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The Role of Location on Exploitation of Agricultural Businesses in Mazandaran Province (Case Study: Agricultural Processing Industry)

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Abstract

Choosing the proper site is essential in constructing units such as agricultural processing industries. In this study, we try to determine the factors affecting the exploitation of the agricultural processing industries and measure the share of location as one of the critical issues in locating research. The 2572 data were collected from the Agricultural Jihad Organization of Mazandaran province. The two-level Logit model was used as the estimation method. The results showed that the variables of cooperative ownership, planned capacity, unit area, industrial parks, and livestock and Horticultural activities harm the exploitation. The variables of capital and fishery activity positively affect exploitation. Also, the construction site explains, on average, 1.2% of the observed deviation, which is not defined by independent variables in the model. The share of the worst and the best location in terms of spatial characteristics are 0.2 and 4.6%. The low percentage of sites in exploitation can be due to the right choice of location by investors or the proximity of the cities of Mazandaran province. Therefore, it is necessary to improve other factors affecting the construction of the Agricultural processing industries in Mazandaran.

Keywords: Agricultural Processing Industry, Location, Exploitation, Two-level Logit, Mazandaran Province.

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1. Introduction

Agricultural processing industries are the most important link between the agricultural and industrial sectors (Pirasteh, 2003). These

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industries, through the processing and transformation of agricultural products, will add to the life of products and prevent their corruption (Pourmezan & Akbari, 2012). The existence of such industries could help to reduce waste in crops, facilitate the transportation of agricultural products, increase the value of agricultural products, and improve the service sector in rural areas (Shahabi et al., 2016). Also, the establishment of these industries in villages would increase income and improve the household economic situation and reduce migration in the village (Soni et al., 2013; Sharma et al., 2010; Dixit et al., 2010; Redzuan and Aref, 2009). For this reason, the establishment of these industries in rural areas is one of the effective ways of developing rural areas. One of the important issues in the creation of processing industries is the choice of a suitable location for the establishment of these units (Pourjafar Abadi et al., 2016). The dependence of these industries on agricultural products as raw materials is one of the important reasons for locating these units (Mohammadi et al., 2012). In other words, the potential of each region plays a crucial role in the development of the agricultural industry. Location studies are one of the key elements in the formation and survival of economic units. This decision effect is on the long-term profitability of the investors. Also, the correct location choice for the construction economic units leads to lower costs and their success (Shahbazi and Salemian, 2017; Ahmadian and Motafaker Azad, 2006). There are many types of research on the location of the construction of the agricultural industries. Vahedi and Moradnezhadi (2018) prioritized the agricultural processing industries for all counties of the Ilam Province by using the Delphi method. These results show the geographical conditions and the special potential of Ilam and Sarableh, the agricultural processing industries of animal products and honey in these areas would be expanded.

Ahmadi et al. (2016) used the Delphi method to collect and analyze the expert comments for prioritizing the development of agricultural conversion and complementary industries in Ahar County. The results showed that an increase in income of local farmers and value-added and productivity of agricultural products is the most and the least important aims for prioritizing, respectively. Besides, first and last priorities for suggested industries were providing of dairy production

and roasting of beans such as lentil and grains such as wheat, respectively.

Balali et al. (2015) prioritized investment in various projects in the field of agriculture processing industry is in the city of Hamedan by the Delphi approach. In this study, according to the cultivation of agricultural products, the processing industry has prioritized.

Alimoradi et al. (2014) Prioritized the Creation of Complementary and Processing Industries of the Agricultural Sector by Using the Delphi Method in Dehloran City of Ilam Province. The number of inhabitants (rural labor force) in rural areas is considered as a priority indicator.

Khajeshakohi et al. (2014) prioritized agricultural food processing industries in Golestan province. The research method of this study is based on a hierarchical triangle for scoring and weighing the criteria. This study suggests that Aliabad and Ramian possess high priority regarding the development of these industries.

Amimo (2013) with Descriptive statistics revealed that four key location factors namely roads, ease of doing business, stable social and political environment and reliability, quality of infrastructure, and utilities are considered the most important in influencing decisions in locating a food manufacturing firm in Kenya.

Nori et al. (2013) Analytical Hierarchy Process (AHP) methodology was used to assess criteria and determine priorities of sextuple districts of the region for data processing industries. In this study criteria such as raw material availability, economical profitability, transportation accessibility, energy resources, geographical situations, land price, and labor force were assessed as criteria for assessing areas.

Darby and Mark (2012) using a GIS-based transportation model determined the optimal location for collocating a Louisiana sugar mill and a new cellulosic ethanol plant.

Mohammadi et al. (2012) to determine the optimal location of Tomato processing industries in Fars a distance-minimizing pattern was used for the transportation network between producing and processing centers. The study findings revealed that paths ending in townships of Marvdasht, Shiraz, Pasargad, Eqlid, and Khorrambid lead to the lowest increase in total transferring.

Mogaddam (2010) determined the optimal pattern of sugar locating industry by using the logit and probit model. In this research, the amount of sugar cane planting was the only effective variable and other variables such as production rate of raw material, unemployed persons ready to work, the distance between the factory and selling place of products, the distance between the factory and purchasing a place of raw materials and total population of the city did not have a significant effect.

Lambert et al. (2007) examined how factors such as infrastructure, agglomeration, product and input markets, labor markets, and fiscal attributes of local communities' influence location decisions across the rural-urban continuum in the lower forty-eight states of the U.S. Negative binomial regression and spatial clustering methods are used to forecast new food processor location patterns. The result showed that the share of aggregate factors is less than 6%.

Henderson and McNamara (2000) analyzed the county characteristics associated with the location of food processing plant investments. Access to input and product markets, agglomeration economies, access to a transportation system, low wages, and local tax policies are factors that influence food manufacturing investment locations.

Although based on the studies mentioned, the location unit plays a significant role in its success, the contribution of this factor has not been quantified in the researches and these studies only by emphasizing the role of the site and not considering other factors and use the Hierarchical analysis methods, TOPSIS and Delphi method (except for Lambert) to prioritize the locations of processing industries, and Suggest a suitable place for the construction of the agricultural industries in different regions. While in the last two decades' patterns such as multilevel models allow researchers to measure the contribution of groups and divisions in a pattern along with identifying the factors affecting the variables studied (Hundt and Sternberg, 2014). Therefore, in this research, we try to determine the factors affecting on the exploitation of the agricultural processing industries of Mazandaran province, Mazandaran province has the second rank in Iran and also 15% of the agricultural processing industries are located in this province (Ministry of Jihad Agriculture,

2016), and measure the share of location as one of the important issues in locating research.

Identifying the factors affecting the exploitation is a first step towards creating favorable conditions for the construction of the units and will make appropriate decisions to remove barriers and strengthen the strengths for their deployment.

2. Materials and Methods

The data of this study collected from the Agricultural Jihad Organization of Mazandaran province. The number of agricultural processing industries by the end of 2014 is 2572 which in this research is investigated.

The status of exploitation of the agricultural processing industries in Mazandaran province is a qualitative variable that has two values of zero (units were unexploited) and one (agricultural processing industries was exploited). To investigate the factors affecting this variable, can use a logit or probit model (Green, 2012). The general pattern of the logit function is given by relation (1):

$$Y= f(\text{ownership. activity. activity size. unit area. industrial parks. total capital} \quad (1)$$

In the above model, Y indicates the status exploitation of unit and independent variables consist of ownership type (Corporate, private and cooperative), type of activity (cultivation, horticultural, livestock and fishery), activity size and unit area. To determine the role of the location, the data were divided into 21 groups according to the cities of Mazandaran province. The division of the units from the location can be explained by using the multilevel models and considering the hierarchical structure of the data. A multilevel structure that is used in this study includes can be presented as (2) (Goldstein et al, 2002):

$$\text{Level1:} \quad \ln\left(\frac{\text{pr}(Y_{ij}=1)}{1-pr(Y_{ij}=1)}\right) = \beta_{oj} + \sum_{q=1}^{Q} \beta_{qj} X_{qij} + e_{ij}$$
$$Level2: \quad \beta_{qj} = \gamma_{q0} + \sum_{s=1}^{s_q} \gamma_{qs} W_{sj} + U_{qj} \quad (2)$$

In the above model, Y is the dependent variable and indicate the status of exploitation of the conversion industry, X is the independent variables mentioned, i is the unit number, j is the number of the group (Cities) and q is parameter number, and β and γ are the estimated coefficients in the first and the second levels. If just the intercept has been random in the model, the second level in the model (2) is rewritten as (3):

$$Level2: \qquad \beta_{0j} = \gamma_{00} + U_{0j} \tag{3}$$

The final model in this paper (4) is:

$$\ln\left(\frac{\mathrm{pr}(\mathrm{Y_{ij}}=1)}{1-pr(\mathrm{Y_{ij}}=1)}\right) = \gamma_{00} + \sum_{\mathrm{q}=1}^{\mathrm{Q}} \beta_{\mathrm{qj}}\,\mathrm{X_{qij}} + U_{0j} + e_{ij} \tag{4}$$

$U_{0\mathrm{j}}$ is the effect of being in group j on the log-odds that y = 1, also it is known as residual of the level 2. To evaluate the multilevel model, we can use the Variance Partition Coefficient (VPC) and the likelihood ratio test. The Variance Partition Coefficient indicates the degree of dependence of the data within the groups. The formula for this coefficient in logistic regression models is (5) (Goldstein et al., 2002):

$$VPC = \frac{\sigma_{oj}^2}{\sigma_{oj}^2 + \frac{\pi^2}{3}} \tag{5}$$

In the above equation, σ_{oj}^2 is the variance of the error components of the second level and $\frac{\pi^2}{3}$ is the variance of the error components at the first level. The Variance Partition Coefficient shows the correlation between observations in groups and the share of clustering independent variable variations (Goldstein et al., 2002). The likelihood ratio test compares the two-level logit model with the logit model. If the null assumption of this test is rejected, the logit model is rejected and the multilevel logit model is accepted.

3. Result

The statistical characteristics of the continuous and dummy variables are reported in table1. The number of exploited and unexploited agricultural industries by the end of 2014 is 1427 and 1145, respectively. In the cultivation and fishery activities, 70.18% and 53.57% of the licenses were exploited, respectively. While in the Horticultural and livestock activities only 28.55% and 40.08% of the units of the Agriculture conversion and complementary industries have come into exploitation.

Table 1: Descriptive Statistics of Explanatory Variables

Variable	Exploited		Unexploited	
	Frequency (No.)	Percent (%)	Frequency (No.)	Percent (%)
private property	1028	55.54	823	44.46
Cooperative	48	38.10	78	61.90
Corporate	179	52.65	161	47.35
Planned capacity	2585		6034	
total capital	4723		1857	
Total unit area	1014		1203	
Establishment in industrial parks	73	32.44	152	67.56
cultivation units	1106	70.18	470	29.82
Horticultural units	203	28.55	508	71.45
Livestock units	103	40.08	154	59.92
Fisheries units	15	53.57	13	46.43
Number	1427	55.48	1145	44.52

Source: Research findings.

According to Table 1, private property has the largest share of cases among types of properties. Among private units, 44.46% of the units did not reach the exploitation stage, while 61.90% of cooperative units were unexploited.

The average planned capacity in exploited and unexploited groups is 2585 and 6034 tons, respectively. The average total Capital of applicants in the exploited and unexploited units is 4723 and 1857 billion Rial.

Among the studied units, 230 units were located in industrial parks of Mazandaran province, of which 67.56 percent have not been exploited and 32.44 percent are exploited.

Figure1 shows that the highest number of licenses of the establishment in Mazandaran province has been located in Babol (407 establishment licenses), Sari (383 establishment licenses), and Amol (332 establishment licenses). These cities formed 43.62 percent of the licenses of the agricultural processing industries establishment. The rate of exploitation in Amol, Babol, and Sari is 66.57, 65.11, and 44.65% respectively.

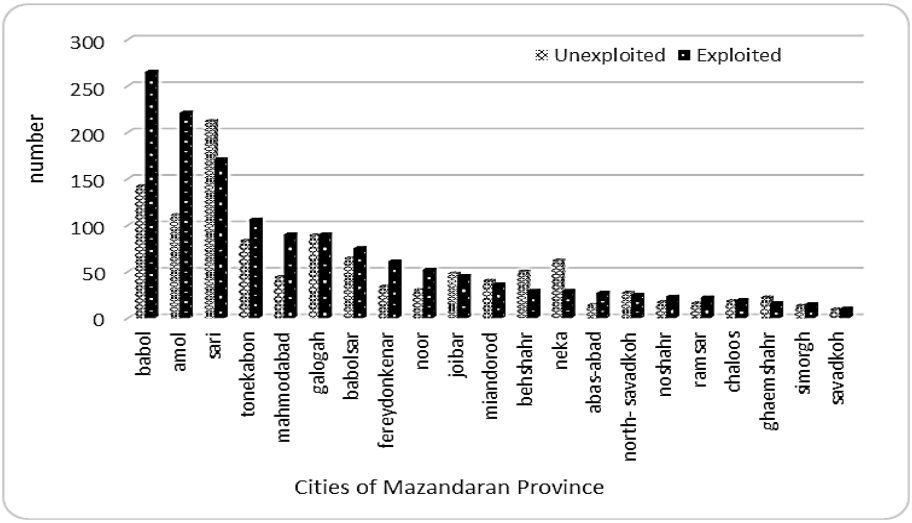

Figure 1: Distribution Exploited and Unexploited Unit in the Cities of Mazandaran Province

The highest rate of exploitation is for Abbas-Abad, Amol, Fereydoonkenar, Babol, Noor, and Mahmoud-Abad respectively. In these cities, almost 60% of establishment licenses are exploited. While, in Behshahr and Neka cities 31.87% and 36.71% establishment licenses are exploited, respectively.

The results of the two-level logit model are reported in Table 2. The quantity of $\chi 2$ statistics (439.79) indicates the significance of the whole regression. The value of the Likelihood ratio statistic of the similarity test of the logit model and the two-level logit model (6.47) shows that the two-level logit model is preferable to the logit model. The Variance Partition Coefficient is equal to 1.2%, which indicates

the classification of industries of Mazandaran province according to construction site explain on average 1.2% of the observed deviation, which is not explained by independent variables in the model.

The share of location in the exploitation of the converting industries of Mazandaran province varies from 0.2 to 4.6%. In other words, the worst and the best location in terms of spatial characteristics are 0.2 and 4.6%. The results of Lambert (2007) also showed that the share of aggregate factors such as access to the product market, Agglomeration, Infrastructure, Labor Availability, Fiscal policy, Distribution of location clusters is less than 6%.

Table 2: Result Estimate of the Two-Level Logit

Variable	Coefficients	Standard deviation	Statistics t	probability	Low	upper	Marginal effect
Cooperative	-0.39	0.22	-1.8	0.08	-0.82	0.05	0.01
Planned capacity	-0.0001	0.00001	-7.7	0.00	-0.0001	-0.0001	-0.00001
unit area	-0.0001	0.0001	-1.2	0.24	-0.0002	0.00005	0.00001
Establishment in industrial parks	-1.12	0.19	-5.8	0.00	-1.50	-0.74	-0.14
total capital	0.0002	0.00002	12.7	0.00	0.0002	0.0002	0.00004
Fisheries units	0.04	0.46	0.1	0.93	-0.86	0.94	0.17
Livestock units	-1.06	0.18	-5.8	0.00	-1.41	-0.70	-0.13
Horticultural units	-1.91	0.12	-15.8	0.00	-2.14	-1.67	-0.32
Constant	0.83	0.09	9.4	0.00	0.66	1.00	-
City Variance (cons)	0.04	0.03	Vpc =1.2		0.16	0.01	-
Pseudo R2 = 0.2066				Percent correct prediction=74.30			
$Wald$ chi2(8)= 439.79				chbari2(1)= 6.74			
Prob > chi2 =0.00				Prob > chibar2 =0.00			

Source: Research findings.

As the coefficients in Table 2 indicate, the variables of cooperative ownership, planned capacity, unit area, industrial parks, livestock, and Horticultural activities have a negative effect, and the variables of the amount of capital and Fisheries activity have a positive effect on the exploitation of the Agriculture conversion and complementary industries. It should be noted that in the activity variable, the group of

cultivation units is considered as the basic group. Among the variables studied, the variables of type of activity, an establishment in the industrial parks and activity size have the most effect on the exploitation of agricultural conversion units .

If the type of property is cooperative, the probability of exploitation of the unit is 7% lower than the type of private and corporate property. Also, if the 1000 tone is added to the proposed capacity of the conversion industry, the probability of exploitation of the unit reduced 2%. In other words, the smaller processing industries are more successful than the larger units in the exploitation of proposed capacity are. If the capital increases 1,000 billion Rials, the probability of exploitation of the conversion industry will increase by 4%.

Table 2 shows that livestock and Horticultural units have 19.5 and 35.2 percent less chance of cultivation units in exploitation, respectively. The most important reason for this is the cultivation activities (especially rice cultivation) are common in Mazandaran province. In contrast to livestock and horticultural units, the Fisheries have a 0.7% greater chance than the cultivation unit does. Also, the probability of building agricultural processing industries in industrial parks is 21% lower than other units, and units located in other areas have a greater chance of construction.

4. Discussion

Agricultural processing industries can potentially play an important role in reducing poverty and sustainable economic growth. Therefor establishment of these industries in rural areas is one of the most important ways of developing rural areas. Various studies have been carried out on locating the conversion and supplementary industries in Iran and proposed appropriate sites using methods such as hierarchical analysis. One of the important points that have been ignored in these studies is the contribution of the location in the construction and exploitation of the agricultural processing Industries. In this study, using a two-level logit model, factors affecting the exploitation of conversion and complementary industries in Mazandaran province identified and the share of the location of units measured. According to the results of the estimated model, the site of the construction explains 1.2% of the changes related to exploitation of the agricultural

conversion and processing industries in Mazandaran province. Also, the difference between the share of the best and the worst in the exploitation of the agricultural processing industries in Mazandaran province is about 5%, which is similar to Lambert (2007). One of the reasons for the small share of the cities (the location) in exploitation is the right choice of the site of the establishment by the investors. Another reason for this conclusion can be the close distance of the cities of Mazandaran province. Therefore, to the exploitation of the new processing industries in Mazandaran province, it is necessary to consider and improve other items.

Considering the negative effect of the size (planned capacity) variable, it is recommended that small units should be supported and their exploitation should be prioritized.

The great effect of the type of activity can be a guide for agricultural Authorities in the licensing stage to guide the owners in the appropriate direction.

According to the results of this research, the priority of new licenses or completing existing half-units should be made to fishery, cultivation, livestock, and horticultural, respectively. Also, to improve the condition of horticultural units, it is recommended that no new licenses be issued for this activity and that the problems of these units should be identified and resolved.

The negative effect of cooperative ownership on exploitation indicates problems with these units. Therefore, it is recommended that the problems and deficiencies of these units should be identified and resolved.

Increasing the capital of applicants is one of the positive factors in the exploitation of units. Therefore, it is suggested that the amount of capital available to applicants be increased by using cheap facilities.

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