

# Planned Distribution Center for Cerdo Real Meat Products in District IV-Batangas Province, Philippines

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**Abstract** - This study aimed to determine the optimal location for BUKLOD-UNLAD Multi-purpose Cooperative (BUKLOD)'s CERDO Real Meat products distribution centers and to identify the market condition once the optimal location was identified. The said cooperative from Dagatan, a barangay of Taysan, Batangas, Philippines identified the need to create distribution center specifically in District IV of Batangas Province due to the growing demand for their real meat products in the area. Hence to address this need, a study to identify for its optimal location was requested by BUKLOD from the researchers. First, interviews with the management and members of the cooperative were done by the researchers to identify the requirements in establishing a distribution center. In the same way, consultations with the 7 municipalities of District IV were piloted to inform them accordingly about the said project. Moreover the researchers also referred to the Comprehensive Land Used Plan 2012-2022 of each municipality provided by the Provincial Planning and Development Office along with geographical maps gathered from the Provincial Engineers Office to acquire specific data on locations of the involved municipalities. Through various facility planning tools such as Factor Rating Method, Analytical Hierarchy Process and Center of Gravity, the researchers identified Rosario, Batangas as the best location for establishing the distribution center. After a market study was conducted, the researchers further proved the viability of establishing BUKLOD's CERDO's products' distribution center in the area.

**Keywords:** planned distribution center, optimal location, facility planning, Factor Rating Method, Analytical Hierarchy Process (AHP) Center of Gravity, market study

## INTRODUCTION

Facility location studies play a critical role in the identification of optimal location strategies for a set of resources or services intended to serve a given set of customers or to meet various demands. Thus, every firm must consider location planning techniques for the establishment of an industry at a particular place. In these techniques decision makers, must select sites that will not simply perform well according to the current system state, but will continue to be profitable for the facility's lifetime, even if environmental factors change, geo-political environments develop, technology and populations shift, and market trends evolve.

In every organization, location decisions are an integral part of the strategic planning process. Thus,

finding an optimal location is considered by many firms as a major strategic concern, not only to control cost but to secure a competitive advantage, as well [1].

Moreover, location has a major impact on the overall risk and profit of the company because one-fourth of a company's total revenue can be attributed to freight expenses of both raw materials and finished products [2].

These are also the same considerations of Buklod-Unlad Multipurpose Cooperative (BUKLOD) at Dagatan, Taysan, Batangas, which wishes to create distribution centers of their CERDO, [a Spanish word for pig] real meat products specifically in District IV – Batangas Province to cope up with the growing demand for their products in the area. BUKLOD

started producing and distributing processed meat products formerly called as Fresh Chilled Carcass Meat and Processed Meat in 2010 at Taysan Municipality and since then daily production is done to meet market orders around Region IV-A and Region IV-B and nearby provinces. The manufacturing facility of the cooperative can process 150 to 200 kg of meat and produce 600 to 900 pcs/day of meat products like pork tocino, embutido, hotdogs, pork tapa, longanisa, ham and siomai, all delivered to the local market.

In 2013, with the help of 288 members/retailers of BUKLOD, demand soared with a sales reaching Php 6,844,737.96 (an increase of 21.77% compared to 2012) and an output volume of 28,383 kg. With these, proven market potential, the General Manager of BUKLOD emphasized the cooperative's desire to enter the market of nearby municipalities through network expansion by putting up distribution centers. It was also stated that BUKLOD is looking for a first-class municipality with high revenue potential, specifically a location with high urbanity, and a location with a minimum transportation cost. Hence conducting this project will help the cooperative to understand a certain market place where they can settle 4 distribution centers within the Batangas area.

The main factors that affect location decisions include regional factors, community considerations, and site-related factors [3]. As an aid in the analysis, the researchers used Facilities Planning concepts such as Factor Rating, Analytical Hierarchy Process and Center of Gravity Method [4].

On the other hand, Statistical tools were used like Arithmetic Straight Line, Statistical Straight Line and Statistical Parabolic Curve for projections of demand, supply and potential market. The researchers believed that through the use of these tools in making the Planned Distribution Center for CERDO Real Meat Products will help to provide holistic understanding between BUKLOD and their customers. This study of determining distribution center for sales potential area, aims to locate an optimum distribution center to improve sales performance, to address a specific market, customer segmentation and optimizing their market using the said plan for distribution centers. This was formulated with the aim and guiding BUKLOD CERDO products to couple a great understanding of their business and measuring their market performance. With this kind of study,

BUKLOD will be able to anticipate higher profitability.

Moreover, to guide the researchers in this study, numerous articles and studies were used as basis. These are studies with the same subject of determining optimal facilities location such as the study of Badri [5] where Analytical Hierarchy process was used in combination with goal programming to solve Global Facility Location-Allocation Problem. The study of Kuo, Chi and Kao [6] combined decision support system, a Fuzzy AHP and artificial neural network in selecting convenient store. The proposed system used components such as hierarchical structure development for Fuzzy AHP and weights determination before having other two components such as data collection and decision making. The hybrid fuzzy AHP model was used by Chou and Yu [7] in their study entitled "Application of a New Hybrid Fuzzy AHP Model to Location Choice". Chang, Chou and Shen [8] used Factor Rating System as one tool in their study. Factor rating was integrated with fuzzy set theory and simple additive weighting in evaluating facility locations alternatives. Similarly, Lee and Yang [9] study used Analytical Hierarchy Process decision model to provide framework to assist managers in analyzing various location factors, evaluation of site alternatives and making final location selection were also considered by the researchers. Center of Gravity Method was applied by Zi-xia and Wei [10] in their study for the selection of a single distribution center.

The present study on the other hand, is also related to the study of Suthamphong [11] entitled "Identifying an Optimal Facility Location for a Factory". He used facility location models such as center of gravity method and Alfred Weber's theory and through the help of the load distance tool the best alternative location was chosen. The main concern of this study is to help a Thai lime-burning company to find an alternative location for its expanding business with an aim of minimizing transportation cost. Net present value (NPV), Internal Rate of Return (IRR) and Payback were calculated on the optimal location while in the present study market potential of CERDO products in the optimal location was analyzed.

## OBJECTIVE OF THE STUDY

The main objective of the study was to determine the optimal location of the distribution center for

CERDO Real Meat Products of Buklod-Unlad Multipurpose Cooperative and to conduct market study of those products once optimal location was identified. Specifically the study aimed to analyze the CERDO Real Meat Products requirements for the planned distribution center with respect to: Regional Factors, Community Consideration, Site- Related Factors and Demand Requirement; to determine the optimal location of the distribution center based from selected requirements using qualitative and quantitative methods of Facility Planning; and to provide a market study for the optimal location.

## **METHODS**

### **Research Design**

The researchers used descriptive method since the Planned Distribution Centers for CERDO real meat products is a fact-finding study that needs adequate and accurate interpretation of the findings. Likewise, descriptive method is also suitable to describe the present condition that BUKLOD is experiencing. Analysis of data gathered from the numerical records of BUKLOD was done for these purposes.

### **Subject of the Study**

The subjects of the study were General Manager, Accounting Staff, Marketing Staff, Production Manager and Meat Processing Head manager of the cooperative. They were interviewed by the researchers to get all the necessary requirements in optimizing location of the distribution center necessary in this study. Similarly, they were the ones interviewed to supply data and to make a deeper analysis on the market performance of the BUKLOD's products. This research will help BUKLOD to make decisions about the optimal location for their business. Likewise, this will help BUKLOD to determine the marketability of the business in that optimal location.

### **Instrument**

To be able to gather the necessary information and data necessary for the study, the researchers conducted interviews with the General Manager, Accounting Staff, Marketing Staff, Production Manager, Meat Processing Head as they were considered subject of the study. Also, they utilized the some tools and principles essential for the progress of the study.

The researchers interviewed the personnel of the Planning and Engineering Office of each municipality

in District IV-Batangas Province and secured a copy of their Comprehensive Land Used Plan (CLUP) with their Geographical Map. Also, the researchers interviewed personnel from the Provincial Planning Office to gather the information needed to solve the problem of the cooperative.

The researchers also used library materials and websites in order to acquire other related studies which can support in the significance of the said study.

### **Procedure**

The researchers conducted informal interviews with BUKLOD personnel to collect information needed in the study. To have idea about location, consultations with the 7 municipalities in District IV of Batangas Province, and Comprehensive Land Use Plan (CLUP 2014) and sectoral studies and geographical maps were gathered. The Provincial Engineers Office and Provincial Planning Office also helped the researchers with a more specific and detailed location map of District IV. The internet and reference books are also used to acquire knowledge related to the problem.

### **Data Analysis**

The statistical measures used to better understand the existing situation for accurate and reliable presentation are Ranking, Percentage, Arithmetic Straight Line, Statistical Straight Line and Statistical Parabolic Curve.

In Factor Rating Method, ranking is used to select the best municipality according to different requirements in District IV-Batangas Province, where 7 being the highest and 1 as the lowest rank. Percentage is also used to identify the proportion of each requirement. In Analytical Hierarchy Process, ranking is an effective tool for dealing with complex decision and may aid the decision maker to set priorities and make the best decision, where 1 is being the equal importance and 9 as the absolutely more important.

After getting the optimal location using different Facility Planning Techniques, a market study is provided using Arithmetic Straight Line, Statistical Straight Line and Statistical Parabolic Curve in projecting the demand and supply for the next ten years. Through this approach, the researchers proved that the location determined is the best location for the Distribution Center for CERDO Real Meat products.

## RESULTS AND DISCUSSION

### Analysis of CERDO Requirements for a distribution center with respect to Regional Factor in terms of Proximity to Market

Proximity to market is a requirement in putting up a distribution center because accessibility to target market can increase number of customers as well as promote customer satisfaction.

Table 1. Municipality Distance to Public Market

Municipality	Distance (km)	RANK
San Jose	0.5 km	2.5
Ibaan	1.1 km	5.5
Lipa	2.4 km	7
Taysan	0.4 km	1
Padre Garcia	0.6 km	4
Rosario	0.5 km	2.5
San Juan	0.8 km	5.5

Source: Provincial Planning and Development office and Engineering office.

The table shows the corresponding distance to public market of different municipalities in District IV-Batangas Province and their rank. Choosing the right location of the distribution center was based on the ease of access to its target market. Taysan and Lipa rank the highest and lowest, respectively.

### Proximity to Supplier

Proximity to Supplier is a requirement in finding the optimal location to avoid high transportations cost, lengthy travel time, and demanding communication.

Table 2. Municipality Distance to Buklod-Unlad

Municipality	Distance (km)	RANK
San Jose	34 km	6
Ibaan	22 km	4
Lipa	27 km	5
Taysan	5.8 km	1
Padre Garcia	18km	3
Rosario	14 km	2
San Juan	37km	7

Source: Comprehensive Provincial Planning and Development office and Engineering office.

Table 2 shows the proximity of BUKLOD located at Dagatan, Taysan, Batangas to different municipalities in District-IV with corresponding distances and ranks. From here, Taysan is determined as the nearest municipality from BUKLOD while San Juan as the farthest.

### Labor Factors

Labor is an important consideration in finding the optimal location because if laborers are from the same municipality where the distribution center could be established, the business can benefit the community as it helps the people living in the area. Also there is a possibility that the laborers can be a factor in selling out the product, in a way that people in the community, their culture and people's background is known by the labor force hired by CERDO. This is an advantage for CERDO to earn more customers.

Table 3. Number of Employed and Unemployed in each Municipality

Municipality	Total Labor Force	Employed	Unemployed	Rank
San Jose	39,358	21,543	17,815	4
Ibaan	25,369	16,425	8,944	7
Lipa	70,167	35,893	34,274	2
Taysan	21,099	11,591	9,508	6
Padre Garcia	25,987	12,591	13,396	5
Rosario	69,338	26,977	42,361	1
San Juan	55,857	27,045	28,812	3

Source: Comprehensive Provincial Planning and Development office and Engineering Office

Table 3 shows the total number of people employed and unemployed in every municipality in District IV and its rank. It has been recorded that Rosario holds the most unemployed individuals while Ibaan has the least.

### Community Consideration in terms of Population

Table 4. Number of Barangays and Population in Urban Areas in Different Municipalities

Municipality	Urban Areas (no. of barangay)	Population	Rank
San Jose	4	15, 692	2
Ibaan	3	8, 059	5
Lipa	30	165, 420	1
Taysan	2	3, 668	7
Padre Garcia	2	7, 358	6
Rosario	6	14, 855	3
San Juan	2	8, 683	4

Source: Socio-Economic Physical Profile (SEPP), Cities and Municipalities CLUP, Batangas Province and Provincial Developments and Physical Framework Plan.

Population analysis is important before putting up a distribution center, starting a business, and expansion of operations. There has to be a market for

products or services for a company to make profit. In this case, the population in the urban area of the municipality must be more than 15,000 people as a requirement in putting up a distribution center. Consequently, if there are more people in the area, there is a bigger possibility of the potential customers and buyers of the product.

Table 4 shows the number of urban areas of each municipality with their corresponding population. The population of municipality in urban areas has been ranked and the biggest urban population is Lipa and the smallest is Taysan.

### Community Consideration in terms of Revenue Classification

This number of public places can be basis from revenue classification of each municipality. To determine how active a municipality is, there should be a consideration of the revenue earned of each municipality. It is also considered as a criterion in choosing the best municipality.

Table 5. Revenue Classification in Each Municipality

Municipality	Employed	Class	Rank
San Jose	36,136,951.04	1 <sup>st</sup>	2
Ibaan	19,632,750.00	2 <sup>nd</sup>	5
Lipa	1,067,392,677.7	1 <sup>st</sup>	2
Taysan	88,950,512.72	2 <sup>nd</sup>	5
Padre Garcia	14,998,518.00	2 <sup>nd</sup>	5
Rosario	121,812,531.50	1 <sup>st</sup>	2
San Juan	40,754,646.04	2 <sup>nd</sup>	5

Source: Socio-Economic Physical Profile (SEPP), Cities and Municipalities CLUP, Batangas Province and Provincial Developments and Physical Framework Plan.

Table 5 shows the total revenue classification in each municipality. This classification is derived from the type of establishment, services and facilities present in given municipalities. Higher level classification for first class municipalities like Lipa, Rosario and San Jose have more functioning services and larger areas than those on lower level municipalities like Ibaan, Taysan, Padre Garcia, and San Juan as the second revenue potential municipalities.

### Consideration in terms of Utilities

The energy and water supply that impact a certain industry in a given location should be included in the location decision. Utilities are considered as a requirement to provide good service for their

distribution center. Utilities are basic needs in every operation of each business.

Table 6. Per Cent of Energy and Water Supply in Each Municipality

Municipality	Energy Supply +0.6	Water Supply 0.4	Total	Rank
San Jose	82.40%	100%	89.44%	7
Ibaan	95.43%	100%	97.26%	5
Lipa	94.94%	100%	96.96%	6
Taysan	96.56%	100%	97.94%	3
Padre Garcia	96.15%	100%	97.69%	4
Rosario	98.26%	100%	98.96%	1
San Juan	96.91%	100%	98.15%	2

Source: Socio-Economic Physical Profile (SEPP), Strategic Environmental Plan, Province of Batangas 2005-2020 and PG-ENRO, Batangas

Table 6 shows the energy and water supply in each municipality. All of the municipalities have hundred percent supply of water. However, there are differences in energy supplied in every municipality where Rosario has the highest power supply and San Jose with the lowest.

### Site Related Factors in terms of Land

Total land area and the land used within a municipality are important to determine how much land is still available for the industrial areas and built up areas. Table 7 shows the distribution of land areas in different municipalities using the Comprehensive Land Used Plan (CLUP 2012-2022) and Socio-Economic Physical Profile (SEPP) by the Provincial Planning and Development Office and Engineering Office.

Table 7. Land Area Allocation in Each Municipality

Municipality	Total Land Area*	Built up Land Area *	Industrial Land Area *	Agricultural and Forest Land Area *	Land Area Available for Use for Future Establishment
San Jose	4,947	355.923	3.771	4,413.71	173.596
Ibaan	6,796	657.214	35.301	5,615.91	487.575
Lipa	20,940	2464.548	333.84	17,941.91	199.702
Taysan	10,936	203.003	35.453	8,491.40	2,206.14
Padre Garcia	9,374	187.96	38.72	3,663.14	5,484.18
Rosario	18,943	800.152	44.124	16,676.76	1,421.96
San Juan	27,340	738.447	18.325	26,182.73	400.498

\*(hectares)

Source: Comprehensive Land Used Plan (CLUP 2012-2022), Socio-Economic Physical Profile (SEPP) and Provincial Planning and Development office and Engineering office.

Table 7 shows the total land in each municipality, including the built up industrial, agricultural and forestry areas, the land available for use for future establishments, and ranks. Padre Garcia ranked first with a total land available for use for future establishment of 5,484.180 hectares.

#### Site Related Factors in terms of Transportation

Transportation has always played an important role in influencing the formation of urban societies because of facilitates trade, exchange and travel. People depend upon the natural resources to satisfy the needs of life but due to non-uniform surface of earth and due to difference in local resources, there is a lot of difference in standard of living in different societies. So there is an immense requirement of transport of resources from one particular society to other. The accessibility of the store and its public transport links are another critical success factor for putting up a distribution center. Ease in transportation is considered in identifying the optimal location. Furthermore, accessibility is important in transporting goods and services with an adequate primary and secondary road networks. BUKLOD requires the optimal location to provide an ease of access to Buklod Meat Processing Plant.

#### Site Related Factors in terms of Zoning and Restrictions

Table 8. Hierarchy of Urban Center

Municipality	Hierarchy of Urban Centers - Municipalities (2008-2013)	Rank
San Jose	Medium	4.25
Ibaan	Medium	4.25
Lipa	Large City	1
Taysan	Medium	4.25
Padre Garcia	Medium	4.25
Rosario	Large	2.5
San Juan	Large	2.5

*Source: Cities and Municipalities CLUP/Zoning Ordinance, Batangas Province and Provincial Developments and Physical Framework Plan*

Zoning and Restrictions are necessary requirement in putting up a distribution center. The basic reason is to know the municipality ordinance in putting up a business. According to Planning Development and Municipal Office, zoning and restrictions of different municipalities can be classified according to Hierarchy of Urban Centers. As stated in the Cities and Municipalities

CLUP/Zoning Ordinance, no certain restrictions are classified for small business that will be established in the locality as long as the business is safe for the environment within the community.

Table 8 shows the hierarchy of urban centers in each municipality. Zoning in Lipa City, as it is classified as a medium city, has site of industrial estate, existing educational and medical facilities, location of regional and national offices, tourism facilities, world-class residential and subdivisions, shopping malls and state-of-the-art telecommunication facilities. On the other hand, large Municipalities like Rosario and San Juan have provincial and administration services. There are also residential subdivisions, world-class tourism facilities, residential subdivisions, comprehensive shopping sites, secondary and tertiary health and education services, processing and marketing establishments in these settlements. Furthermore, medium municipalities like San Jose, Ibaan, Taysan and Padre Garcia, have residential subdivisions, medium and large industries, small agro-processing and services, full range convenience and extension shops and tourism facilities.

#### Demand Requirement

The demand is a requirement in putting up a distribution center as it demonstrates the quantity of goods demanded in a certain location. BUKLOD provides the necessary data to be able to compute the demand for each municipality. The demand of each municipality is shown below:

Table 9. Municipality Demand for CERDO Real Meat Products

Municipality	Demand (Kg)
San Jose	10.0
Ibaan	480.9
Lipa	382.4
Taysan	21927.2
Padre Garcia	10.0
Rosario	282.1
San Juan	10.0

*Source: BUKLOD-UNLAD annual demand per municipality*

Table 9 shows the market demand in each municipality. Taysan, as the home-based of CERDO products at Dagatan, Taysan, Batangas, totals 21,927.2 kg, while San Jose, Padre Garcia and San Juan has ten 10kilograms each.

# **Determination of optimal location of the distribution center based from selected requirements using qualitative and quantitative methods of Facility Planning**

To determine the optimal location of the distribution center, three methods were used in the study and these methods are classified as either Quantitative or Qualitative method. The qualitative methods used are the Factor Rating method and the Analytical Hierarchy Process, while the Center of Gravity was the quantitative method used.

## **Qualitative Methods**

### **A. Factor Rating Method (Subjective Factor Weighting)**

From each possible location, different factors are relevant in selecting an optimal location. A weight to

each factor that indicates its relative importance compared to all other factors is assigned. Then, with the common scale for all factors of 0 to 100, each location alternative is scored and the factor and sum of the results is multiplied for each location alternative.

Table 10 shows a list of CERDO location requirements or relevant factors called critical factors for each municipality where Cost and availability factor is pertaining to utilities. These data collected are ranked in each municipality.

Table 11 shows the raw score of CERDO location requirements or relevant factors for each municipality where 7 as the highest and 1 as the lowest score. In cases of municipalities with the same score, it is divided into two to get the average of each municipality.

Table 10. CERDO Location Requirements or Critical Success Factor in Each Municipality

	San Jose	Ibaan	Lipa	Taysan	Padre Garcia	Rosario	San Juan
Proximity to Market (km)	0.5	1.1	2.4	0.4	0.6	0.5	0.8
Proximity to Supplier (km)	34	22	27	5.8	18	14	37
Population	70,737	44,317	150,406	40,180	41,082	117,367	96,224
Public Places	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	1 <sup>st</sup>
Cost & Availability	7	3	5.5	2	4	1	5.5
Land (ha)	5,954.3	6,796	20,940	9,236	9,374	22,310	27,340
Zoning & Restriction	Medium	Medium	Large City	Medium	Medium	Large	Large

Table 11. CERDO Location Requirements or Critical Success Factor Raw Scores for Each Municipality

	San Jose	Ibaan	Lipa	Taysan	Padre Garcia	Rosario	San Juan
<b>Proximity to Market</b>	5.5	2.5	1	7	4	5.5	2.5
<b>Proximity to Supplier</b>	2	4	3	7	5	6	1
<b>Population</b>	4	3	7	2	1	6	5
<b>Public Places</b>	1	4	6.5	2	3	6.5	5
<b>Cost &amp; Availability</b>	1	5	2.5	6	4	7	2.5
<b>Land (ha)</b>	3.5	3.5	5	1	2	7	6
<b>Zoning &amp; Restriction</b>	4	1	7	2.5	2.5	5	6

Table 12. CERDO Location Requirements or Critical Success Factor Weighted Scores for Each Municipality

	Weight	San Jose	Ibaan	Lipa	Taysan	Padre Garcia	Rosario	San Juan
Proximity to Market	20	110	50	20	140	80	110	50
Proximity to Supplier	20	40	80	60	140	100	120	20
Population	20	80	60	140	40	20	120	100
Public Places	10	10	40	65	20	30	65	50
Cost & Availability	10	10	50	25	60	40	70	25
Land (ha)	10	35	35	50	10	20	70	60
Zoning & Restriction	10	40	10	70	25	25	50	60
<b>Total</b>	<b>100</b>	<b>325</b>	<b>325</b>	<b>430</b>	<b>435</b>	<b>315</b>	<b>605</b>	<b>365</b>

Table 12 shows a weight to each factor. Weight for each CERDO requirements was based from General Manager of Buklod and the researchers. Raw scores are multiplied by weights for each factor for each location. From these data, it was determined the the municipality of Rosario has the highest score followed by Taysan.

## B. Analytical Hierarchy Process

The foregoing table presents the location requirements that are used in selection assessment for distribution center of CERDO products using AHP. It includes the pair-wise comparison matrix where criteria are evaluated, the location comparison with respect to different requirements.

Figure 1 show each possible location decomposed into a hierarchy of interrelated decision criteria and alternatives

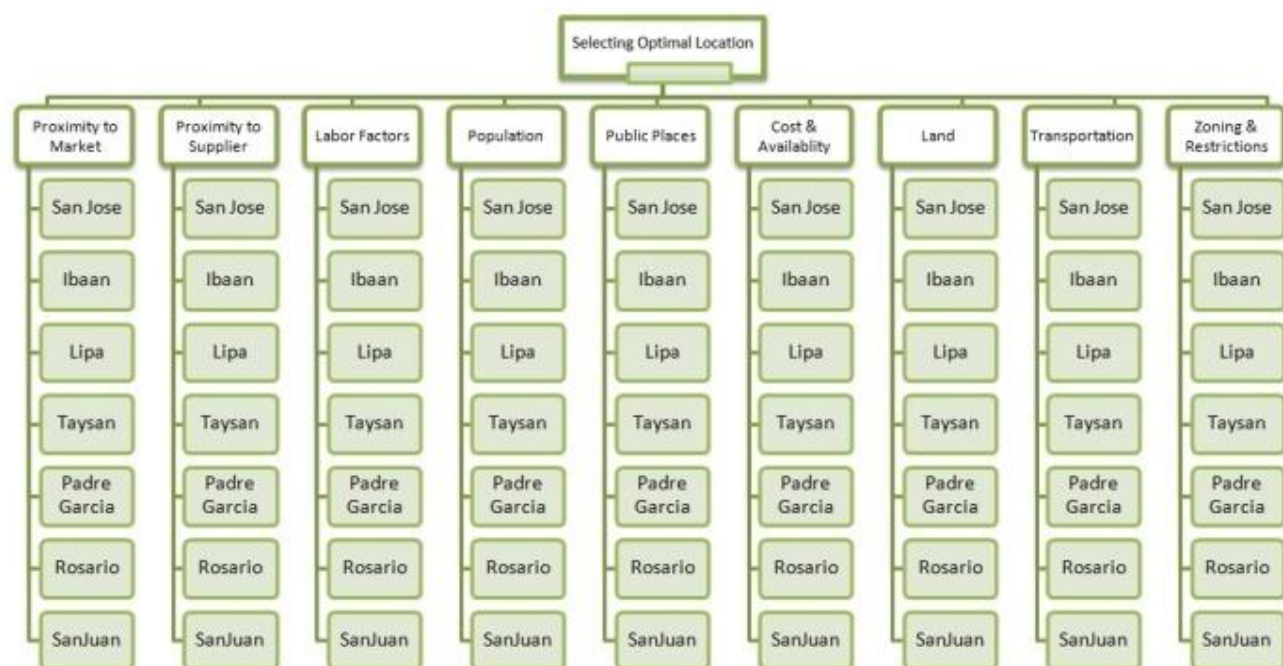


Figure 1. Hierarchy Tree

**Table 13. Pairwise Comparison Matrix: Evaluation Criteria (Original Matrix)**

	Proximity to Market	Proximity to Supplier	Population	Public Places	Cost & Availability	Land	Zoning & Restriction
Proximity to Market	1	8	3	3	7	4	5
Proximity to Supplier	1/8	1	1/3	1/3	1/6	1/5	1/7
Population	1/3	3	1	1/3	5	1/6	6
Public Places	1/3	3	3	1	5	1/6	7
Cost & Availability	1/7	6	5	1/5	1	1/8	4
Land (ha)	1/4	5	6	1/6	8	1	7
Zoning & Restriction	1/5	7	6	1/7	4	1/7	1
<b>Total</b>	<b>2.38</b>	<b>33</b>	<b>24.33</b>	<b>5.18</b>	<b>30.17</b>	<b>5.8</b>	<b>30.14</b>

Table 13 is pair wise comparison which determines the relative importance of one criterion over the other. Using CERDO requirements and informed judgments, weights and priorities are derived. Then the relative rankings of alternatives are determined.



Table 14. Pair wise Comparison Matrix: Evaluation Criteria (Adjusted Matrix)

	Proximity to Market	Proximity to Supplier	Population	Public Places	Cost & Availability	Land	Zoning & Restriction	Weighted Average
Proximity to Market	0.42	0.24	0.12	0.58	0.23	0.69	0.17	<b>0.35</b>
Proximity to Supplier	0.05	0.03	0.01	0.06	0.01	0.03	0.00	<b>0.03</b>
Population	0.14	0.09	0.04	0.06	0.17	0.03	0.20	<b>0.10</b>
Public Places	0.14	0.09	0.12	0.19	0.17	0.03	0.23	<b>0.14</b>
Cost & Availability	0.06	0.18	0.21	0.04	0.03	0.02	0.13	<b>0.10</b>
Land (ha)	0.10	0.15	0.25	0.03	0.27	0.17	0.23	<b>0.17</b>
Zoning & Restriction	0.08	0.21	0.25	0.03	0.13	0.02	0.03	<b>0.11</b>

Table 14 shows the evaluation of criteria using Comprehensive Land Used Plan (CLUP) of each municipality and data from Provincial Planning and Engineering Office.

Table 15. Summary of Best Location Using Analytical Hierarchy Process

	Proximity to Market	Proximity to Supplier	Population	Public Places	Cost & Availability	Land	Zoning & Restriction	Weighted Average
San Jose	0.06	0.00	0.02	0.00	0.01	0.02	0.01	<b>0.12</b>
Ibaan	0.04	0.00	0.01	0.02	0.01	0.02	0.01	<b>0.12</b>
Lipa	0.03	0.00	0.02	0.03	0.01	0.03	0.02	<b>0.15</b>
Taysan	0.08	0.01	0.01	0.02	0.02	0.02	0.01	<b>0.16</b>
Padre Garcia	0.05	0.00	0.02	0.02	0.01	0.02	0.01	<b>0.13</b>
Rosario	0.06	0.01	0.02	0.03	0.02	0.04	0.02	<b>0.18</b>
San Juan	0.04	0.00	0.01	0.02	0.01	0.04	0.02	<b>0.14</b>

In this table it shows that Rosario is the optimal location using AHP with a weighted average of 0.18.

### Quantitative Method Center of Gravity Method

This method uses the distance formula;

$$d = \sqrt{(X_1 - X_2)^2 + (Y_1 - Y_2)^2}$$

where,  $X_1$  and  $X_2$  are the coordinates of existing and proposed facility respectively,  $Y_1$  and  $Y_2$  are Y-coordinates of existing and proposed facility respectively and the Center of Gravity Heuristic;

$$X = \frac{\sum X_i l_i}{\sum l_i} \quad \text{and} \quad Y = \frac{\sum Y_i l_i}{\sum l_i}$$

where,  $X_i Y_i$  are X and Y coordinates of destination i and  $l_i$  = quantity shipped to destination i.

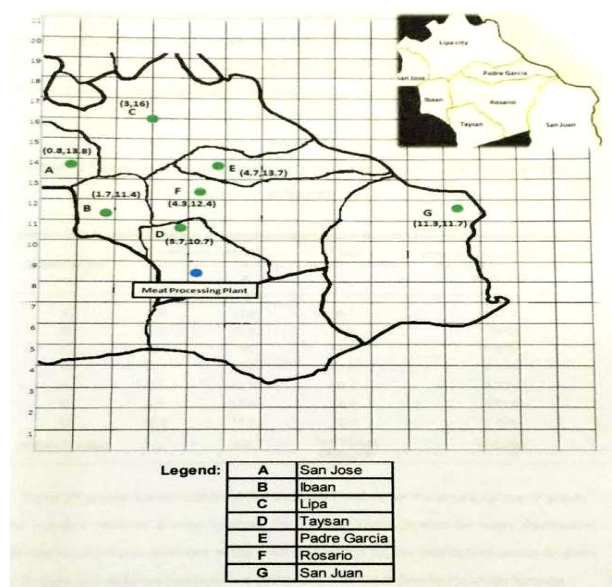


Figure 2. District IV – Batangas Province Municipalities Grid Map of Target Market

Table 16. Demand Center in Each Municipality, Loads and Straight Line Distance from Buklod

Municipality	Demand Center		Load	Straight Line Distance of Demand Center from BUKLOD
	X	Y	L	
A	0.8	13.8	0.1	6.329
B	1.7	11.4	4.8	3.842
C	3	16	3.8	7.679
D	3.7	10.7	21.97	2.335
E	4.7	13.7	0.1	5.334
F	4.3	12.4	2.8	4.005
G	11.3	11.7	0.1	7.92
<b>BUKLOD UNLAD</b>	<b>4.1</b>	<b>8.4</b>	<b>Total Load Distance</b>	<b>112.084</b>

Table 16 shows the tabulation of the computed values for the center of gravity.

Table 17. Straight line Distance of Proposed Distribution Centers from Demand Centers in Each Municipality

Municipality	Demand Center		Load	Straight Line Distance of Demand Center from BUKLOD
	X	Y	L	
A	0.8	13.8	0.1	3.434
B	1.7	11.4	4.8	1.710
C	3	16	3.8	4.458
D	3.7	10.7	21.97	0.910
E	4.7	13.7	0.1	2.502
F	4.3	12.4	2.8	1.229
G	11.3	11.7	0.1	7.899
<b>Proposed Distribution Center</b>	<b>3.402703</b>	<b>11.56041</b>	<b>Total Load Distance</b>	<b>49.97288788</b>

Table 17 shows the optimal location at point (4, 12) using Center of Gravity

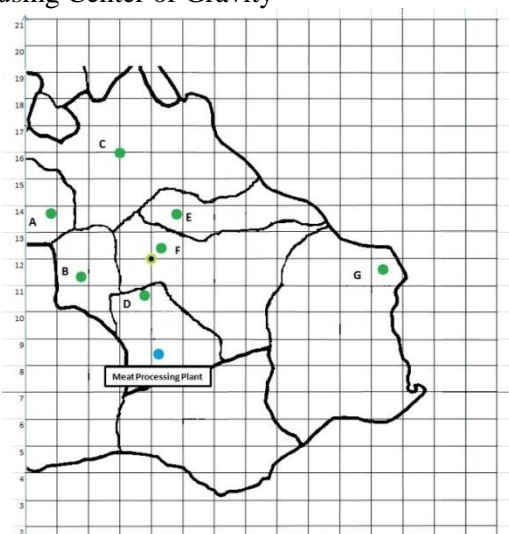


Figure 3. Coordinates of the Optimal Location

The figure shows the centroid or the optimal location where it is more cost-efficient to ship directly between BUKLOD and Rosario than to ship near the centroid.

Table 18. Evaluation of Alternatives

Alternative	Coordinates of Prospective Location	Method of Development
Qualitative Method 1	Rosario	Factor Rating Method
Qualitative Method 2	Rosario	Analytical Hierarchy Process
Quantitative Method 1	(4,12) Rosario	Center of Gravity

Table 18 summarizes the best alternative for the optimal plant location, identified by the methods mentioned earlier.

By Factor Rating Method, the site with the most points was selected and it is found out that the best location for the new distribution center are (1) Rosario – 605, (2) Taysan – 435, (3) Lipa – 430 and (4) Ibaan and San Jose – 325.

On the other hand, by Analytical Hierarchy Process, the site with the most points and deemed to be the best location for the new distribution center is Rosario with 0.18.

In the case of using Center of Gravity, the centroid is found by calculating the X- and Y-coordinates that result in the minimal transportation cost. This gives the management the X- and Y-coordinates of approximately 4 and 12, respectively, and provides an initial starting point to search for a new site. By examining the location of the calculated centroid on the grid map, it is most cost-efficient to ship directly between the Manufacturing plants in Buklod to Rosario, Batangas.

### Provide a market study for the optimal location

The market study is conducted to identify market opportunities while giving a thorough description of the industry which relates to the service desired.

### Analysis of the Market

#### Demand – Supply Analysis

Every business is looking forward to penetrate market which they think has a potential demand for the goods offered. Considered one of the fundamental elements of the planning stage for a business, demand-supply analysis is regarded as an essential means of

determining whether there is dissatisfaction in the part of the customers. In this case, the researcher perceived that current competitors cannot accommodate its clients who need to avail their services.

Table 19. Demand-Supply Analysis of Processed Meat

Year	Demand (Kg)	Supply (Kg)	Potential Market
2015	725113.986	715660.868	9453.118
2016	783254.894	772794.325	10460.569
2017	841395.802	829927.781	11468.020
2018	899536.710	887061.238	12475.471
2019	957677.618	944194.695	13482.922
2020	1015818.526	1001328.152	14490.373
2021	1073959.434	1058461.609	15497.824
2022	1132100.342	1115595.066	16505.275
2023	1190241.250	1172728.523	17512.726
2024	1248382.157	1229861.980	18520.177

Table 19 shows the projected demand, supply and potential market of processed meat in Rosario, Batangas.

Table 20. Demand-Supply Analysis of Fresh Chilled Carcass Meat

Year	Demand (Kg)	Supply (Kg)	Potential Market
2015	1618119.090	1596944.691	21174.399
2016	1682573.870	1660493.243	22080.627
2017	1747028.650	1724041.795	22986.854
2018	1811483.429	1787590.347	23893.082
2019	1875938.209	1851138.899	24799.310
2020	1940392.989	1914687.451	25705.537
2021	2004847.769	1978236.003	26611.765
2022	2069302.548	2041784.555	27517.993
2023	2133757.328	2105333.107	28424.220
2024	2198212.108	2168881.659	29330.448

Table 20 above shows the projected demand, supply and potential market for carcass meat.

### Market Share Analysis

Market share is a tool used to determine the percent of share of the business as well as distinguishes the position of the competitors in the market. Currently, in Rosario, Batangas, there are 4

distributors and seven 7 retailers that distribute processed meat.

Table 21. Capacity of the Competitors for Processed Meat

Distributor and Retailers	Capacity (kg)	Percentage
Limcoma	80, 500.500	11.10%
SIDC	64, 475.366	8.89%
Distributor	395, 390.000	54.53%
Retailers	175, 295.000	24.17%
CERDO Real Meat Shop	9453.120	1.31%
<b>Total</b>	<b>725, 113.986</b>	<b>100%</b>

Sources: Distributor and Retailer at Rosario, Batangas

Table 21 shows the capacity of the each producer of processed meat in Rosario, Batangas. The capacity of all competitors came from the interview with the distributors and retailers of processed meat. After computation, it was determined that the market share of CERDO Real Meatshop comes from the potential market, 9,453.12kg, representing 1.31% of the total demand.

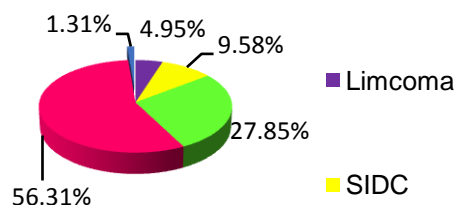


Figure 4. Pie Chart of Potential Market for Processed Meat

The figure shows the market share of the competitors, such as Limcoma, SIDC, distributors and retailers.

Table 22. Capacity of the Competitors for Fresh Meat

Distributor and Retailers	Capacity (kg)	Percentage
Limcoma	80, 030.063	4.95%
SIDC	155, 060.065	9.58%
Distributor	450, 570.330	27.85%
Retailers	911, 284.233	56.31%
CERDO Real Meat Shop	21, 174.399	1.31%
<b>Total</b>	<b>1, 618, 119.090</b>	<b>100%</b>

Table 22 shows that the capacity of the competitors of fresh meat in Rosario, Batangas based from interviews with the distributor and retailer of fresh meat. The market share of the CERDO Real Meat Shop comes from the potential market, which is 21,174.399 kg, representing 1.31% of the total demand.

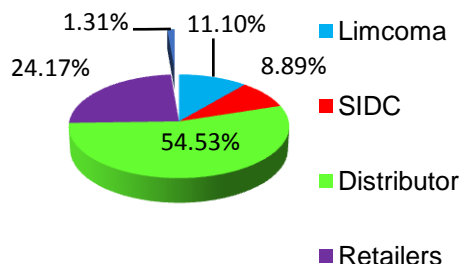


Figure 5. Pie Chart of Potential Market for Fresh Meat

### B. Plant Size and Service Schedule

The business will operate every day for 15 hrs starting from 5:00 am to 7:00 pm. The shop will just operate beyond the working hours in cases that there will be holiday and other seasonal activities. It will also be open for member non-member and retailers.

CERDO Real Meat Shop can have an average capacity of 26 kg of processed meat and 58 kg of fresh meat per day, depending upon on the 15-hour operation and standard time to process meat and fresh meat, and on the seasonal demand of meat consumption. The projected demand and supply of processed meat and fresh meat for the next 10 years in the market study were also considered. Potential market had been identified which defines the proposed plant size of the distribution center.

### CONCLUSIONS

CERDO requirements analysis helps to propose and solve an optimal location for the distribution center easier. It helps the researcher to earn more ideas on how they can achieve the optimal location.

Using proposed scheme and techniques for solving location problem and by having detailed evaluation of all the alternatives in District IV – Batangas Province according to criteria, brings the best decision for optimal location to the cooperative's greatest advantage.

Market study is a proof if the optimal location of the distribution center should really be best located in Rosario, Batangas, Philippines. Trends on market, demand, supply, potential market and production capacity in the area must be identified and monitored if the CERDO distribution center wishes to optimize its life.

### RECOMMENDATIONS

Future researchers of Buklod-Unlad Multi-purpose Cooperative may also consider studying establishing a distribution center in Lipa, Batangas (Second Optimal Location), Ibaan, Batangas (Third Optimal Location), and Padre Garcia (Fourth Optimal Location) considering the demand, potential market and profit from engaging a business with the different location chosen.

Future researchers of the cooperative may also study putting up distribution center in Lobo, Batangas and Batangas City. As per BUKLOD records of annual sales, fifty per cent (50%) of the sales come from this location point.

Other quantitative techniques in optimizing location are highly encouraged not only in BUKLOD but for other related problems.

When this CERDO Real Meat shop is constructed, further research and improvements on the marketing strategies using mix marketing variables or the 4Ps must be well incorporated with the business. It involves creating a unique blend of the right product, sold at the right price, in the right place, using the most suitable methods of promotion. In this study, location is our consideration, so the researchers are intently recommending BUKLOD the other Ps such as product, price, and promotion of the marketing variable to use in their business.

The cooperative may also consider adding a research and development department to conduct studies on product developments as well as the packaging material to be used and for more advance industrial processes involved in manufacturing processed meat.

### REFERENCES

- [1] Stevenson, W. (2002). Location Planning and Analysis. *Operation Management*. 361-375.
- [2] Heizer, J. & Render, B. (2011). Location Decisions. *Operations Management*. 343-355.
- [3] Sule, D. (2009). Plant Site Selection and Service Support Considerations. *Manufacturing Facilities: Location, Planning and Design*. 611-615.

- [4] Stevenson, W & Sum, C. (2010). Operation Management: An Asian Perspective.
- [5] Badri, M. (2014). Combining the Analytic Hierarchy Process and Goal Programming for Global Facility Location- Allocation Problem. Elsevier Journal. Production Economics 62(3) 237-248.
- [6] Kuo,R., Chi, S. & Kao, S. (2013). A Decision Support System for Selecting Convenience Store Location Through Integration of Fuzzy AHP and Artificial Neural Network. Journal in Computers in Industry. 47(2). 199-214.
- [7] Chou, C. & Yu, K. (2013). Application of a New Hybrid Fuzzy AHP Model to the Location Choice. Mathematical Problems in Engineering. Article ID 592138.
- [8] Chang, Y., Chou, S., & Shen,C.(2008). A Fuzzy Simple Additive Weighting System under Group Decision Making for Facility Location Selection with Objective/Subjective Attributes. European Journal of Operation Research.189(1). 132-145.
- [9] Lee, H. & Yang, J.(2006). An AHP Decision Model for Facility Location Selection. Facilities. 15(9/100) 241-254.
- [10] Zi-xia, C. & Wei, H. (2010). Application of Center of Gravity on the Selection of Single Distribution Center. Logistics Systems and Intelligent Management. International Conference. Vol. 2. 981-984.
- [11] Suthamphong, A. (2012). Identifying an Optimal Facility Location for a Factory. Assumption University Journal. 82-98.

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