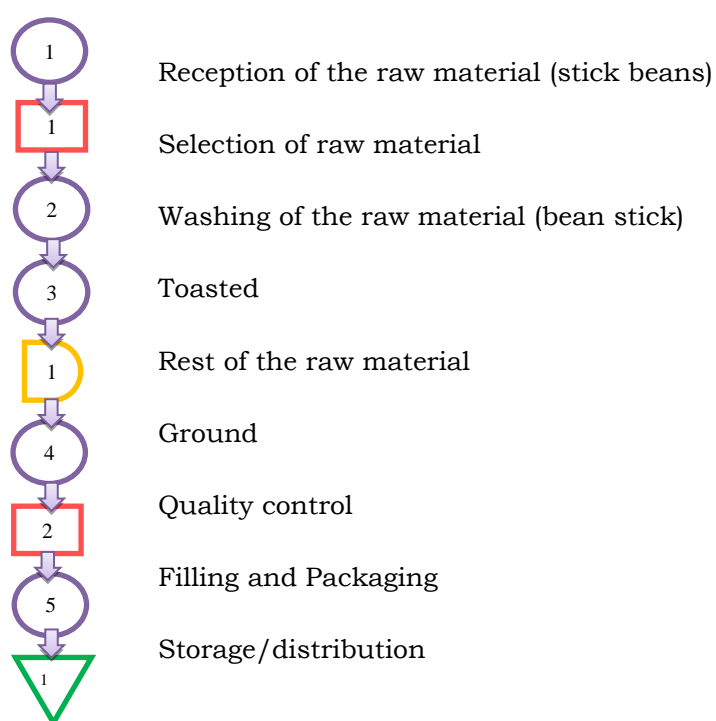


Figure 2. Flowchart of the production process of the bean coffee of stick
Source: Pin et al. (2021)

Financial analysis

As a result of the financial analysis of the production of Palo bean coffee, it is condensed in Table 5.

Table 5
Investments

Investments	Total value (\$)	%
Fixed investment	830,28	32,14
Working capital	1.752,71	67,86
Total	2.582,99	100,00

Source: [Pin et al. \(2021\)](#)

The results of the fixed investment can be found in table 6 below.

Table 6
Fixed investment

Investments	Total value (\$)	%
Machinery and equipment	394,80	47,55
Other assets	360,00	43,36
incidentals (10%)	75,00	9,09
Total	830,28	100,00

Source: [Pin et al. \(2021\)](#)

Table 7 shows working capital.

Table 7
Working capital

Denomination	Time (meses)	Monthly value (\$)	Total value (\$)
Production costs	3	579,24	1.737,71
Administrative and General Expenses	3	0,00	0,00
Selling and Promotion Expenses	3	5,00	15,00
Total			1.752,71

Source: [Pin et al. \(2021\)](#)

Working capital is shown in detail in Table 8.

Table 8
Working capital

Description	Unit (g)	Quantity	Unit price (\$)	Total
Café de fréjol de palo de 50	Cajas 50	455	1,00	455,00
Total				455,00

Source: [Pin et al. \(2021\)](#)

Working capital is shown in detail in Table 9.

Table 9
Estimated sales

Description	Value (\$)
Ingresos por ventas	455,00
Egresos totales	84,24
Utilidad neta	370,76

Source: [Pin et al. \(2021\)](#)

Financial evaluation

The results of the application of three methods of financial evaluation, net present value (NPV), benefit-cost ratio (B/C), and internal rate of return (IRR), can be seen in Table 10.

Table 10
Financial evaluation by VAN, B/C y TIR

Description	Value
VAN	\$ 417,65
B/C	1,26
TIR	30,92%

Source: [Pin et al. \(2021\)](#)

The production of stick bean coffee is viable since the VAN represented in Table 8 yielded a value of 417, 65, this constitutes the amount that will be obtained at the end of the useful life of the project estimated for 10 years of production. In the B/C ratio, the indicator of 1.26 that is greater than 1 means that the business is viable to be implemented. The TIR reflects a rate of 30.92% which is higher than the market opportunity rate or passive rate which is at an average of 7.89%, a rate that a financial institution would pay for investing our money, ([Central Bank of Ecuador, 2021](#)) however the interpretation is that the money invested would return at a higher rate equivalent to 30.92%.

The study refers that the application of the tools of VAN and IRR add solidity to the analysis and evaluation of investment projects, in this sense these methods of financial evaluation are applied to assess the viability or feasibility of ([Mete, 2014](#)) the progress of the new productive business, being also the benefit-cost ratio an important index to determine the viability of the project ([Zambrano et al., 2019](#)). These three methods together are ideal for any type of projector, once the financial analysis is completed, to be able to evaluate the financial sustainability of the new business to be implemented.

In the research, a market study was carried out to determine the population that would be ([Sanchez, 2018](#)) likely to buy the product concerning variables such as presentation, consumption, and quantity demanded. The current supply of

similar products, demand, and demand projection were also determined to carry out the financial analysis accordingly. (Paladins, 2020) its work of artisanal coffee production, developed a technical study to determine the location of the coffee processing plant, considering the proximity to suppliers, safety conditions, and communication routes; establishing the stages of the production and transformation process of coffee, to determine the raw materials, the necessary inputs and the selection of machines and tools required direct and indirect labor (Budryn et al., 2015; Lee et al., 2016). Fully coinciding with the present work, which determined its location in the rural community from which raw material is supplied; the description of the transformation process from ancestral knowledge, the elaboration of the flowchart was viable for the production of Palo bean coffee.

The financial study determined the profitability of the project, using a positive VAN, a (Bletrán & Jiménez, 2018) TIR of 41 points more than the opportunity; the benefits of the project outweigh the costs, which meant that the project is viable and can be invested in the business. In the present study, a positive VAN was determined, a TIR that exceeds three times the opportunity rate of the Ecuadorian financial market and a B/C greater than 1, the methods of financial evaluation that indicate that the business of production of artisanal coffee of beans of the stick is feasible for its start-up (Ryan et al., 2004; Cerdán et al., 2012).

Conclusion

It was possible to rescue the ancestral knowledge of the production of traditional coffee of Palo beans in the rural commune Barranco Colorado, through an open interview with a peasant woman of the place (Millard, 2017; Prado et al., 2018). The recovery of this traditional knowledge, allowed us to carry out the technical study and financial analysis of the production and consequently to be able to determine the feasibility of implementation of the new business or enterprise. The production of traditional coffee from stick beans is viable to be implemented on a micro, small or medium scale, as a new investment.

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