Innovation Architecture: Pickle Processing Industry “La Pukarina” – Province of Huancayo, Peru

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Abstract. The Pucara area has land with horticultural potential, so the project proposes the construction of “La Pukarina” Pickle Processing Plant. The proposal is the result of the diagnosis of horticultural production in the area to give added value to your vegetables; producing pickles, promoting associative business work. Using the Location Factors Rubric, made up of 9 indicators, the land for the Processing Plant was located, with an area of 24823.25 m², accumulating 34 points. The design of the plant is born from a formal search, using the geometry of the medium as the corridors and ceilings. In the same way, the Mahoney Table will be seen, a bioclimatic design method for its distribution. After the economic analysis of the project, the initial investment of 445282.73 USD was established in the first year, financed at a bank interest of 7%, and financed in 6 years. The market study requires the target population, made up of men and women between 25 and 39 years old, of whom 58% consume pickles every two weeks, especially an organic vegetable base in the area. Finally, the Pickles Processing Industry "La Pukarina" is proposed as a technically and economically viable alternative to up 100.8 %.

1 Introduction
The Pucara area, located in the province of Huancayo (Peru) enjoys land with high potential for growing vegetables, its population is dedicated to intensive agriculture of horticultural products well known in central Peru and part of Lima, especially those produced in the populated center of Raquina, Pucapuquio, Asca [1], all produced under irrigation because they are immersed in the Chanchas river micro-basin, whose harvests are marketed in nearby markets and apart for self-consumption, highlighting: Chinese onion, radish, beet, carrot, spinach, among others [2]. After diagnostic work on horticultural production in the Pucara area, the Project: Innovation Architecture for the production of the Pickles Processing Industry "La Pukarina" was proposed.

The project seeks to propose a favorable infrastructure, thus ensuring markets and profitability of its production, knowing that, for the most part, the horticulturists in the area are small producers, smallholders; that they practice traditional agriculture with low technological capacity, without financing, with yields that can be surpassed giving an added value to their vegetables; producing pickles and fundamentally with associative business work.

The work addresses the design of a food canning and production plant, specifically the production of Pickles, located on “5 de Febrero Avenue” in the Pucara district, Huancayo Province, Junin Region; in an area of 24823.25 m² and a perimeter of 694.53 linear meters, zoned as District Commerce which is compatible with light industry. No major geological structures were found in the area, making it a...
safe area. The soil for agriculture is composed of conglomerates of clay, silt and sand, the place to build the plant has gravels which allows the processing plant to be built safely. The turnip, beets, and carrots will be processed, in their first stage as they are the most produced vegetables in the area accompanied by spices, aromatic herbs, condiments, vinegar, etc. that is to say preserved by means of natural fermentation.

The process begins with reception machinery such as scales; production machinery that highlights the spray washer, conveyor belts, autoclave, cutter, filler, vinegar tank, government liquid dispenser, etc. Expedition machinery such as labeler, pasteurizer, packaging, etc. Warehouse area with a forklift and cleaning area. An orchard is included, for the introduction and subsequent technical assistance to the farmers of the area, for the treatment of wastewater a biodigester is included in order to treat these waters and reuse them in the area dedicated to plantations and obtaining organic fertilizer. The infrastructure is divided into 4 zones: Administrative, Commercial, Production, and Services.

2 Method
The present study is of a descriptive type since it collects theoretical, documentary, and interview information considering the characteristics of its components: the vegetable processing industry and the innovative architecture proposed in the study. To collect information, the fieldwork was carried out, visiting the communal authorities of Pucará and Raquina in order to request authorization to locate the plant of processing.

The Pucara district is located at 3,340 m. a. s. l. with an area of 110.49 km², 20 km from the city of Huanca, with a population of 5,063 inhabitants according to the last national census by INEI (2007), is divided into 10 annexes and scattered settlements: Asca, Puca Puquio, Raquina, Talhuis, Jatun Suella, Pachachaca, Patala, Marcavalle, Chucos, Dos de Mayo and dispersed population.

The area of Raquina, an eminently horticultural town, was analyzed on the banks of the Chanchas river in its origin and with five springs that supply water to its vegetable crops, the annex has a narrow road, surrounded by mountains, with only single-phase electric energy. Population of “Anexo de Raquina” is dedicated to agriculture, especially the cultivation of organic vegetables. Vegetable production, mostly a smallholder activity, is produced in small plots that contribute to family nutrition and as a source of income for their families.

The production of vegetables is predominant crops are the turnip, onion, beet, radish, Chinese onion, among others, whose production costs and yield per hectare vary according to the species produced and the use of agricultural technology or traditional plowing, adding the use of organic fertilizers and fertilizers, leaving aside the use of chemical products because organic agriculture is promoted in the place. Yields vary between 5,000 to 12,000 kg/ha depending on the species to be cultivated with an average investment of 570 USD to 1500 USD per ha. The cultivation area for vegetables under irrigation is 864 ha between Raquina and Pucará.

To determine the location of the Pickle Processing Plant, the Location Factors Rubric was used, which considers among other aspects: Proximity to raw materials, proximity to the target market, availability of labor, the supply of electrical energy, drinking water, sewage, wind orientation, access to transportation, industrial waste management, with Scale values from 1 to 5 respectively. The fundamental reason for choosing the land was due to its location close to the production centers, proximity to the highway that facilitates the transport of the processed product to the target markets.

Three lands suitable for the construction of the Processing Plant were taken into account. Proposal N°1: is found in Jr. Cabo Saavedra, Pucara district, Huancayo province; with an area of 3 169.29 m². Proposal N° 2: is found on Av. Catalina Huanca, Pucara district, Huancayo province; with an area of 3 086.0 m². Proposal N° 3: is located on “5 de Febrero Avenue”, Pucara district, Huancayo province; with an area of 24,823.25 m².

To find trends to industrialize vegetables, a significant sample was applied to 100 respondents, applying the theory of statistical sampling based on the Economically Active Population of Junín considered in the 2017 census of 538,286 inhabitants [3].
2.1 Productive strategy
Pickles are vegetables preserved in vinegar, they are important because they keep vegetables longer, which must be kept in hermetically closed and previously sterilized glass containers; whose production is carried out throughout the year, in our proposal it is carried out in 8-hour days a day, respecting current legal provisions of the Ministry of Labor, having as working hours: Entering at 08:00 until 17:00 with an hour that includes rest, snacks and maintenance of machinery.

During the snack, the cleaning staff will carry out the cleaning of the production facilities including offices, warehouses, sanitary services, among other environments.

240 days a year will be worked, that is to say with 20 days a month; the week will consist of 5 days of productive activity and the Saturdays of each week will be used for cleaning and maintenance of the production machinery.

2.2 Productive program
The production process begins with the reception and quality control of the vegetables, then a heat treatment is given, the vegetables are minced in different ways: in pieces, halves, julienne, etc. They are packed and finished with their storage and later commercialized in the markets of the Mantaro Valley.

3 Results
Land Location
Applied the Rubric, the Proposal N° 3 was selected, where the land is located on “5 de Febrero avenue”, Pucara district, with area of 24 823.25² accumulating 34 points as shown in table I.

Table 1. Indicators to determine the location of the pickle processing industry

| Proposal | Proposal N° 1 | Proposal N°2 | Proposal N°3 |
|----------|---------------|--------------|--------------|
| Scale    | 1 2 3 4 5     | 1 2 3 4      | 1 2 3 4      |
| Indicators |               |              |
| Proximity of raw materials | X | X | X |
| Close to the target market | X | X | X |
| Availability of labor | X | X | X |
| Electric power supply | X | X | X |
| Potable water supply | X | X | X |
| Drainage supply | X | X | X |
| Wind orientation | X | X | X |
| Access to transportation | X | X | X |
| Industrial waste management | X | X | X |
| Total score | 25 | 20 | 34 |

¹ Poor, ² Regular, ³ Good, ⁴ Very good, ⁵ Excellent

The first step for the market study of pickles; was to determine the target population to arrive at the market the Pickles "La Pukarina" which was made up of men and women from 25 to 39 years, the
Figure 1 shows the 58% consume pickles biweekly in meals with friends, especially based on vegetables organic from the area. For this purpose, a survey was prepared with 10 questions, reaching a survey of 100 people throughout the city of Huancayo, the non-probability sampling technique was used.

![Figure 1](image1.png)  ![Figure 2](image2.png)

**Figure 1.** Pickles consumption frequency in the Mantaro Valley  **Figure 2.** Projection of final consumer purchase of pickles

Figure 2 shows the question: Would you buy Pickles from a local company with organic products? 68% of the respondents would probably buy because their prices would be reasonable, strengthening the viability of the Project.

### 4 Architectural Proposal

The work addresses the design of a Pickle Production and Processing Plant in the Pucara area. A marginal strip of 50 m is proposed, 2 access roads, the first connect Pucara with our raw material; Raquina, the second for the entrance of workers and visitors. The green barrier for the welfare of workers against noise emission.

- The guiding idea is born from a formal search, using geometry.
- The design starts from a sociocultural dimension and the concepts of the environment.
- The formal spatial values of the area were used: patios and corridors and as envelopes, sloping roofs, favorable to the climate, and identification to the context.
- The internal spatial forms have dimensions appropriate to the production process, lighting, ventilation, views, and comfort. In the compositional part, horizontal and vertical spatial fluidity are proposed with integrations relevant to the activities.
- It begins with 3 prisms with a rectangular base, compositionally related to each other.

**Assembly techniques**

Two assembly techniques were used. The first one is the penetration assembly in the commercial zone with the administrative following the joint assembly for the service area. To obtain a better condition for the Plant and the workers, the Mahoney Table [5] was used, a bioclimatic design method that evaluates climatic conditions to compare them with a comfort limit and evaluate them to reference the type of bioclimatic resource to be used [6].

The data obtained at the Viques meteorological station [7] was processed to the climatic data table for the analysis of the Mahoney indicator table. After this, it indicates the North-South orientation, the spread of compact configuration, the size of the openings between 50% - 80%, which can be seen in the Production area and the light and isolated roofs. Figure 3 shows the design of the Production Zone, the pickling process [8], [9] and [10] was considered, starting with the reception and quality control of the vegetables, then treatment is given thermal, the vegetables are chopped in different ways: in pieces, halves, julienne, etc. They are packed and finished with their storage and later commercialized in the markets of the Mantaro Valley [11]. The turnip, beet, and carrot processing will be prioritized, as it is a vegetable of greater production in the area accompanied by spices, aromatic herbs, condiments,
vinegar, etc, preserved by natural fermentation [12]. The administrative area has spaces for the development of its activities: Advertising Office, in charge of promoting the products; Shipping and sales office to market pickles, an institutional hall as figure 4 shows for workers and clients, Administrative Office, Human Resources, Accounting, and Archives.

Figure 3. Production area of the pickle processing industry.

Figure 4. Institutional dining room for workers and visitors.

The commercial area has two exhibition rooms, a multipurpose room, the reception and entrance of visitors to the plant. The service area has a nursery for the introduction and subsequent technical assistance to the local horticulturists, to treat wastewater from productive activities and others; A biodigester is included in order to treat these waters and reuse them in the area dedicated to plantations. Finally, composting to obtain organic fertilizer.

5 Benefits and costs
The costs and benefits are made up of investment in land, construction (infrastructure), machinery, labor, raw materials; with an initial investment approximately 445282.73 USD in the first year financed at a bank interest of 7% payable in 6 years. “La Pukarina” S.A. integrated by 20 community members of the Peasant Community of Pucara - Huancayo, who will produce 1500 units of pickles daily, for the markets of the Mantaro Valley, Lima and others. From the Investment Analysis, we state that the rate of return (IRR) after investing in the project will be 115% with profitability of 100.88%. The Net Present Value (NPV) is greater than 0, which means that the capital would be recovered in the fifth year and the amount of profits will exceed the initial investment and the capital will be increased.

6 Conclusion
After the study, the “La Pukarina” Pickle Processing Industry is proposed as a technically and economically viable alternative 100.8 %, since in Mantaro Valley there is no logistics chain for the distribution of horticultural products, nor for processed products, which in the long term generates losses to producers in the Pucara area.

A new infrastructure and the start of a vegetable product processing industry in the region respect the environment and its surroundings, enables the construction of a Pickle Production and Processing Plant with materials from the region in the Pucara, province of Huancayo, Peru.

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