

A Study of Behavioral Model on Green Consumption

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Abstract—The origin of green consumption was aroused by the understanding of crisis of the deterioration of resources and the environment. Therefore, the enterprise or manufacturer has to provide a greener product and service in order to comply with the changing of consumer purchasing behavior. The concept of the technology acceptance model was referred to in this study. Through the combination of the theory of planned behavior and service quality, we consider research variables which involve the tangible and intangible products or services in the consumption process at the same time. Then we propose a concrete and feasible green consumer acceptance model and hope to explore the key factors for green consumption behavior so as to provide important reference basis for academia and practice in sustainable services planning issues. The design of the questionnaire was conducted by the item analysis of the pretest. The total recovery of 598 valid questionnaires was collected. The Amos structural equation model was used to carry out the statistics and path analysis. The empirical analysis results showed that green-consumption attitude, subjective norm and perceived behavioral control had positive impacts on service quality. Green subjective norms had a positive effect on satisfaction. Service quality had a positive effect on satisfaction. Service quality had a positive effect on behavior intention. Behavioral intention toward actual behavior showed a positive impact.

Index Terms—Green consumption, theory of planned behavior, technology acceptance model, service quality, satisfaction.

I. INTRODUCTION

A metaphor for green generally contains life, resources, environment, energy conservation, environmental protection and sustainability. So, green consumption is subject to sustainability of green behavior, taking into account energy-saving and carbon reduction, environmental resources and sustainable development [1]-[3]. Thus, green consumption in daily life not only widely covers life-needed green products in food, clothing, housing, transportation, education and recreation, but includes resource recycling, efficient energy use planning, living environmental protection of human species, etc., including production systems, consumer systems and environmental systems [4]-[7]. Hopefully, such implementation would enable people to give environmental resources a positive consideration, thereby, furthering green economy to truly implement. However, its practice shall be subject to individual consciousness and attitudes leading to a change of and

influence on social, economic and environmental virtuous circle. Facing the world's continuously growing population, ongoing deterioration of the ecological environment and the energy crisis highlights, it is essential to exclusively confront the importance and urgency of green consumption to meet people's basic needs and to establish thrifty concept [8]. Through green development, energy conservation, pollution reduction, sustainable consumption patterns, we should start with the individual and make an overall plan and preparation and take into account environmental protection, nation and society and economic development before we can embrace the sustainable green environment [9], [10].

Early green consumption comparatively emphasized on the impact arising from the use of products, however, after pushing forward the concept of sustainable development, green consumption is not merely limited to the use of products, but is conducted in an approach of both sustainability and more social responsibilities [11]. When a consumer buys green products, he/she also earns recognition for what he/she has given to the producer, environmental resources and sustainable development, and thereby the integration of a personal attention to the environment and sustainable development issues concerned by people will be converted into practice [12]-[14]. In the past two or three decades, green consumption and the environmental movement have shown its results in many countries, and have positively impacted manufacturers and enterprise on development strategic planning, thus the robust green consumption concept represents an non-ignorable strength on the way to the sustainable development [11].

A. Specific Objective

It is found in domestic and foreign literature in related research that most of the green consumption studies research consumer patterns of attitudes and behavior through Theory of Reasoned Action and Theory of Planned Behavior. However, these studies almost target some certain green product. Service quality in the relevant literature review has been confirmed to have a significant impact on consumers' intent and use attitudes. Therefore, this study refers to Technology Acceptance Model, and proposes specifically viable green consumption patterns through Theory of Planned Behavior combining with service quality, hoping to use concept of sustainable services for exploration of green life practice to provide academic and practical issues on sustainable services planning with an important reference. Hence, the specific objective of this study can be summarized into the three following points:

- 1) To explore the influence of green rationalism awareness on between service quality and satisfaction under green-consumption acceptance model.
- 2) To explore the influence of service quality and

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satisfaction on green-consumption behavioral intention under green-consumption acceptance model.

- 3) To propose a specifically feasible green-consumption acceptance model through empirical research, and to offer an important basis for planning sustainable services targeting future green-consumption awareness and living practice.

II. LITERATURE REVIEW

Fishbein and Ajzen [15] proposed Theory of Reasoned Action (TRA) in 1975. According to the theory narrative, intention to perform a certain behavior is determined by attitudes to behavior and subjective norms and the degree to which carrying out the intention under the volitional control of the individual. Fishbein and Ajzen [15] expanded expectancy models [16] and added two facets—behavioral intention and subjective norm—to propose the Theory of Reasoned Action. Ajzen [17] added individual self-determination and perception i.e. perceived behavioral control, and further developed the Theory of Planned Behavior (TPB), hoping to predict weak control ability behavior. Therefore, according to theory of planned behavior, three forecast variables that must be considered separately when predicting the behavior of a particular individual, which are specific attitude on behavior, subjective norms and the degree considered by themselves of control over the behavior. While the more favorite attitudes towards the behavior, the more support from subjective norm for engaging in such behavior, the stronger perceived behavioral control of the behavior is, the higher the intent to carry out the behavior will be [18], [19]. This theory has been widely used in exploration of different aspects of green consumption in recent years. Many scholars have applied it to studies of green consumption topics such as green transportation [20], [21]; green recreation [22]-[24]; green shopping [25], [26], and green production [27], [28]. On the other hand, Sheeran *et al.* [29] empirically proved thirty types of different behaviors based on Theory of Planned Behavior and Theory of Reasoned Action, and found the average increment of explained variation was about 8%, it proves that Theory of Planned Behavior surpasses Theory of Reasoned Action in behavior prediction.

Many studies have confirmed that Theory of Planned Behavior or behavioral attitude, subjective norms and perceived behavioral control respectively affect behavioral intention. Lin's [30] study on adolescent green consumers' awareness, attitudes and behavior indicates that the more positive attitude towards green food consumption, the better its green consumer behavior will be. Related studies also point out that consumers' subjective norms affect the extent of its possibilities to perform the act. Madden, Ellen and Ajzen's [31] study concludes that perceived behavioral control can improve the ability to predict behavioral intention. The ability of degree of difficulty and time of consumers' awareness to purchase green products will affect their purchase intention [32]. Hsu [33] found that in the perceived behavioral control, if consumers consider that driving a Green Car is easy, and have absolute discretion, participation and sufficient budget, they will be willing to purchase a

Green Car. Hung [34] noted in the study of urban and rural residents on green consumption and green consumption behavior had shown the green consumer attitudes and green consumer behavior presented significant positive correlation. It is concluded that people's green consumption is affected by green concept, and therefore, we explore Tunghai University students' green consciousness and behavior based on Theory of Planned Behavior.

Researching the determinant of customers' measure on service quality, Parasuraman, Zeithaml and Berry [35] and others put forward assessment on the five SERVQUAL service quality dimensions in 1985 after integration in order to reduce overlapping among the above mentioned ten cognitive facets which are tangibles, reliability, responsiveness, assurance and empathy, and developed five facets' SERVQUAL scale comprising 22 questions.

Relevant research scholars present an idea that perceiving quality is customers' variable to attitudes, and attitudes influence behavior, so the customers' quality perception affects their consumption behavioral intention [35], [36]. Boulding, Kalra and Zeithaml [37] believe that service quality is the antecedent of consumer intentions. Anderson and Sullivan [38] believe that the quality of service is antecedent variable for the customer satisfaction. Parasuraman, Zeithaml and Berry [39] consider that, after integration of the research views, when consumers engage in a specific transaction, product quality, service quality and price assessment are antecedent variables affecting transaction satisfaction, and then after several transactions, the customer will form an overall impression towards the transaction object. Boulding *et al.* [37] believe that customer perception of service quality will affect their assessment of the overall service satisfaction, and customer satisfaction will subsequently affect the behavioral intention. In terms of research model presented by service industry, in 2000, Cronin, Brandy and Hult [40] explored impact of service quality, value and satisfaction on customer behavior intention, after the use of multiple models empirical comparison, they proposed that service quality and value of services have positive effect on behavioral intention.

III. RESEARCH METHODS / METHODOLOGY

Domestic and international promotion and implementation of individual green consumption are based on the daily life oriented consideration, for example, the concept of green consumption behavior proposed by the Environmental Protection Administration of the Executive Yuan (EPA) covers people's six large demands in daily life, containing a variety of necessary demands of material life and spiritual life. Therefore, this project will use Ajzen's [17] Theory of Planned Behavior as the basis adding the theoretical model studied by Cronin *et al.* [40], and the overall green consumption as the starting point, further develop a research framework of this program. Research framework includes "green consumer behavior and attitude", "green consumption subjective norms", "green consumption perceived behavioral control", "green consumption quality of service", "green consumption satisfaction", "green consumer behavioral intention" and "actual green consumption behavior". The

research framework proposed is shown in Fig. 1.

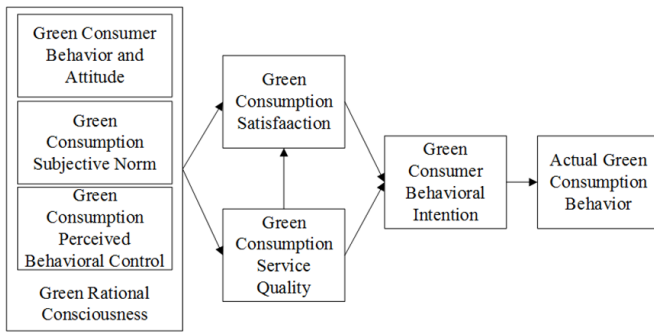


Fig. 1. Research framework.

According to the relevant literature review's discussion, inference and definitions, and assumptions of each facet of the association through the literature's relevant empirical proof, this study develops a specific research hypothesis as follows:

H₁: Green-consumption consciousness has positive impact on green-consumption service quality.

H₂: Green-consumption consciousness has positive impact on green-consumption satisfaction.

H₃: Green-consumption service quality has positive impact on green-consumption satisfaction.

H₄: Green-consumption service quality has positive impact on green behavioral intention.

H₅: Green-consumption satisfaction has positive impact on green behavioral intention.

H₆: Green behavioral intention has positive impact on actual green-consumption behavior.

The program will study on the daily lives' green consumer behavior as a whole, through questionnaires and related statistical analysis to better understand consumers' critical influencing factors on consumer behavioral intention and behavior, and to make recommendations based on findings, hoping to provide green consumers with an important reference for implementation planning through this empirical research. The statistics of this research are prescribed as follows:

- 1) Descriptive statistics analysis: mainly used to describe basic information of samples.
- 2) Item analysis: mainly used to analyze the degree of being able to test scale items [41]. The total item analyses herein include discrimination testing, inspection on missing values, descriptive statistics test, extreme groups test, internal consistency test and test of item-total correlation coefficient.
- 3) Factor analysis: this study uses confirmatory factor analysis to test first-order factors dissociated directly from manifest variables, estimate variance of measured variables and covariance matrix representing strength of ties between latent variables, and test structural relationship between factors.
- 4) Structural equation modeling (SEM): structural equation modeling is a statistical method used to deal with causality model. It provides researchers with possible ways to turn exploratory factor analysis into confirmatory factor analysis because SEM can simultaneously deal with the relationships among

multiple sets of variables. This study uses AMOS software to carry out SEM's assessment of fit and uses absolute fit indices, relative fit indices and parsimonious fit indices to measure the constructed scale fit.

IV. DISCUSSION AND FUTURE STUDY

This study sends out pre-test questionnaire in a convenience sampling, the test subjects are the Tunghai University students. Using small sample test and then, subjected to preliminary test version and through the questionnaire pre-testing methods to determine the extent to the usable subject, further remove the bad subject, and finally decide the formal scale. Pre-test questionnaire contains a total of eight variables attitude questions, eight subjective norm questions, six perceived behavioral control variables questions, twenty six quality variables questions, eight satisfaction variables questions, four intent variables questions, five actual behavior variables questions, and constitutes a total of sixty-five-question pre-test questionnaires, it totally collects 100 valid samples of pre-test questionnaire. The analytical methods of related items are shown as follows:

Descriptive statistics tests:

- 1) Average test: the average total amount should fall on the average neither up nor down the table more than 1.5 standard deviations, the average of full scale is 3.839, and the standard deviation is 0.738. Therefore, the value should be neither greater than 4.946 nor less than 2.642. As a result, the average value of attitude 4 (ATT 4) is less than 2.732, so the above item did not pass the average test.
- 2) Standard deviation test: because this scale uses the five-point scale, the standard deviation should not be less than 0.5. The standard deviation of each of the 65 questions is greater than 0.5, so all questions of inspection have passed the standard deviation.
- 3) Skewness test: absolute value of skewness coefficient should not be more than 1. The absolute value of skewness coefficient of each of the 5 questions — subjective norm (SN 8), quality (QUA 2, 3, 5, and 9), actual behavior (BEH 3) and so on is greater than 1, so they did not pass the skewness test.
- 4) Extreme groups test: p -value should be less than 0.05, the lowest score group (total score ≤ 3.7302) and the highest score group (total score ≥ 4.0965) derive attitude (ATT 4) question's extreme groups test ($t(57) = -0.669$, $p = 0.509$) p -value greater than 0.05 after independent sample t -test of average amount in the extreme groups. It shows that this item does not have a good discernment on the test subject's nature, so it did not pass the extreme groups test. Those that did not reach the level of 0.01 were the first question of subjective norm's (SN 1) extreme group test ($t(57) = -2.422$, $p = 0.019$), quality's (QUA 1 and 6) extreme groups test ($t(57) = -2.635$, $p = 0.012$; $t(57) = -2.496$, $p = 0.015$).
- 5) Validity test (item-dimension categorization test):

item-total correlation coefficient should reach 0.5 or more. Item-total correlation coefficient of each of the 15 items—actual behavior (BEH 1, 2, 3, 4 and 5), attitude (ATT 4 and 6), subjective norm (SN 5, 6), perceived behavioral control (PBC 1, 2 and 3), quality (QUA 6 and 18), satisfaction (SAT 1, 3 and 7)—is less than 0.5, so they did not pass the test.

After item analysis and overall judgment through the data of the above various indicators and the project analysis, three questions are deleted, and 62 questions are retained for the next stage's formal scale test. In this study, the population targets the object of study—Tunghai University students, and carries out the test on the respondents based on proportion of each college's students for the purpose of widening the sample's coverage and representativeness. In the study design, that how large the number of test objects is good enough to be a representative has not reached a consensus concluded by the social science research field. Recommendations made by the Roscoe [42] indicate that, in the multivariate study, it is better that the sample size has more than 10 times the number of variables. Ghiselli, Campbell and Zedeck [43] point out that the sample size must be able to provide sufficient statistical variance of a variable item while maintaining a normal distribution hypothesis without being contravened; it is suggested that minimum number of samples involves the scale used, the minimum number of samples should be 10 times the number of questions. Referring to the above scholars' suggestion and the number of questionnaires questions herein, this study has set the actual effective sample number at 650 people.

Returned effective questionnaires by the Institute totaled 598 with a total effective rate 92%. In respect of gender, the male samples accounted for 44.6%, female samples accounted for 55.4%; regarding colleges, Arts, Science, Engineering, Management, Social Sciences, Agriculture, Design, Law and International College respectively accounted for 10.7%, 10%, 18.1%, 19.2%, 13.9%, 7.9%, 7.4%, 10.9% and 2%; first-year students accounted for 20.7%, sophomore 18.4%, junior 31.4%, senior accounted for 25.4 percent and students of Institute 4.0%; in addition, as for the green consumer products experience, junior and senior students accounted for the majority with a rate of 28.9% and 21.1% respectively.

The inherent quality of the overall mode is measured through the index of fit of internal structure of model, which contains the estimated parameters reaching a significant level (p-value), individual item (measured variable) reliability i.e. the square of standardized factor loadings (SMC) is higher than 0.5, composite reliability of hidden constructs is more than 0.6/0.7, and the average variance extracted (AVE) of hidden construct is higher than 0.5, the absolute value of standardized residuals is less than 2.5/4.0, excluding unsuitable items after the above-mentioned measurement index analysis. The results show that standardized factor loadings of theoretical model neither less than 0.50 nor more than 0.95 and reach a significant level, and not found to have a negative value, plus the CR is greater than 0.7 indicating a reliability. Overall, therefore, the measure of each construct amounted to an acceptable level, and all the average variance

extracted (AVE) is more than 0.5, it means the internal consistency of index is all acceptable.

In order to understand the relationship between research variables, the relevant analysis adopts (Pearson) correlation matrix to measure degree of correlation between constructs. The results showed that the degree of correlation between most variables presented a moderate correlation between 0.4 and 0.7 in which the associated degrees of satisfaction and service quality, consumer intention and attitudes were higher, which were 0.653*** and 0.621***, that is, the higher the quality of service is, the higher the satisfaction will be; the higher the green consumption attitude is, the higher the green consumption intention will be. The correlation reached the low degree of correlation between variables in other studies which ranged from 0.350*** to 0.375***.

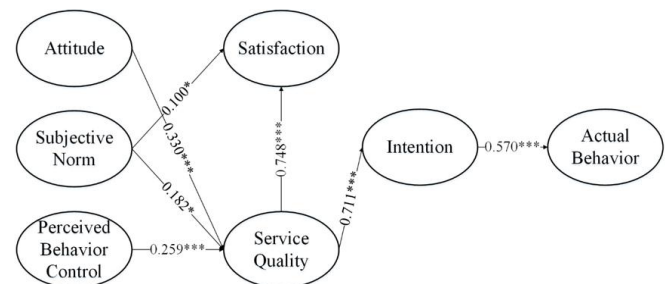


Fig. 2. The results of research paths.

TABLE I: THE RESULTS OF HYPOTHETICAL PATHS

Hypothetical path	Expected effect	Results
H ₁ : Green consumption consciousness → Green service quality	positive	Support
H ₂ : Green consumption consciousness → Green satisfaction	positive	Partial support
H ₃ : Green service quality → Green satisfaction	positive	Support
H ₄ : Green service quality → Green behavioral intention	positive	Support
H ₅ : Green satisfaction → Green behavioral intention	positive	Not support
H ₆ : Green behavioral intention → Actual green behavior	positive	support

Confirmatory factor analysis is referring to using balancing mode to carry out goodness of fit test in order to test whether each facet has sufficient convergent validity and discriminant validity. The indicator judgment criteria adopted by this study are shown as follows: GFI and AGFI between 0.80 and 0.89 is considered reasonable, 0.90 or higher is considered to be an evidence of ideal fitting [44], [45]. In addition, Hair, Anderson, Tatham and Black [46] pointed out that the problem caused by too strong power of test in the large sample χ^2 test had been existing, and therefore recommended the shift to the chi-square / degrees of freedom (χ^2/df) way as an indicator for measuring, in general, χ^2/df less than 5 is acceptable; and Bentler [47] and Byrne [44] advised that Comparative Fit Index (CFI) may be used as a measure. It has a good fit as long as CFI is above 0.9.

With respect to assessment of the mode of goodness of fit, this study assesses in three aspects based on Bagozzi and Yi's [48] view, which respectively are the basic goodness-of-fit indices, fit of internal structure of model and overall model fit indices. They are described as follows:

Absolute fit measure: used to confirm the degree of covariance or correlation matrix predicted by overall model. The measure contains a chi-square value (χ^2), ratio of chi square to its degrees of freedom (χ^2/df), goodness-of-fit indices (GFI), adjusted goodness of fit indices (AGFI), root mean square residual (RMR) and root mean square error of approximation (RMSEA) etc. In this study, the absolute fit measure of overall theoretical model: $\chi^2 = 3072.967$, $df = 1103$, $\chi^2/df = 2.7860$, GFI = 0.903, AGFI = 0.886, RMR = 0.021, RMSEA = 0.043, except that AGFI slightly lower than the standard value 0.9 and higher than 0.8 is still acceptable, the other indices have met standard.

Incremental fit measures: used to compare the developed theoretical models with nothingness mode. The measure contains normed fit index (NFI) and comparative fit index (CFI). In this study, the incremental fit measures of overall theoretical model: NFI = 0.927, CFI = 0.961, both of them are within the acceptable range.

Parsimonious fit measures: used to adjust fitness measures so as to compare different number of coefficient of estimation to determine the extent of each of the estimated coefficients can acquire. In this study, the parsimonious fit measures of overall theoretical model: PNFI = 0.836 and PGFI = 0.768 have reached the acceptable range (> 0.500). Overall, judging based on the comprehensive indicators, the overall model fit herein is acceptable.

Research framework of this study includes "green-consumption attitude", "green-consumption subjective norms", "green-consumption perceived behavioral control", "green-consumption service quality", "green consumption-satisfaction", "green-consumption behavioral intentions" and "green-consumption actual behavior" and their path analysis results of structure model (Fig. 2).

Conclusively, green-consumption attitude, subjective norm and perceived behavioral control have a positive impact on green-consumption service quality, such phenomenon shows that the higher the degree of attitude, subjective norms and perceived behavioral control are, the better the service quality will be. That green-consumption subjective norm has a positive impact on satisfaction means the higher the degree of subjective norm is, the higher the satisfaction will be. That service quality has a positive impact on satisfaction indicates the higher the quality of service is, the higher the behavioral intentions will be. That behavioral intentions have a positive impact on actual behavior presents that the higher the behavioral intentions are, the higher the actual behavior will be. The path coefficient and hypothesis verification of theoretical structure model are shown in Table I.

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