Identifying Entrenched Users of Social Networking Sites: Empirical Study on Facebook

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Abstract

Recently, the rapid growth of users has considered ending their Facebook use or actually done so due to privacy issues, concerns about overexposing personal information online, or interpersonal interventions or distress. This study conducted research on users of Facebook, the most representative social networking site in the world, to determine the effect of Big Five personality traits, self-monitoring, and Facebook usage behaviors on continuance usage intention. A total of 498 valid samples were collected from a questionnaire survey and a multivariate nonparametric regression technique —multivariate adaptive regression splines— was employed to screen critical variables and predict users' continuance usage intention in the future. The results revealed that when the main motivation for Facebook use is not documenting life or expressing emotions, continuance usage intention notably decreases. In addition, the degree of agreeableness has a moderating effect on the relationship between Facebook usage behaviors and continuance usage intention.

1. Introduction

In recent years, social networking sites have grown rapidly with respect to the number of platforms and users. These sites have become part of the daily lives of millions of registered members (see Boyd and Ellison [6]). Moreover, companies have been using these sites as a marketing medium and accrued considerable profits because of the increasing number of users (see Ulusu [31]). Meanwhile, issues associated with social networking site usage have become the focus for numerous scholars. For example, Back et al. [4] investigated whether Facebook profiles reflect the true personalities of users or an idealized version. The study determined that Facebook is a medium through which users can effectively express their true personalities rather than building and broadcasting an idealized self. Lin and Lu [20] explored the reasons why people continued joining and using these social networking sites on the basis of network externalities and motivation theory and determined that recreation was the principle influencing factor, followed by

peer participation and practicality. Facebook users search for friends they know in real life more often than they browse profiles of total strangers (see Ellison et al. [11]).

A recent study aimed to understand the influence of personality traits on the use of Internet technology platforms (see Moore and McElroy [23]). A study on the relationship between personality and Facebook usage behaviors based on the Big Five personality traits indicated that personality is highly correlated with Facebook usage behaviors. For example, individuals who score high in extraversion have more friends and groups on Facebook. However, the hypothesis that individuals who score high in agreeableness spend less time on Facebook was not proven. The study revealed that individuals who scored high in conscientiousness tend to post messages on the wall less frequently but are more likely to regret inappropriate posts. Additionally, conscientiousness was not notably related to duration or frequency of use, number of friends, or number of pictures (see Moore and McElroy [23]). Individuals who score high in neuroticism exhibit a lesser tendency to upload pictures. Finally, individuals who score high in openness to experience tend to use numerous functions on Facebook (see Amichai-Hamburger and Vinitzky [2], Ross et al. [25]). He et al. [15] predicted the self-monitoring ability of individuals using textual analysis based on their Facebook posts and revealed that the content of Facebook posts can partially predict the self-monitoring ability of the user. Particularly, vocabulary related to family is the most critical prediction factor, whereas the use of emojis and Internet slang is the most robust basis of classification.

Although social networking sites have become interwoven in the daily lives of numerous persons and have changed their habits and manner of socializing, more and more users have considered ending their Facebook use or actually done so due to privacy issues, concerns about overexposing personal information online, or interpersonal interventions or distress. In view of the aforementioned situation, the present study investigated the continuance usage intention of these social networking sites, focusing on users of Facebook. First, the behaviors of Facebook users were studied to determine the crucial factors that influence user intention and could be used to effectively predict users' willingness to continue using the site in the future and identify characteristics of loyal users. Second, research based on the Big Five personality traits and self-monitoring was conducted to understand the influence of user behavior on personality traits. This study further aimed to determine the effect of personality traits on the continuance usage intention of these sites. Finally, we assessed whether various degrees of personality traits have a moderating effect on the relationship between user behavior and the continuance usage intention of Facebook.

In practice, this study can serve as a reference for corporate operating activities such as developing online marketing strategies for marketing personnel or managing human resources. The sections of this study are as follows: Section 2 Literature Review, Section 3 Research Methods, Section 4 Results, and Section 5 Conclusion and Research Limitations.

2. Literature Review

2.1. Social networking sites and Facebook

Social networking sites enable users to create public or semipublic personal profiles in a specific system to connect with a list of friends and share links through the Internet. Users may link to the profile of others by browsing their friends lists (see Boyd and Ellison [6], Ellison et al. [11], Oh et al. [24]). Users of these sites have integrated their daily lives with social networking sites, on which users share their life experiences and personal opinions and upload pictures or videos. These sites have become online and offline bridges of contact between people (see Ellison et al. [11]) because even when a friend is offline, users can keep track of each other through earlier posts or messages on the site. People can stay in contact with friends at any moment without the limitations of place or time.

Facebook is currently the social networking site with the most users and with the widest user age distribution. The large number of users suggests the availability of a large amount of information. Facebook's influence in the future is deserving of continual attention and research. Therefore, the present study targeted Facebook users to be research participants.

2.2. Continuance usage intention

Although intentions are not necessarily consistent with actual actions in the future, intentions can be used to predict possible situations in the future. A study indicated that the continuance usage intention of an information system depends on the level of satisfaction and usefulness users perceive (see Bhattacherjee [5]). The higher the satisfaction a user feels for a social networking site, the higher the continuance usage intention is (see Sun et al. [30]).

The present study focused on whether a user will continue to use Facebook in the future. Therefore, the continuance usage intention was defined in this study as a user being willing to continue being a member in the community without considering stopping or pausing the use of said social networking site.

2.3. Big Five personality traits and related studies

The Big Five personality traits has often been used to predict the behavior or attitude of an individual in fields such as psychology and management. The relevant literature on social networking sites and personality has offered numerous opinions and findings. A study indicated that personal profiles on social networking sites are used by users to create and present an idealized self rather than to depict the true personality (see Manago et al. [22]). Other studies have indicated that social networking sites are media that are used to effectively express actual personality traits and that people can obtain valid information on personality on the basis of messages, thoughts, pictures, or the social behaviors of the user. In addition, these studies have indicated that manipulating information on personal profiles is difficult because friends may leave clever feedback or

comments on the messages or pictures that the users post, which renders it difficult to effectuate the intention to present an image of an idealized self (see Back et al. [4], Vazire and Gosling [32]).

Andreassen et al. [3] studied Facebook addiction among university students and determined that such addiction is positively related to extraversion and neuroticism but negatively related to conscientiousness. A relevant study on conscientiousness also reported similar results. People who are highly conscientious tend to reduce their use of Facebook to focus on their own goals because they believe that using Facebook does not benefit their efficiency or productivity but is a mere distraction (see Devaraj et al. [9]).

2.4. Self-monitoring and related studies

Self-monitoring is a type of personality trait proposed by Snyder [27]. Self-monitoring refers to the degree to which individuals adjust their own behavior according to social context. Relevant studies often study this trait on the basis of its application in real world or face-to-face interactions. For example, Sharma et al. [26] revealed that high self-monitors are more capable of controlling impulsive buying behavior by using various strategies compared with low self-monitors.

In recent years, the growing popularity and number of users of social networking sites have provided numerous new research topics for researchers and have also enabled the extension of the study of self-monitoring to virtual platforms. For example, Hall and Pennington [14] studied the relationship between the self-monitoring and honesty of Facebook users and extraversion and conscientiousness and revealed that high self-monitors tend to establish extroverted personal profiles to present the best of themselves because these users wish to be an ideal Facebook friend who is extroverted, popular, and socially attractive. By contrast, low self-monitors tend to be honest on Facebook and establish conscientious personal profiles.

Overall, it is evident that self-monitoring takes place in both real-life social environments as well as social networking platforms. The popularity of these sites has offered people more platforms for self-expression and interpersonal interactions and caused some users to become considerably dependent on social networking sites. The present study aimed to determine the effect of the self-monitoring level of users on their continuance usage intention of social networking sites.

2.5. Multivariate adaptive regression splines

Relevant studies (see Al-Debei et al. [1], Bhattacherjee [5], Kang et al. [16], Lin and Lu [20]) have tended to apply structural equation modeling or analysis of variance to verify research hypotheses regarding user intentions. However, these methods impose numerous limitations on data structures and conditions. Moreover, results obtained from these methods only confirm the relationships between variables but are not favorable for prediction analysis. MARS is a multivariate nonparametric regression technique that is capable of automatically establishing correct models to predict continuous and binary dependent variables. MARS uses various basic functions to form a flexible prediction

model and is capable of identifying the optimal variable conversion and interaction under a high-dimensional and complex data structure (see Chang et al. [7], Kayri [17], Lin et al. [19], Lu et al. [21], Xiong and Meullenet [33]).

The literature review has proven the superiority of MARS over other models. Most studies have applied MARS to classification problems in data mining. Recent studies have used its ability to screen critical variables to integrate and assist with other models. Xiong and Meullenet [33] established a consumer preference model using MARS based on a consumer survey of their preferences for cheese sticks. The results revealed that MARS is capable of identifying potential relations hidden behind complex data structures. Lu et al. [21] established a sales prediction model for computer distributors and found that the prediction ability of MARS is superior to artificial neural networks. Moreover, MARS prediction was used to identify substantial predictor variables and their relations, yielding useful information for computer distributors in terms of sales decision-making or sales strategy.

In summary, MARS is superior in data screening, model prediction ability, and identification accuracy to regular linear regression models. A literature review revealed that MARS is high in practical values and flexibility. Therefore, this study employed MARS for variable selection and prediction model establishment.

3. Research Methods

3.1. Research participants and data collection

Facebook is currently the biggest social networking site with the largest number of members and the widest age distribution, thus making it a representative site. Therefore, this study targeted all individuals in Taiwan who have used Facebook to be research participants. The population included all individuals aged 13 years or older, which is the minimum age requirement to sign up as a Facebook member. Sampling was performed and questionnaires were distributed to carry out this study.

The questionnaire distribution of this study consisted of an online questionnaire and a paper questionnaire. The link to the online questionnaire was posted on the Facebook page of the author and shared by Facebook friends of the author. In addition, the questionnaire link was also posted on the National Taiwan University PTT Bulletin Board System (telnet://ptt.cc), which is currently the most popular terminal-based bulletin board system in Taiwan (see Lin and Lu [20]).

3.2. Research instrument

The questionnaire was designed with reference to relevant Taiwanese and foreign studies and other scales established by scholars and experts. The questionnaire consisted of six parts, which are presented as follows:

(1) Facebook Usage

Items regarding usage of Facebook were included to learn about different usage habits and behaviors of users. These items included the number of Facebook accounts, the time a user has been signed up as a Facebook member, the number of pictures a user owns, the number and type of frequently visited fan pages, the number of friends on Facebook, the most frequently used device for browsing Facebook, the main motives for use, and the most frequently used Facebook function.

(2) Facebook Usage Frequency

To understand the time and habits of usage, this study included items concerning the duration of daily use, the number of daily log-ins (including visiting the webpage), and the total weekly use time. The respondents were asked to choose the answer most similar to their actual situation.

(3) Continuance Usage Intention

The continuance usage intention scale of this study was established on the basis of items proposed by Lin and Lu [20] and modified in accordance with the Facebook context and the requirements of this study. Items adopted in the questionnaire of this study included "Considered terminating Facebook account," "Will delete Facebook account permanently," "Will recommend Facebook to others," and "Will continue using Facebook." The respondents were asked to list these four items in the sequence of the highest to lowest inclination.

(4) Self-Monitoring Level

The self-monitoring scale employed in this study was based on the version developed by Lennox and Wolfe [18], which was based on the theory of Snyder [27], and modified according to a Taiwanese study by Chen [8] and other compilations and modifications carried out by the present study. The 5-point Likert scale was adopted in this questionnaire with 1 to 5 points representing "strongly disagree" to "strongly agree". Reverse scoring was applied to the reverse coded items.

(5) Personality Traits

The personality trait scale designed by Donnellan et al. [10], which was based on the five-factor model of personality developed by Goldberg [13], was used in this study. Additionally, the five-factor model of personality translated from Goldberg [13] by Su [29] was used as a reference because this scale was tested through a careful back translation method that ensured the correctness of the translation of this questionnaire. The 5-point Likert scale was also adopted for the scoring of this scale.

(6) Demographic Data

This part of the questionnaire included items regarding gender, age, occupation, education level, and current relationship status. These data were used to analyze sample structure and distribution in order to understand the relationship between the demographic data and other variables.

3.3. Research methods

(1) Validity Analysis and Reliability Analysis
Validity refers to the ability to evaluate a particular ability or function that a scale is designed to evaluate. The validity analysis shows the relevance of the scale to this study. Because the questionnaire in this study was adapted from scales that have been developed by Taiwanese and foreign scholars, the scale used in this study has a certain level of accuracy. Reliability is used to measure the internal consistency and stability of a scale. This study used the Cronbach's α coefficient to test the reliability of the scale.

(2) Moderating Effect and Fisher's Z-Transformation
The MARS model in this study is a data-driven prediction model. To verify the moderating effect, this study employed the Fisher's Z-transformation to convert the correlation coefficient from two different samples. The conversion equation is as follows:

$$Z_r = \frac{1}{2}\ln\frac{1+r}{1-r}. \tag{3.1}$$

(3) MARS
MARS is a multivariate nonparametric regression technique that is superior in data screening, prediction ability, and identification accuracy to regular linear regression models. MARS mainly uses multiple spline basis functions (BFs) to sum up a flexible prediction model to solve problems with multivariate and complex data and explain the technique of various nonlinear statuses (see Friedman [12]). The MARS general model is defined as follows:

$$\hat{f}(x) = a_0 + \sum_{m=1}^{M} a_m B_m(x) \tag{3.2}$$

where a_0 and a_m are parameters that functions similar to the regression coefficient in a linear regression model. M is the number of BFs, which is determined by the evaluation criteria. $B_m(x)$ is a BF that can be obtained by continuous multiplying of a single or multiple equations and is defined as follows:

$$B_m(x) = \prod_{k=1}^{K_m} [s_{km}(x_{v(k,m)} - t_{k,m})]_+ \tag{3.3}$$

where K_m is the number of knots split, and the value of s_{km} is 1 or -1 and its function is to indicate direction. In addition, $v(k,m)$ marks the variables, and t_{km} is the threshold (numerical value) between each node.

In addition, the number of BFs is determined by cross-validation between parameters of the data, and the judgment standards are based on the loss of fit (LOF). By constantly eliminating the BF with the least contribution among various input variables, a balance between the number of variables and errors can be achieved and the optimal variable combination, number of knots, and interactions can be obtained.

Within a set of target variables and predictor variables that can be chosen from, MARS can first separate meaningful variables from the less appropriate ones. Then, MARS can determine whether interactions exist between these predictor variables and apply the new variable clustering technique to process the missing value. Finally, considerable self-testing was applied to prevent overfitting (see Steinberg et al. [28]).

An optimized MARS model was determined using the forward and backward stepwise procedure. Details of the procedure are as follows:

(1) The Forward Pass

During this phase, the model constantly adds BFs (including all main effects, knots, or interactions) until the MARS model grows into an extremely complete model and comprises a large number of BFs. The variables may be continuous, sequential, or categorical. In addition, these variables may have interactions or be limited to a single additional variable in the model.

(2) The Backward Pass

The backward pass determines and removes the least effective BF in the model from the previous stage according to the LOF concept using the generalized cross-validation (GCV) criterion. The objective is to find the optimal balance between the number of variables and errors, thereby achieving a change that reaches the fittest balance. The GCV criterion is applied to determine the selection of variables. Specifically, if the GCV markedly decreases when a variable is to be removed from the model, the variable is considered to be a critical factor.

The literature review revealed that MARS is relatively superior to other models and has practical value and high flexibility. Therefore, this study employed MARS to screen variables and carry out modeling.

4. Results

A total of 498 valid samples were collected from the questionnaire survey. Descriptive statistics and related analyses were applied to understand the distribution and relevance of samples. Additionally, MARS was applied to establish the prediction model.

4.1. Descriptive statistics of the sample

Among the research samples, male users comprised 234 (47%) and female users 264 (53%). Fifty-three respondents (10.6%) were aged 13 to 18 years; 391 of them (78.6%) were aged 19 to 29 years, which was the age group comprising the highest number of participants; 49 respondents (9.8%) were aged 30 to 39 years; and 5 respondents (1%) were aged 40 years and above. The majority of the respondents were students, totaling 325 persons (65.4%), followed by employees in the service industry, totaling 49 persons (9.8%), and 32 respondents (6.4%) were in the military, public service, or teaching professions.

With respect to the frequency of usage, a total of 119 respondents (23.9%) reported spending 1 to 2 hours on Facebook daily, which is the majority. Then, a total of 90 (18.1%) and 85 (17.1%) respondents reported spending 30 minutes to 1 hour and 2 to 3 hours daily, respectively. A majority of 193 respondents (38.8%) reported logging into Facebook (including opening the webpage) 5 to 9 times per day, followed by the group of 172 respondents (34.5%) who reported logging in 4 times or fewer daily. Regarding weekly use time, the majority group consisted of 139 respondents (27.9%) who reported 7 or fewer hours of use, followed by 126 respondents (25.3%) who reported using the site 7 to 14 hours weekly. According to these questionnaires, the average number of friends users had was 364.21 persons with a standard deviation of 199.17.

4.2. Reliability analysis

The Big Five personality traits employed in this study was based on the scale developed by Donnellan et al. [10], which consisted of 20 items that measure the personality traits of the respondent. The self-monitoring scale adopted was established by Lennox and Wolfe [18] and consists of 13 items. The results revealed that the Cronbach's α coefficients for extraversion and openness to experiences were 0.766 and 0.816, which indicated high reliability because both were higher than 0.7. The Cronbach's α coefficients for agreeableness, conscientiousness, and neuroticism were 0.645, 0.639, and 0.657, respectively. The reliability for these three traits was acceptable because each was higher than 0.5. The Cronbach's α coefficient for the Big Five personality traits was 0.612, which was acceptable; however, that for the self-monitoring scale was 0.803, which indicates considerably high reliability.

4.3. Continuance usage intention prediction based on FB usage behaviors

(1) Data Processing Measures

This study evaluated the continuance usage intention according to the answers given for the strongest and the second strongest intention. As long as the respondent selected 3: "Will recommend Facebook to others" or 4: "Will continue using Facebook," the respondent was considered to have high continuance usage intention regardless of whether the same answer was given to other questions. Similarly, if the respondent replied either 1: "Considered terminating Facebook account" or 2: "Will delete Facebook account permanently" for either of the strongest or the second strongest intention, the respondent was considered to have low continuance usage intention even if statement 3 or 4 was selected as the strongest intention. As a result, a total of 385 samples were classified as exhibiting high continuance usage intention, comprising 77.3% of the total samples. One hundred thirteen samples were classified as exhibiting low continuance usage intention (22.7%).

(2) MARS Modeling Results

In this study, Facebook usage behaviors was set as the predictor variable and the continuance usage intention was set as the target variable to establish a continuance

usage intention prediction model based on Facebook usage behaviors through the classification ability of MARS. This model can be used to understand the correlation between user behavior variables and future continuance usage intention. The results revealed one significant predictor variable, which was "Usage motivation priority 7 (Mot7)"— the least principle motivation. In addition, when said motivation was documenting life or expressing emotions, the BF1 value was 1, otherwise the BF1 value was 0. The relative importance of usage motivation priority 7 was 100% and its regression coefficient was -0.233735, which indicated a negative effect direction. In other words, if the main usage motivation was not documenting life or expressing emotions, the continuance usage intention markedly decreased. MARS modeling results are presented in Table 1.

Table 1: Critical variable screening and results for MARS continuance usage intention model based on usage.

Critical variable screening	Relative importance (%)	BF
Usage motivation 7	100	BF1 = (usage motivation 7 is in SubSet1), SubSet1={"documenting life," "expressing emotions"}
MARS prediction equation: $Y = 0.812048 - 0.233735 \times$ BF1		

Table 2 presents the results of MARS modeling. According to the table, the overall accuracy was 60.64%. The individual prediction rate for {2-2} was 70.65%; that is, of the 385 samples in the source population that were determined to evince strong intention, 113 of them might have been mistaken as weak intention users.

Table 2: MARS modeling results for continuance usage intention based on usage.

Actual intention	Number of testing samples	Prediction results (persons/percentage %)		Accuracy rate	Overall accuracy rate
		Weak intention	Strong intention		
Weak intention	113	30 (26.55)	83 (73.45)	26.55 %	
Strong intention	385	113 (29.354)	272 (70.65)	70.65 %	60.64 %

4.4. Continuance usage intention prediction model based on personality traits

Through the use of variable screening by MARS, three significant classification variables were obtained, and these were conscientiousness scoring, agreeableness scoring,

and extraversion scoring. The relative importance of conscientiousness was 100% and its regression coefficient was -0.139889, which indicated a negative relation. The relative importance of agreeableness was 80.96% and the regression coefficient was 0.127117, which indicated a positive relationship with continuance usage intention. In addition, the regression coefficient of extraversion was -0.0652629, which was negatively related to continuance usage intention. The relative importance of extraversion was considerably low, and therefore the percentage was not presented in the MARS results. The modeling results are presented in Table 3.

Table 3: Critical variable screening and results for MARS continuance usage intention model based on personality traits.

Critical variable screening	Relative importance (%)	BF
Conscientiousness scoring	100	BF14 = max (0, 3.5 -conscientiousness scoring)
Agreeableness scoring	80.96	BF15 = max (0, agreeableness scoring-3)
Extraversion scoring		BF16 = max (0, extraversion scoring-3.25)
MARS prediction equation: $Y = 0.735313 - 0.139889 \times \text{BF14} - 0.0652629 \times \text{BF16} + 0.127117 \times \text{BF15}$		

According to the BFs, 3.5 was the knot for conscientiousness. That is, when a user scores less than 3.5 in conscientiousness, the continuance usage intention may decrease; however, when a user scores higher than 3.5 in conscientiousness, this variable has zero effect on the prediction equation. An agreeableness evaluation score higher than 3 indicated a relatively high continuance usage intention. An extraversion score higher than 3.25 may reflect a relatively low intention to continue using Facebook.

Table 4 presents the MARS modeling results. As evident in the table, the overall accuracy rate was 68.07%. In addition, the individual prediction rate for {2-2} was 78.96%; that is, of the 385 samples in the source population that were determined to exhibit strong intention, 81 of them were mistaken as weak intention users.

Table 4: MARS modeling results for continuance usage intention based on personality traits.

Actual intention	Number of testing samples	Prediction results (persons/percentage %)		Accuracy rate	Overall accuracy rate
		Weak intention	Strong intention		
Weak intention	113	35 (30.97)	78 (69.03)	30.97 %	
Strong intention	385	81 (21.04)	304 (78.96)	78.96 %	68.07 %

4.5. Moderating effect of personality scoring on FB usage behaviors and continuance usage intention

(1) Data Splitting

To verify the moderating effect of personality scoring on Facebook usage behaviors and continuance usage intention, samples were split into high and low groups according to the mean personality scoring before MARS modeling. Specifically, a respondent who scored higher than the mean value was categorized in the high-degree group of that personality trait, whereas the respondent who scored lower than the mean value was categorized in the low-degree group of that personality trait. This categorization was done to facilitate the following computation, and the numbers of split samples are presented in Table 5.

Table 5: Numbers of samples split based on personality scoring.

	Extraversion	Agreeableness	Conscientiouness	Neuroticism	Openness to experiences	Self-monitoring
Number of high-degree samples	282	298	256	236	277	285
Number of low-degree samples	216	200	242	262	221	213

(2) Moderating Effect Verification Results

This study converted each correlation coefficient (square root of the coefficient of determination R^2) of the MARS prediction model to a Z-score by using the Fisher's Z-Transformation to conduct a Z-test. If this test results in significance, the personality scoring has a moderating effect on Facebook usage behaviors and continuance usage intention. The coefficient of determination of each personality trait obtained by MARS is presented in Table 6.

   According to the Z-test results, only agreeableness reached the level of significance. In other words, the degree of agreeableness may have a moderating effect on the effect of Facebook usage behaviors on continuance usage intention. At various levels of agreeableness, several particular actions may enforce or weaken continuance intention.

5. Conclusion and Suggestions

5.1. Conclusion

   Departing from common methods other studies have used, the present study applied the MARS model. With this method, this study aimed to identify underlying connections between a large quantity of seemingly meaningless and unrelated data. These connections can be converted into meaningful data and serve as a reference for companies in

Table 6: Coefficient of determination and Z-test results.

	Extraversion	Agreeableness	Conscientiouness	Neuroticism	Openness to experiences	Self-monitoring
High-degree R^2	0.05	0.0843	0.0343	0.0766	0.0604	0.0241
Low-degree R^2	0.0798	0.2903	0.0736	0.0579	0.077	0.0717
Z_{hi}	0.2274	0.2989	0.1874	0.2842	0.2509	0.1565
Z_{lo}	0.2904	0.6025	0.2783	0.2454	0.285	0.2744
Z_{test}	-0.692	-3.30***	-1.008	0.4300	-0.375	-1.2941

*** $|Z| > 2.58$

organizational operations and decision-making in the future. The empirical analysis in Section IV identified user personality traits and current usage and behaviors that promote continuance usage intention in the future. The findings are further explained in the following paragraphs along with relevant inferences:

(1) Regarding the relationship between continuance usage intention and Facebook usage behaviors, usage motivation was screened out by MARS as a critical variable. When the users' least prioritized usage motivation is documenting life or expressing emotions, their continuance usage intention is relatively low. Thus, when users are emotionally attached to Facebook usage behaviors, their continuance usage intention is high because using Facebook has become part of their lives. In addition, because these users often share their lives on Facebook, the possibility of stopping the usage is relatively low.

(2) Regarding the effect of personality traits on continuance usage intention, conscientiousness and agreeableness were determined to be crucial. When a user scores less than 3.5 in conscientiousness, continuance usage intention may also decrease. Possible reasons for this finding are that individuals with low conscientiousness are less focused on things and are less likely to stay with anything for a prolonged period of time. When a user scores higher than 3 in agreeableness, continuance usage intention increases because people who score high in agreeableness are empathic, friendly, and less likely to say no to others. These individuals may be using Facebook to care for their friends and therefore tend to have higher continuance usage intention. In addition, users who scored higher than 3.25 in extraversion had lower continuance intention, whereas a score in extraversion lower than 3.25 did not affect the prediction. Nevertheless, the importance of this trait is relatively low. Therefore, this study inferred that individuals who score high in extraversion can achieve favorable interactions with others in real life through the use of their own social skills rather than depending on Facebook for maintaining friendships. By contrast, individuals who scored medium or low in extraversion exhibited no notable difference in continuance usage intention.

(3) The moderating effect of the degree of a personality trait on the relationship between Facebook usage behaviors and continuance usage intention was only observed for agreeableness. Different degrees of agreeableness may enhance or weaken continuance usage intention through certain actions.

5.2. Managerial implication

The results of this study can be applied to human resources management. For example, when an organization is looking for an employee with leadership strength, a highly extroverted individual meets the criterion. According to the research results, such an organization can determine the personality of a potential employee by observing the number of friends and uploaded pictures on their Facebook page. Even the content of these pictures can be informative. In addition, the content of the posts on Facebook can be used to determine the level of conscientiousness of an employee or an interviewee.

The results may also be applied to marketing strategies to attract or target potential customers on Facebook. Identifying the personality of a customer and establishing appropriate marketing strategies can improve the outcomes of marketing. If functionality, practicality, and safety are emphasized in a product, its potential consumer population should be conscientious individuals. Then, the company can identify potential consumers with this personality trait by observing their information on Facebook and send out relevant advertisements and messages to these individuals. The company could even post information about experiential marketing events to attract this type of consumer. Establishing appropriate marketing strategies according to target customers can improve the effectiveness of marketing and enhance the yield of benefits from the invested resources.

5.3. Research limitation

The samples acquired in this study were mainly from individuals aged 19 to 29 years. Samples from other age groups were relatively few. Therefore, the results cannot be generalized to all Facebook users. Additionally, the samples were collected mainly through Internet by convenience sampling, which was adopted because of the cost and convenience for this study. However, this sampling method is prone to great sampling errors and insufficient representativeness, which affected the overall accuracy rate of this study. Therefore, studies in the future are encouraged to collect more samples from other age groups and apply other sampling methods that qualify as probability sampling to enhance the representativeness and reduce errors to obtain more favorable indicators.

According to the variable-screening results of this study, the intention or personality of a user is not easy to determine only by browsing or observing the Facebook page of the user. For example, a questionnaire survey or an interview is required to understand the usage motivation of a user, which is a complicated and time-consuming method. Additionally, users can manage their privacy setting on their Facebook page, which affects the visibility of the information on their page. Employers are not necessarily able to acquire the desired information. Therefore, Facebook can only be a reference for human resources management. Nevertheless, if assessment indicators based on the direct

observation method for personality prediction can be established in the future, human resources management should be able to develop a novel recruiting or training method that can identify the true qualities of an employee or an interviewee in order to place them in the appropriate position.

References

[1] Al-Debei, M. M., Al-Lozi, E. and Papazafeiropoulou, A. (2013). *Why people keep coming back to Facebook: Explaining and predicting continuance participation from an extended theory of planned behaviour perspective*, Decision Support Systems, Vol.55, 43-54.

[2] Amichai-Hamburger, Y. and Vinitzky, G. (2010). *Social network use and personality*, Computers in Human Behavior, Vol.26, 1289-1295.

[3] Andreassen, C. S., Torsheim, T., Brunborg, G. S. and Pallesen, S. (2012). *Development of a Facebook addiction scale*, Psychological Reports, Vol.110, 501-517.

[4] Back, M. D., Stopfer, J. M., Vazire, S., Gaddis, S., Schmukle, S. C., Egloff, B. and Gosling, S. D. (2010). *Facebook profiles reflect actual personality, not self-idealization*, Psychological Science, Vol.21, 372-374.

[5] Bhattacherjee, A. (2001). *Understanding information systems continuance: An expectation-confirmation model*, MIS Quarterly, Vol.25, 351-370.

[6] Boyd, D. M. and Ellison, N. B. (2007). *Social network sites: Definition, history, and scholarship*, Journal of Computer-Mediated Communication, Vol.13, 210-230.

[7] Chang, L., Chu, H., Lin, D. and Lui, P. (2012). *Analysis of freeway accident frequency using multivariate adaptive regression splines*, Procedia Engineering, Vol.45, 824-829.

[8] Chen, S. H. (2005). Relationships of Interviewee Personality and Interview Outcomes Under Low-Structured Situation Interviews: From the Perspective of Big Five, Self-Monitoring, and Self-Efficacy (Unpublished master's thesis), National Chengchi University, Taipei City.

[9] Devaraj, S., Easley, R. F. and Crant, J. M. (2008). *Research note-how does personality matter? Relating the five-factor model to technology acceptance and use*, Information Systems Research, Vol.19, 93-105.

[10] Donnellan, M. B., Oswald, F. L., Baird, B. M. and Lucas, R. E. (2006). *The mini-IPIP scales: tiny-yet-effective measures of the Big Five factors of personality*, Psychological assessment, Vol.18, 192-203.

[11] Ellison, N. B., Steinfield, C. and Lampe, C. (2007). *The benefits of Facebook "friends:" Social capital and college students' use of online social network sites*, Journal of ComputerMediated Communication, Vol.12, 1143-1168.

[12] Friedman, J. H. (1991). *Multivariate adaptive regression splines*, The Annals of Statistics, Vol.19, 1-141.

[13] Goldberg, L. R. (1999). *A broad-bandwidth, public-domain, personality inventory measuring the lower-level facets of several five-factor models*, Personality Psychology in Europe, Vol.7, 7-28.

[14] Hall, J. A. and Pennington, N. (2013). *Self-monitoring, honesty, and cue use on Facebook: The relationship with user extraversion and conscientiousness*, Computers in Human Behavior, Vol.29, 1556-1564.

[15] He, Q., Glas, C. A., Kosinski, M., Stillwell, D. J. and Veldkamp, B. P. (2014). *Predicting self-monitoring skills using textual posts on Facebook*, Computers in Human Behavior, Vol.33, 69-78.

[16] Kang, Y. S., Hong, S. and Lee, H. (2009). *Exploring continued online service usage behavior: The roles of self-image congruity and regret*, Computers in Human Behavior, Vol.25, 111-122.

[17] Kayri, M. (2010). *The analysis of internet addiction scale using multivariate adaptive regression splines*, Iranian Journal of Public Health, Vol.39, 51-63.

[18] Lennox, R. D. and Wolfe, R. N. (1984). *Revision of the self-monitoring scale*, Journal of Personality and Social Psychology, Vol.46, 1349-1364.

[19] Lin, H., Wang, W., Liu, Y., Soong, S., York, T. P., Myers, L. and Hu, J. J. (2008). *Comparison of multivariate adaptive regression splines and logistic regression in detecting SNP-SNP interactions and their application in prostate cancer*, Journal of Human Genetics, Vol.53, 802-811.

[20] Lin, K. and Lu, H. (2011). *Why people use social networking sites: An empirical study integrating network externalities and motivation theory*, Computers in Human Behavior, Vol.27, 1152-1161.

[21] Lu, C., Lee, T. and Lian, C. (2012). *Sales forecasting for computer wholesalers: A comparison of multivariate adaptive regression splines and artificial neural networks*, Decision Support Systems, Vol.54, 584-596.

[22] Manago, A. M., Graham, M. B., Greenfield, P. M. and Salimkhan, G. (2008). *Self-presentation and gender on MySpace*, Journal of Applied Developmental Psychology, Vol.29, 446-458.

[23] Moore, K. and McElroy, J. C. (2012). *The influence of personality on facebook usage, wall postings, and regret*, Computers in Human Behavior, Vol.28, 267-274.

[24] Oh, H. J., Ozkaya, E. and LaRose, R. (2014). *How does online social networking enhance life satisfaction? The relationships among online supportive interaction, affect, perceived social support, sense of community, and life satisfaction*, Computers in Human Behavior, Vol.30, 69-78.

[25] Ross, C., Orr, E. S., Sisic, M., Arseneault, J. M., Simmering, M. G. and Orr, R. R. (2009). *Personality and motivations associated with Facebook use*, Computers in Human Behavior, Vol.25, 578-586.

[26] Sharma, P., Sivakumaran, B. and Marshall, R. (2010). *Impulse buying and variety seeking: A trait-correlates perspective*, Journal of Business Research, Vol.63, 276-283.

[27] Snyder, M. (1974). *Self-monitoring of expressive behaviour*, Journal of Personality and Social Psychology, Vol.30, 526-537.

[28] Steinberg, D., Bernard, B., Phillip, C. and Kerry, M. (2001). MARS User Guide, San Diego, CA: Salford System.

[29] Su, H. W. (2004). Antecedents and Consequences of Perceived Person-Environment Fit (Unpublished master's thesis), National Taiwan University of Science and Technology, Taipei City.

[30] Sun, Y., Liu, L., Peng, X., Dong, Y. and Barnes, S. J. (2014). *Understanding Chinese users' continuance intention toward online social networks: An integrative theoretical model*, Electronic Markets, Vol.24, 57-66.

[31] Ulusu, Y. (2010). *Determinant Factors of Time Spent on Facebook: Brand Community Engagement and Usage Types*, Journal of Yasar University, Vol.5, 2949-2957.

[32] Vazire, S. and Gosling, S. D. (2004). *E-perceptions: Personality impressions based on personal websites*, Journal of Personality and Social Psychology, Vol.87, 123-132.

[33] Xiong, R. and Meullenet, J. F. (2004). *Application of multivariate adaptive regression splines (MARS) to the preference mapping of cheese sticks*, Journal of food science, Vol.69, SNQ131-SNQ139.

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