Establishing high value markets for data-driven customer relationship management systems

An empirical case study

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Abstract

Purpose – Online customer relationship management (CRM) is an important issue for implementing digital marketing of electronic commerce or social commerce. The purpose of this study is to establish valuable markets for discovering customer knowledge from data-driven CRM systems for enhancing growth rates of businesses. Airline or travel agency industries are online businesses in the world. Therefore, the industries in Taiwan will be an empirical case for this study.

Design/methodology/approach – This research applied a procedure with an applied proposed model for establishing valuable markets from data-driven CRM systems. However, the study used a proposed customer value model (recency, frequency and monetary [RFM]; RFM model-based), the analytic hierarchy process (AHP) procedure and a proposed equation for estimating customer values.

Findings – For enhancing the data-driven CRM marketing of the industries, in this research, the market of air travelers can be partitioned into eight markets by the proposed model. As well, the markets can be ranked by the AHP procedure. Furthermore, the travelers' customer values can be estimated by a proposed customer value equation.

Originality/value – Via the applied proposed procedure, online airlines, travel agencies or other online businesses can implement the research procedure as their data-driven marketing strategy on their online large-scale or Big Data customers' databases for enhancing sales rates.

Keywords Customer value, Airline industry, Travel agencies, RFM model, CRM systems, AHP procedure

Paper type Case study

Introduction

Airfare always takes the major portion of a traveling budget for transportation costs of an international travel plan. Hence, low-cost carriers (LCCs) attract more international travelers for their travel plans. In Taiwan, a new LCC was launched by China Airlines (Tigerair Taiwan). In other words, the impact of airline markets in Taiwan between regular airlines and LCC airlines will be extremely competitive in the near future.

Therefore, for enhancing online customer relationship management (CRM) systems of international regular airlines in Taiwan, the purpose of this work is to analyze customer values of international travelers for marketing strategies of online CRM systems in the regular airline industry in Taiwan. However, a data-driven marketing strategy for online CRM is an important issue for airlines' ecommerce or social commerce. The results of this research can be applied in their online merchandising or social commerce systems for enhancing the sales rates.

Typically, retailers can realize their markets by using a questionnaire, survey or some investigation methods with designed variables of customer shopping benefit. Hence, the

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markets can be identified by recency, frequency and monetary (RFM) model as well (Kotler and Keller, 2016; Chiang, 2018). However, air travelers and retailers' shoppers have different shopping behaviors. Thus, the RFM model can be modified due to different characteristics of industries (Chiang, 2012, 2018). Regarding the model, the researcher discussed with three scholars and managers in airlines' management field, and the discussion results showed that three variables can identify travelers' customer values. In accordance with the discussions, the research proposed a novel model for airlines and travel agencies to identify travelers' customer values and markets, which consists of frequency, monetary and average number of group travelers (FMA model, RFM model-based). Furthermore, the FMA variables can be substituted for other businesses.

The FMA model (markets) can be ranked via the well-known decision-making procedure of analytic hierarchy process (AHP, Saaty, 1990), because the AHP procedure can identify the weights of markets' customer values. Via the weights of rank markets, the research proposed a customer value equation. The travelers' customer values can be obtained using the proposed equation. However, the airlines/travel agents' group or other businesses may implement customized marketing plans in their online marketing systems.

Different types of enterprises can use the RFM model in various ways to plan their marketing projects for enhancing customer value or extending customers' life cycle (Berry and Linoff, 2004). This research revises the RFM model to be the FMA model for airlines and travel agents' group; the F variable is "frequency travel times in a specific period", M variable is "average travel monetary in a specific period" and A is "average travel member number of group travelers in a specific period." Via the analysis of the FMA model, the travelers' customer values of family tourists can be discovered clearly. Hence, the study enhances the RFM model to become more suitable for observing the customer values of group travelers.

2. Literatures review

2.1 Customer relationship management

A successful CRM for retailer should contain a key factor, which is organizational consistency. For instance, customers' intentions should be involved as a key factor. Hence, the factor (customers' intentions) is quite difficult to be discovered via marketing departments (Reinartz *et al.*, 2004). Therefore, retailers can shift their value from "value exchange" to "customer value" (Payne and Frow, 2017). Via online CRM systems, business can solve the issue. Businesses can analyze customer transaction data for understanding customers' intention. Therefore, an effective CRM should be created by both customers and companies (Kunz *et al.*, 2017).

Customer value consists of some profit variables that can contribute profits or save cost to businesses (Linoff and Berry, 2002; Chiang, 2017). For enhancing online CRM systems, the author discusses with some scholars and managers in the airline marketing field. The conclusion of the discussion is as following:

- An online CRM should be designed via a customer-centric approach for airlines or business systems.
- A data-driven activity that helps airlines or companies to understand business and customers' future information should be held.
- This research is designed for online CRM systems. A successful online CRM is not only a customer-centric system but also an analytics system that can help airlines or companies to analyze their customers.

2.2 Recency, frequency and monetary model

In 1994, Hughes (1994) defined the RFM model for retailer industries. The R (recency) variable was defined as "last purchasing time in a recent specific period"; the F (frequency) variable was defined as "purchasing frequency in a recent specific period"; and the M (monetary) variable was defined as "average amount of purchasing in a recent specific period".

The RFM model can be applied in different industries. For example, in an application of the RFM model, the model was applied on sport stores for analyzing its members (Lo *et al.*, 2008). The result of their research found that the shoppers of the highest customer value were male and were 26-35 years old.

The RFM model can be applied in other industries and can also be applied in market segmentations. For example, in 2006, Lin *et al.* used the RFM model to partition their customers of music products. They divided each RFM variable into high (H) and low (L) levels; that is, there were eight markets partitioned from L-L-L to H-H-H.

The RFM model can be associated with segmentation analysis for marketing information systems. In 2009, for instance, Cheng *et al.* applied the RFM model with K-means clustering algorithm to mine rules for the data mining marketing of CRM systems. Besides, Huang *et al.* (2009) also applied three clustering methods associated with the RFM model. The clustering methods were K-means, bagged clustering and fuzzy C-means. However, in their research, they found that bagged clustering was superior to the other two methods.

About the RFM applications in market segmentation fields, for example, in 2009, Cheng *et al.* applied the RFM variables and K-means algorithm into rough set theory for mining accurate classification rules. These rules can be applied in data-driven CRM systems for enterprises. Another example is to discuss the research of fuzzy clustering and RFM model; in 2009, Huang *et al.* applied K-means method, fuzzy C-means clustering method, RFM model and bagged clustering algorithm to analyze the customer value for an outfitter in Taiwan. Their study concluded that bagged clustering algorithm was better than the others. Furthermore, Khajvand and Tarokh (2011) evaluated customer value based on weighted RFM model for making decisions in CRM systems in the banking industry; and Shim *et al.* (2012) proposed very important person (VIP) or non-VIP for the RFM model. They applied a new model and data mining for reaching customer rules of online store.

The RFM model can be revised for a specific industry. For example, Chiang (2009) adds the discount variable to the RFM model so that the model is improved to be RFMD model (D for discount). Chiang discovers useful rules for internet retailers' industry via the RFMD model. There were five association rules established for urban and four association rules established for suburb university students.

As for the analysis of customer value, for instance, Wong and Chung (2007) adopts the RFM model and decision tree algorithm to analyze the Taiwan's domestic airline markets. Their research found customer values for each of the domestic routes. The domestic airlines of Taiwan can implement their marketing plans to these routes (markets). Their study can help domestic airlines to enhance the growth rates of passengers.

For improvement research on RFM model, Chiang (2011) improved the RFM model to be the RFMDT model (D variable for discount; T variable for shopping times within six months); the research objectives were experienced online shoppers in Taiwan. Chiang's study created some decision rules for marketing projects of online retailers.

Sarvari *et al.* (2016) used K-means clustering, Apriori algorithm, Self-organizing map neural networks and weighted RFM model to analyze transactions data from a global pizza restaurant chain for application of the CRM system. Their research extracted association rules and the best customer purchase behavior pattern. Also, the results were applied in

some scenarios and the best one was determined. The best scenario showed that M (monetary) factor was the most important factor for clustering among the RFM analysis results.

Although the RFM variables can process the segmentation, as mentioned above, comparing a "high frequency and low monetary" to a "low frequency and high monetary" customer, both customers may be having similar customer values. Thus, the customer value in this case is not easy to be identified. Hence, customer value should be a profit variable to a business (Linoff and Berry, 2002; Chiang, 2012; Kotler and Keller, 2016). However, the RFM model is not applicable to any business. The model is proper for retail business (Chiang, 2017).

2.3 Analytic hierarchy process procedure

Saaty introduced the AHP procedure in 1977. The purpose of the AHP was to develop a method for structured decision-making. In general, AHP procedure can be used to obtain weights for RFM variables. Therefore, in this study, the AHP procedure can be used to rank the RFM market by the weight of RFM variables. For instance, in 2008, Weiwen *et al.* applied the AHP procedure with RFM markets in logistics enterprises for segmenting their customers. They found that for the weighted RFM markets, the results were effective to the segmentations. As another example, Chiang (2014) applied the AHP procedure and a proposed model (RFM-based) to sort the customer database with customer values.

For the features of the weighted AHP procedure based on the literature reviewed, Velasquez *et al.* (2013) summarized that the features of weighted AHP procedure were "Easy to use; Scalable; Adjustable for fitting different sized problems; and Not intensive for data".

The AHP procedure can be applied to problems of multi objective decision-making (MCDM), which can help variables to define their weights. Taha and Daim (2013) concluded that the weighted AHP is one of the best methods and the most used methodology among the MCDM methods listed below. Their research reviews studies regarding the MCDM methodologies that included AHP, ANP, ELECTRE, PROMETHEE Fuzzy sets, VIKOR, TOPSIS, SWA, SIMUS, UTADIS and value trees.

In a research of selecting the best financial leasing case for bank customers, Chalúpková and Franek (2014) summarized that the best alternative for a customer is not being sensitive to a change in the weights estimated by the AHP in their research. For determining the weights of the RFM model, some relevant studies were applied in different industries, such as Shih and Liu (2003) applied the AHP procedure to determine the weights of the RFM model and sort the customer values. This research found eight customer clusters and two types of valuable customers in the hardware retailer industry. Also, Zhao (2008) applied the AHP procedure to determine the weights of RFM variables. The study applied the cluster algorithm to identify students to decide loan subsidy. In the same year, Weiwen *et al.* (2008) used the AHP procedure in RFM markets for a logistics enterprise to partition the customers. Their research found that the weighted RFM model was effective in the markets. Rezaeinia *et al.* (2012) applied the AHP procedure to determine the weights of the RFM variety of banking customers. Their research also applied clustering algorithm to segment the customers and evaluate each customer group.

For research in the online shopping industry, Liao and Chang (2016) applied the AHP model and Apriori algorithm with rough set theory on online shopping customers for recommendation system. Their research found four preference association rules of online shoppers, and these rules can be applied in two patterns for online recommendation systems. According to the above-mentioned discussion, the research applied the AHP for obtaining the weights of the proposed model.

2.4 Customer value

Day (1990) summarized that customer value actually is a type of value equation. That is, for evaluating the customers' perceptions, customer value can be estimated via the value difference between product cost and product benefits. Bauer and Hammerschmidt (2005) stated that customer value is to estimate profits via total possible cash flows on individual customers for business. Hence, Linoff and Berry (2011) indicated that customer value is the difference between profit and cost of customers for many retail businesses. As well, Han *et al.* (2012) pointed out that customer value is profit of customer to business. Therefore, the assessment of customer value includes attributes that can calculate the past or expected future profit of the customer (Chiang, 2013).

However, for improving customers' satisfactions, Gudem (2013) stated that retailers should provide their products, which are exactly the customer needs. In other words, for maximizing customer values, retailers must understand what customers need for increasing loyalties. Furthermore, for enhancing customer values, Pynnönen *et al.* (2014) summarized that businesses should offer full intergraded service solutions for customers.

Hence, the RFM model can be applied in the retailers' industry for discovering the customer values, such as sport stores (Lo *et al.*, 2008). The RFM model can be used in marketing segmentations for understanding high-value and low-value customers (Birant, 2011). The RFM model can also be used as a daily dynamic clustering procedure for retailers (Linoff and Berry, 2011).

As customer value can be estimated via the RFM model (Goodman, 1992), many retail industries applied the RFM model to get customer value for the purpose of marketing strategy. Although a variety of industries assess customer value via the RFM model, many customers are low-customer-value shoppers. Miglautsch (2002) pointed out an important point of view: more than 50 per cent of customers are only one-time buyers in many stores. In other words, these customers are low-value customers to those businesses. In 2006, Su *et al.* applied the RFM model in comprehensive industries. They found that valuable customers were about 18.59 per cent, that is, their research finding matched the rule of 80/20.

The RFM model can be applied in direct sales for discovering customer value as well (Roberts, 1992). In 2006, Lin *et al.* used the RFM model and applied Apriori algorithm (Agrawal *et al.*, 1993) to create association rules. Hence, according to the discovered rules, customers will recommend their favorite music to others who are in the same cluster. However, the recommendation rate of their research was 0.78.

In the field of classifying and segmenting by using the RFM model, Cheng and Chen (2009) applied the RFM model and K-means algorithm into rough set theory for mining accuracy classification rules. Their research results can be used for CRM systems of enterprises.

Additionally, the RFM model can be used in market segmentation for discovering valuable customers (Goodman, 1992). Chiang (2011) applied the RFM model for mining useful customer value, and a total of three online shopping markets were found, practical-oriented, additional cost and enjoy shopping, and a total of five association rules were established for identifying high-customer-value market.

For estimating the weights of the RFM model, Shih and Liu (2003) applied AHP for identifying the weights of the RFM model. For example, Zalaghi and Varzi (2014) proposed a method to identify customer loyalty. Their study used K-means clustering method to segment customers. Each customer loyalty was estimated via a WRFM model (W as Weighted, RFM model-based). Finally, the customers in their research can be classified into 16 groups with profit rate. As a second example for estimating the weights RFM model, Maskan (2014) applied a proposed weighted RFM model on internet service provider users. Maskan's study segmented customers into five groups accurately.

3. Methodologies

3.1 Research design

The research applies the FMA variables as the research variables. The RFM model (FMA) can be the basis of marketing segmentation for an airline market (Miglautsch, 2002). However, the designed FMA model refers the scholars and managers in this field. The FMA model contains three variables: frequency, monetary and average number of group travelers variables.

The research uses AHP (Saaty, 1977) to recognize the weights of FMA variables for air passengers. Thus, the FMA model can be sorted by the identified weights. The customer values (CV) can be reached via a proposed equation as follows: $CV = W1 \times F + W2 \times M + W3 \times A$, where CV is the customer value and W1, W2 and W3 are the weights of recency (negative), frequency (positive) and monetary (positive) variables, respectively. Therefore, as Figure 1 shows, market segmentations can be ranked via the sorted scores of customer values.

3.2 Frequency, monetary and average number of group travelers model

Each of R-F-M variables can be divided into five levels, the lowest level is "1" and the highest level is "5", the levers are from 1-1-1 to 5-5-5 (Miglautsch, 2000). Thus, the R-F-M model can be applied as "from 1-1-1 to 5-5-5." As a result, there are a total of 125 grades for the RFM model.

The FMA model is based on the RFM; FMA refers to frequency, monetary and average number of family traveler variables, respectively, and F, M and A variables also refer to the opinions of three scholars and three managers in airlines' management field.

For airline companies, the R (recency) variable of the RFM model is not suitable for shopping behavior in air travel markets. For consumers, air traveling is not as frequent as shopping in the supermarket. Thus, the R variable's feature can be included in the F (frequency) variable in a recent specific period. The M (monetary) variable is a positive variable because it brings profits for airlines. Thus, the M variable is an important variable to estimate the travelers' customer value. Hence, the A variable can observe a traveling number of a group. However, this study uses the AHP (Saaty, 1990) to obtain the FMA markets' weights (Shih and Liu, 2003; Weiwen *et al.*, 2008; Rezaeinia *et al.*, 2012).

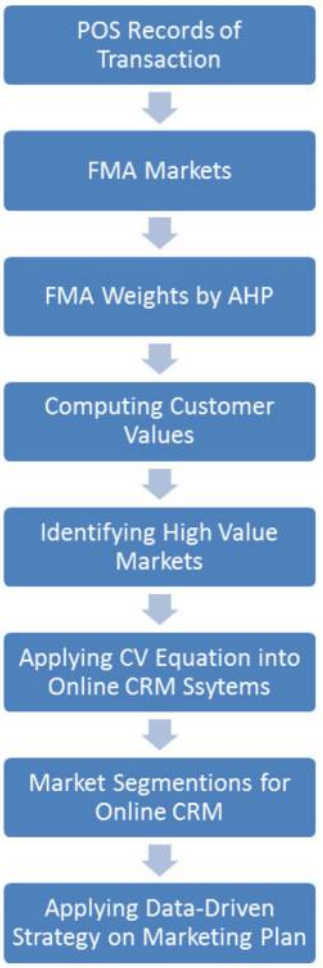
3.3 Analytic hierarchy process steps for frequency, monetary and average number of group travelers model

- As Table I shows, the FMA model can be designed for AHP pair-wise comparison matrix.
- Fill out the matrix with 1-9 scales by professional persons or scholars in the airline marketing field.
- Compute the consistence index (C.I. = $\frac{\lambda - n}{n-1}$).
- Compute the consistency ratio (C.R. = $\frac{C.I.}{R.I.}$), where R.I. is random index).
- The R.I. table is shown as Table II.

4. Results

For enhancing data-driven CRM marketing of airline or travel agency industries, in this research, the market of air travelers can be partitioned into eight markets by the proposed model. In addition, the markets can be ranked by the AHP procedure.

Many airlines or businesses use a variety of marketing projects on the traveler or customer segmentation to extend their travelers or customers' life cycle (Berry and



Source: This research

Figure 1.
Research flow chart

Linoff, 2004). As airline businesses are service businesses, the model of airlines' customer value model can be modified according to the product's features for obtaining the highest customer values (Chiang, 2012).

4.1 Frequency, monetary and average number of group travelers model and analytic hierarchy process

Air travelers' markets can be created via the FMA model. Hence, the FMA model can be divided into two levels, low and high (L and H, Lin and Tang, 2006; Chiang, 2012; Chiang, 2018), for observing the customer values. Therefore, created markets can be from L-L-L to H-H-H; thus, there are a total of eight markets in this FMA market. For obtaining the weights of the FMA markets, the AHP 1-9 scale (pair-wise comparisons) questionnaires

of FMA markets were filled out by three scholars and managers in airlines' management field in March 2017.

The weights of the RFM variables can be computed via an AHP spreadsheet. The results have shown as follows:

- Consistency index (CI) = 0.01619;
- Random index (RI, where the $n = 4$, n is number of factors) = 0.8095; and
- Consistency ratio (CR) = CI/RI = 0.01619/0.8095 = 0.02, where CR is 0.02 (<0.1).

However, the CR is quite well because Saaty (1977) stated that "the consistency ratio is well while the C. R. value is smaller than 0.1." As mentioned above, the consistency ratio of the FMA elements in this industry is quite well. Via an AHP spreadsheet calculation, the FMA variables' weights are listed as:

- F = 30.54 per cent;
- M = 48.96 per cent; and
- A = 7.86 per cent

Therefore, according to the FMA variables' weights, their importance by the weights is given in the following order: M > F > A. Then, the ranked markets should be HHH-1, HHL-2, LHH-3, HLH-4, LHL-5, HLL-6, LLH-7 and LLL-8. Furthermore, the travelers' customer values can be computed by the proposed equation as shown below. In equation (1), CV is customer values and F, M and A variables are frequency, monetary and average number of group travelers, respectively:

$$CV = 0.3054F + 0.4896M + 0.0786\mathrm{A} \tag{1}$$

4.2 Frequency, monetary and average number of group travelers markets and customer values

The research proposes a procedure for mining travelers' customer values of family travel passengers. The FMA model can be applied for marketing segmentation in this research. In accordance with the FMA weights, the customer values can be computed by the customer value [equation (1)].

Hence, the records of RFM are formatted to be a suitable database for computing the equation. However, the data are substituted into the customer value [equation (1)]; thus, the customer values are stored in a field of "customer values".

Table I. AHP pair-wise comparison matrix for FMA model

FMA model	F	M	A
F	1	a	b
M	1/a	1	c
A	1/b	1/c	1

Table II. Random index table

N	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

The study filters 386 records from a point-of-sales (POS) database of an online travel agency in Taiwan for the empirical case study. The CV equation (1) is applied to the POS database of the online travel agency (data collected from January to March 2017). In the database, the suitable FMA model records are filtered and the variable data are substituted into the customer value [equation (1)]; therefore, the customer values are computed. Finally, there are some samples shown in Table III.

5. Conclusions, suggestions and managerial implications

5.1 Conclusions and suggestions

For enhancing the data-driven CRM marketing of the air traveling industries in Taiwan, in this research, the air traveler market can be clustered into eight markets/clusters by the proposed model. As well, the markets/clusters can be ranked by the AHP. Besides, the travelers' customer values can be estimated by a proposed customer value [equation (1)].

As Table III shows, higher customer value travelers may not be included in higher valuable markets. For example, Traveler-4 is the highest customer value traveler in the samples, but Traveler-4 is in the market LHL-3 (middle ranking market). Because the M (monetary, weight = 48.96 per cent) variable for Traveler-4 is H ($1,630), the F and A variables for Traveler-4 are L (low); thus, the customer value is the highest in the samples and also in the middle ranking market LHL-3.

For marketing applications in the market LHL-3, the airlines/travel agencies can provide tour plans for enhancing the market LHL-3's frequency and family number. For marketing applications in the market HLH-4, because the customer value is lower than others, for low-customer-value travelers, the travel agency industry group can plan short-route travel packages for this market before the holidays (spring break, new year or long weekend), such as the east South/North Asia or the coast cities of China.

Via the FMA weights, businesses can easy to identify the higher customer value and markets. In real databases of online large-scale-database CRM systems, airlines or travel agencies can apply the customer value equation (1) in their online marketing systems to calculate travelers' customer values. However, through the research framework, travel agencies, airlines or businesses can implement their online large-scale-database systems or large-scale (Big Data) customer databases for focusing on high-value markets.

In this research, the author develops an applied customer value model for airlines. However, the RFM model is not proper for any retail industry. Researchers can improve and apply it on some specific industries. The research results can be applied in CRM systems for Big Data analytics in businesses. Hence, the application of this research can be a sustainable system by machine-learning daily loop in marketing or CRM systems.

ID#	Travelers	F	M (US$)	A	CV	Ranking markets
1	Chen	5:H	1,210:H	3:L	594.1768	HHL-2
2	Huang	6:H	1,170:L	4:H	574.9764	HLH-4
3	Lin	7:H	1,350:H	6:H	663.5666	HHH-1
4	Lee	3:L	1,630:H	2:L	799.1202	LHL-3
:	:	:	:	:	:	:
386	Chang	5:H	1,050:L	3:H	515.8408	HLH-4

Notes: F: frequency; M: monetary; A: average number of group travelers; CV: customer value; H: high; L: low
Source: POS database of an online travel agency in Taiwan, 2017

Table III.
FMA markets and customer values

The design of this research can discover customer value precisely for target markets. Customer values can be promoted to be higher by marketing plans. According to the research results, businesses can discover customer values in their large-scale (big) database for CRM or marketing systems. They can aim at their target markets more accurately for implementing marketing plans.

Transaction records of a long-run online retailer may have a big database including customer-shopping records. For a long-run online retailer with big data, the retailer can apply the research design on marketing or CRM systems for retaining existing customers and increasing customer values.

For future studies, researchers can investigate data-driven strategies for LCC industry or other businesses.

5.2 Managerial implications

- The research results can be applied in marketing systems or data-driven CRM systems for discovering valuable markets for businesses.
- For short-run or long-run retailers, the application of this research can be a sustainable system by machine-learning (daily loop) in marketing systems.
- The logic of this research can discover customer value precisely, that is, customer values can be promoted to be higher values by marketing plans.
- According to the research results, travel agencies or airlines may easily discover customer values in their large-scale database for marketing or data-driven CRM systems.
- The cost for retaining an existing customer is about one-fifth of the cost of developing a new customer (Kotler and Keller, 2016). As a result, businesses can retain existing customers by improving their marketing or CRM systems.
- According to the research results, travel agencies or airlines in Taiwan can arrange short, middle and long distances for different vacation packages in Taiwan. Since Wells (1994) concluded that "an air route is a market," that is, for example, the popular shortest air route for Taiwan is from Taipei (TPE) to Hong Kong (HK), this market (TPE-HK) is a highly competitive market (a golden route), because five airlines operate for this route: Eva Airways, China Airlines, Cathy Dragon Airlines, Hong Kong Airline and Cathy Pacific Airways. Hence, Hong Kong is the top tourist destinations in 2017 (Euromonitor's Top 100 City Destinations). However, Taipei city is also a tourist destination. Thus, the route is short but the market is huge. In practical data-driven marketing, managers of travel agencies can implement marketing plan with cross-industry alliance for attracting high-value travelers, for example, cross-selling two kinds of tickets (air ticket and ticket of Hong Kong Disneyland with hotel) for high-value family and couple travelers. The marketing plan can also retain existing travelers and attract new travelers (meets the conclusion of Kotler and Keller, 2016).
- In accordance with the A variable (average number of group travelers), the air travel industry in Taiwan can promote different tour plans for different types of family (from two- to five-person families). For the last example of travelers from TPE to HK, if the A variable is 5 and up, travel agency in Taiwan can arrange large size room for this type of travelers. The better service can also increase travelers' customer values.

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