A Regression Model of Location Selection for Beverage Chain in Taiwan

Hui-Chi Chuang
Institute of Information Management
National Cheng Kung University
Tainan City, Taiwan, R.O.C.
e-mail: huichi613@gmail.com

Yi-Chung Cheng
Department of International Business Management
Tainan University of Technology
Tainan City, Taiwan, R.O.C.
e-mail: t20042@mail.tut.edu.tw

Chih-Chuan Chen
Interdisciplinary Program of Green and Information Technology
National Taitung University
Taitung, Taiwan, R.O.C.
e-mail: ccchen@nttu.edu.tw

***Abstract*—Location selection plays a crucial role in the restaurant industry, especially for the beverage chains. A comprehensive location selection model and appropriate analytical technique can improve the quality of location decisions, attracting more customers and substantially impacting market share and profitability. Location selection is a significant part of strategic management activities. In Taiwan, thanks to its special cuisine culture, the environment of beverage industry is very competitive and versatile. Therefore, it is very important to have an efficient location selection process for a beverage chain, for both franchiser and franchisees. This study establishes a regression model for the turnover of a local beverage chain in the city of Tainan in southern Taiwan. The model is based on the factors that would affect the location selection, such as crowd flow in front of the chain stores, resident population, complementary stores, and competitive stores. For franchiser, the model can be applied to stores in different areas, and for the franchisees, the model can help them to decide the location of the stores.**

Keywords- Location selection; Regression; Beverage Chain; Customer intention.

I. INTRODUCTION

In the food and beverage industry, right location selection is one of most important strategic decisions for the success of the business. In Taiwan, thanks to its warm climate and special cuisine culture, the beverage industry is very prosperous. The most common and the easiest way to start a business is to be a franchisee of a beverage chain for its low entry barrier.

In general, the franchiser would provide the know-hows, such as business process and techniques and help with the planning, while it is the franchisee who is in charge of the location selection. Location selection results in the convenience of service and how many customers can be attracted, and, as a consequence, influences customer loyalty and operation performance [1]. Therefore, for a franchisee, location selection is crucial to the success of the business. There are more than 200 chain brands in Taiwan's beverage industry. In 2017, there were more than 21,000 beverage stores. On average, every person drinks seven cups of beverage monthly. Due to fierce market competition, the location of the beverage store is even more important.

Most studies on location selection focus on the major factors that influence the turnover. This study takes into account the "shop rent to gross profit" ratio. Although it is crucial to the franchisee's profit, most location selection methods just apply an estimated value, which could be quite different from the real value. Moreover, the better the location is, the higher the rent would be. It is an important issue that the franchisee has to take into account.

This study proposes a regression model with turnover as the dependent variable and with location selection factors as independent variables. Both franchiser and franchisee can determine the store location based on the predicted turnover and the store rent. The proposed model can help the franchiser to make the decision on whether to develop the business in a certain area, while it can help the franchiser to determine the location of the store.

The rest of this paper is organized as follows. Section 2 provides some necessary literature review while Section 3 describes the methodology. The model evaluation results and discussion are summarized in Section 4. Conclusions are drawn in Section 5.

II. LITERATURE REVIEW

Franchising is an important way for enterprises to expand their markets, especially for the business environment in Taiwan, where small and medium-sized enterprises are established, and to join the franchise of small brands is the first choice for young people to start their own businesses. Thanks to the special cuisine culture in Taiwan, the beverage industry is very well developed and various beverage chains are competing in the market. It is the most common and the easiest way for a young entrepreneur to join a beverage chain as a franchisee. In the extremely competitive beverage market, store location is crucial to the success of the beverage store.

Right location selection is one of the strategic decisions that carries importance for the success of the business. The location selection problem for all kinds of organizations could be assessed in a wide range of issues with regard to the

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following critical aspects: plant location selection, store and warehouse location selection, shopping centre location selection, retail site location selection and healthcare centre and hospital location selection that have the similar problems [2]. Davis et al. identified a number of factors that have influence on the success of food and beverage industry, among which location of food service facility is the most important feature [3]. Location selection results in the convenience of service and how many customers can be attracted, which, as a consequence, would affect customer loyalty, operation performance, and the market share and profitability of a company [1]. A location decision usually involves a long-term commitment of resources, making this issue very important [4]. Several factors need to be taken into account, such as choice of commercial area, competitive stores, complementary stores, and traffic flow.

The choice of commercial area is a decision problem that needs to take into account a large number of criteria and to identify the best option among alternatives, such as ease in accessibility, parking facilities, and located at a street corner [5][6]. The selection of commercial area directly affects the performance of the store [7]. Therefore, it is important to have a thorough investigation on the commercial area to assess the performance of the store [8]-[10].

Jaravaza and Chitando investigated the role of store location in influencing customers' store choice [11]. The research shows that customer store choice decisions are heavily hinged on store convenience, such as shorter travelling distance, complementary services, and convenient public transport. Traffic density is another important issue. Although high traffic density means high crowd flow, it also has a downside of traffic jam, which would impair consumers' intention of coming into the commercial area [12]. For high traffic density areas, one needs to consider the parking facility or if the store is on the street in the location selection process.

In Taiwan, the density of beverage stores is extremely high, that is, it is easy to find various beverage shops of different brands on the same street, and in some areas of the same brand. They compete with each other even if they provide different kinds of drinks. The competition factor should be taken into account in the location selection process. The number of competitors and intensity of competition are included as two criteria. The number of competitors refers to the number of similar restaurants in the vicinity. The intensity of competitors refers to the scale of beverage stores in the vicinity [13]. Although competitors would compete for the customers, in some cases, high intensity of competitive stores could attract more customers.

During the last few decades, there has been a significant increase in one-stop shopping strategies. Shoppers tend to economize on the amount of time they spend on shopping by making multi-purpose shopping trips, combining purchases for different product categories and reducing the number of trips during a particular time period [14]. Multi-purpose shoppers often bypass closer stores to visit agglomerated stores that are further away in order to shop for different types of goods or indulge in different activities on the same trip [15]. Therefore, this study takes into account the complementary stores.

The most often used conventional location selection methods include checklist methods, analog approaches, regression models and location allocation models [13]. The checklist method uses a list of location factors, and systematically evaluates each of the candidate locations, and then identifies the most suitable locations. The analog approach aims to determine the boundary of the interested commercial area and predict the turnover of the new location [16]. To this end, researchers have to find out some similar stores in the earlier stage and investigate their drawing powers in the different areas and locations, then the turnover of the new location can be evaluated. The regression model has been widely used in various fields, which determines the relationship between the major factors and the business performance, by identifying a regression function with the business performance as the dependent variable and the major factors as the independent variables.

Some techniques of artificial intelligence have been applied to location selection problems, such as artificial neural networks and fuzzy set theory [13][17][18]. Jungthirapanich developed a decision support system incorporating a linear additive multi-attribute utility method and a database system which collects the location data extracted from public documents and reports [19].

III. RESEARCH METHODOLOGY

In this study, a regression model is applied to predict the turnover of a beverage store. Based on the studies on location selection in the literature [12][20], and local domain experts' advice, it takes into account several independent variables such as crowd flow, residential population, complementary stores, and competitive stores.

A. Regression Model

In statistics, linear regression is a linear approach to modelling the relationship between a scalar response (or dependent variable) and one or more explanatory variables (or independent variables). The case of one explanatory variable is called simple linear regression. For more than one explanatory variable, the process is called multiple linear regression [21].

Given a data set $\{y_i, x_{I,1}, x_{I,2}, \ldots, x_{I,k}\}_{i=1}^{n}$ of n statistical units, a linear regression model assumes that the relationship between the dependent variable y and the k-vector of regressors x is linear. This relationship is modeled through a disturbance term or error variable ε — an unobserved random variable that adds "noise" to the linear relationship between the dependent variable and regressors. Thus, the model takes the form

$$y = b_0 + b_1 x_1 + b_2 x_2 + ?? b_k x_k + \varepsilon, \qquad (1)$$

where the constant b_0 is the intercept term, and $b_1, b_2, ?? b_k$ are known as effects or regression coefficients, ε is the error term. Usually, in statistics, the linear least squares method is applied for estimating the unknown parameters in a linear regression model. Let $\hat{b}_i$ denote the

squares estimator of b_i $i = 0, 1, 2, \ldots, k$. Then, the estimator of y, denoted as $\hat{y}$, can be presented as follows.

$$\hat{y} = \hat{b}_0 + \hat{b}_1 x_1 + \hat{b}_2 x_2 + \cdots + \hat{b}_k x_k. \quad (2)$$

The coefficient of determination, denoted R^2, is the proportion of the variance in the dependent variable that is predictable from the independent variable(s). It provides a measure of how well observed outcomes are replicated by the model, based on the proportion of total variation of outcomes explained by the model [22]. The coefficient of determination normally ranges from 0 to 1. The greater the value of the coefficient, the stronger the relationship between the independent variable and the dependent variables.

The most general definition of the coefficient of determination is

$$R^2 = \frac{\sum_{i=1}^{n}(\hat{y}_i - \bar{y})^2}{\sum_{i=1}^{n}(y_i - \bar{y})^2} \quad (3)$$

Two kinds of hypothesis testing, *t*-tests are applied to test the significance of each coefficient, respectively, and *F*-test the model significance. The corresponding statistics area is as follows.

$$t_i = \frac{\hat{b}_i}{se(\hat{b}_i)}, \; i = 0, 1, 2, \ldots, k, \quad (4)$$

where $se(\hat{b}_i)$ denotes the standard error of $\hat{b}_i$.

$$F = \frac{R^2/k}{(1-R^2)/(n-k-1)} \quad (5)$$

B. Model development

Based on the studies on location selection in the literature, and local domain experts' advice, at the initial stage, this study takes into account eight major factors that are crucial to location selection of beverage chain [12][20]. They are (1) crowd flow, (2) residential population, (3) target customers in the commercial area, (4) complementary stores, (5) mutually exclusive shops (6) competitive stores, (7) advantages in establishing the store, and (8) disadvantages in establishing the store. During the initial stage, the results show that three variables, target customers, advantages in establishing the store, and disadvantages in establishing the store, are not significant in this case. Meanwhile, to the research object of this study there are no mutually exclusive shops in the commercial areas. Therefore, this study takes into account four major factors for location selection of the beverage chain, and they are (1) crowd flow in front of the store, (2) residential population in the commercial area, (3) complementary stores, and (4) competitive stores.

The dependent variable Y represents the turnover of the store, and the four independent variables are X_1: crowd flow, X_2: residential population, X_3: number of complementary stores, and X_4: number of competitive stores. The regression model can be described as follows.

$$Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + \varepsilon \quad (6)$$

where the constant b_0 is the intercept term, and $b_1, b_2, \ldots, b_4$ are known as effects or regression coefficients, and ε is the error term. Let $\hat{b}_i$ denote the squares estimator of b_i $i = 0, 1, 2, \ldots, 4$. Then, the estimator of y, denoted as $\hat{y}$, can be presented as follows.

$$\hat{Y} = \hat{b}_0 + \hat{b}_1 X_1 + \hat{b}_2 X_2 + \hat{b}_3 X_3 + \hat{b}_4 X_4. \quad (7)$$

IV. Results and Analysis

This study investigated a beverage chain including 27 stores and located in the North, Central, East, South, Anping and Yongkang districts of Tainan City. These districts are areas where the population of Tainan is more concentrated. We collected crowd flow, residential population, complementary stores, and competitive stores to predict the turnover of a beverage store. The description of the independent variables is as follows.

(1) crowd flow in front of the chain stores: slack season (July to September); peak season (October to May); non-holiday (Monday to Friday) and holidays (Saturday to Sunday or national holidays). Pick one hour from the daytime (10:00 to 17:00) and evening (17:00 to 22:00) to collect the crowd flows.

(2) residential population in the commercial area: collect the number of households within a radius of 250 meters centered on the location. If it is a general household, 4 people are calculated. If it is an office building, it is based on the number of employees registered in the business. If it is a factory, the number of people who enter the factory at 8:00 is considered.

(3) complementary store: such as restaurant, seafood shop, barbecue restaurant, Internet café.

(4) competitive store: the number of stores serving drinks.

This study utilizes crowd flow, residential population, complementary stores, and competitive stores as independent variables and turnover of a beverage store as dependent variable to develop the prediction model. The regression model is as follows:

Turnover = 0.354* *'crowd flow'* + 0.270* *'residential population'* + 0.655* *'complementary stores'* + 0.088* *'competitive stores'*.

In this paper, we use Analysis of Variance (ANOVA), which is a collection of statistical models and their associated estimation procedures, to analyze the differences among group means in a sample. From Table I, the F-value ($MS_{reg.}$ / MS_{err}) of the regression model is 26.347 and p-value is .000. The P value is the probability of finding the observed results when the null hypothesis of a study question is true. If the value less than 0.05, it means that the prediction model is statistically significant. Table II shows that the predictive power of the model is 79.6% (adjusted R^2). The p value of crowd flow, residential population and complementary stores are less than 0.05, respectively, it means these three factors are significant and positive influence to turnover, on the contrary competitive stores are not significant to turnover. The results show that the number of complementary stores has the greatest influence on the business of the beverage chain, followed by the crowd flow in front of the stores, and the resident population in the region has the least influence.

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TABLE I. THE ANOVA TABLE OF THE PREDICTION MODEL FOR THE TURNOVER OF THE FRANCHISEES OF A BEVERAGE CHAIN IN TAIWAN

Model	df	SS	MS	F	P
regression	4	8.727E11	2.182E11	26.347	0.000
error	22	1.822E11	8.281E9		
total	26	1.055E12			

df : degree of freedom
SS : sum of square
MS : mean square
F : $MS_{reg.}$ / $MS_{err.}$
P value : significance

TABLE II. COEFFICIENTS OF THE REGRESSION MODEL FOR THE TURNOVER OF THE FRANCHISEES OF A BEVERAGE CHAIN IN TAIWAN

Model	UnStd. coef.		Std. coef	t	P
	B	Std. Error	β		
(constant)	6164.964	52532.577		0.117	0.908
Crowd flow	39.441	18.519	0.354	2.130	0.045
Resident population	55.378	19.397	0.270	2.855	0.009
Complementary stores	6473.280	1336.359	0.655	2.844	0.000
Competitive stores	-2465.031	3260.591	0.088	-0.756	0.458

$R = 0.910$, $R^2 = 0.827$, adjusted $R^2 = 0.796$
UnStd. coef. : Unstandardized coefficient
Std. coef. : Standardized coefficient

V. CONCLUSION

Thanks to Taiwan's unique culture of cuisine, an extremely competitive beverage industry exists. For a beverage chain, usually the franchisor takes the responsibility for planning, counseling as well as offering services, such as training and support. On the other hand, while the franchisees take the franchisor's business systems, training and know-how and put it into practice in their location, they typically are responsible for most of the costs and risks. As the franchisor holds all the data of each franchisee, such as turnover and the location information, if it can provide services, such as location selection advice and turnover forecasting to its franchisees, it can help franchisees to avoid unnecessary losses, and hence it would be mutually beneficial to both parts. Moreover, it can also improve corporate reputation and establish a better brand image.

This study focuses on the location selection problem of a local beverage chain in the city of Tainan in southern Taiwan, where the climate is warm all the year round and it is very common to see people with a cup of tea in hand, and therefore, it forms a special beverage industry with tea shops and beverage booths everywhere. A regression model was proposed for location selection. The results show that the number of complementary stores in the area has the greatest impact on the business of the beverage chain, followed by the crowd flow in front of the stores, and the resident population in the region has the least impact.

The number of competing stores did not show significant impact on turnover, indicating that the target beverage chain has established reputation in the city such that even though there are stores of different beverage chains in the area, consumers would still choose their favorite brand.

Although this study only focuses on the chain beverage stores in Tainan, it can be applied to other cities and different cuisine industries, to identify the factors that have impact on the business.

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