

Partial Least Squares Structural Equation Modeling (PLS-SEM): An application in Customer Satisfaction Research

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Abstract

The importance of business newspaper reading for education is increasing by year-by-year at education level and particularity for University. This study used a quantitative approach seeking a causative explanation of the BNIE (Business Newspaper in Education) learning. After a literature review on the mentioned topics, research model was developed. Our study framework was based on the SERVQUAL Model and TAM (Technology Acceptance Model). A survey of 120 participants (students) was conducted to collect the research data. The valid 100 data were analyzed using PLS-SEM (Partial Least Squares Structural Equation Modeling). Results show the usefulness of BNIE (Business Newspaper in Education) factor is significantly impact on customer satisfaction. And Customer satisfaction is significantly impact on Intention to business newspaper. Some implication and conclusions are included.

Keywords: *BNIE (Business Newspaper in Education) learning, SERVQUAL Model, TAM (Technology Acceptance Model), PLS-SEM (Partial Least Squares Structural Equation Modeling), Customer satisfaction*

1. Introduction

Reading is vital and the backbone for university education. Reading a business newspaper is a good habit that can provide a great sense of educational value. It carries information about politics, economy, entertainment, sports, business, industry, trade and commerce. With this habit, it will not only enhance your knowledge about general information but it will likewise improve general knowledge and business insight. Business newspaper creates reading habits and easily differentiates people who read and who do not. Reading is the art of learning something. Newspaper is the store house of knowledge and provides knowledge of different tests and kinds of different segments of the society. It is equally important for the entire people from student to government officials. Reading builds vocabulary skills and background knowledge that strengthens reading skills and increases the enjoyment of reading (Strommen & Mates, 2004)

Many university students in Korea have habits of reading news newspapers that their days seem incomplete without taking hold of early business newspapers. But parts of university student have not good habit of business newspaper.

This paper has three objectives. The first is developing the research model based on literature review related to education and newspaper. The second is written to address PLS-SEM (Partial Least Square Structural Equation Modeling) and help SEM learners to understand how PLS-SEM can be used in research area. The third is that useful implications and conclusions are offered to related education area.

2. Literature Review

2.1. SERVQUAL

Service “with a kindness” used to be enough to satisfy most students. These days, university education is very complicated. University social responsibility (USR) is offering great service quality in war for talent era. Service quality in education is a complex topic, as shown by need for a definition that includes five dimensions: reliability, responsiveness, assurance, empathy, and tangibles (Fitzsimmons, Fitzsimmons, 2011).

Customers identified five principal dimensions that customers use to judge service quality.

Reliability: The ability to perform the promised service both dependably and accurately. Reliable service is a customer expectation and means that the service is accomplished on time, in the same manner, and without errors every time. For example, delivering business newspaper at approximately the same time each day is important to most students. Reliability also extends into university back office, where accuracy in offering service and record keeping is expected.

Assurance: The knowledge and courtesy of professor as well as their ability to convey trust and confidence. The assurance dimension includes the following features: competence to perform the service, politeness and respect for student, effective communication with the student, and the general attitude that the server has the customer’s best interest at heart.

Tangibles: The appearance of physical facilities, equipment, personnel, and communication materials. The condition of the physical surroundings (*e. g.*, hands on learning) is tangible evidence of the care and attention to detail that are exhibited by the professor. This assessment dimension also can extend to the conduct of the other students in the service (*e.g.*, a noisy student in class).

Empathy: The provision of caring, individualized attention to students. Empathy includes the following features: approachability, sensitivity, and effort to understand the student’s needs. One example of empathy is the ability of professor to find solution of student problem.

Responsiveness: The willingness to help students and to provide prompt service. Keeping students waiting, particularly for no apparent reason, creates unnecessary perceptions of quality. If a service failure occurs, the ability to recover quickly and with professionalism can create very positive perceptions of quality. For example, serving elaborate knowledge and wisdom in class can turn a potentially poor student experience into one that is remembered favorably.

2.2. TAM

The TAM (Technology Acceptance Model) is widely known and it has received strong theoretical and empirical support in the literature, being cited more 700 times (Davis, 2007). TAM is an adaptation of the Theory of Reasoned Action. TRA (Theory of Reasoned Action) is a widely studied model from social psychology which is concerned with the determinants of consciously intended behavior (more general theory).

According to TRA, a person’s performance of a specific behavior is determined by his/her behavioral intention (BI) to perform the behavior and BI is jointly determined by the person’s attitude (A) and subjective norm (SN) concerning the behavior in question. Introduced by Fred Davis (1986) – an adaptation of TRA and specifically tailored for modeling user acceptance of information systems. TAM is based on two main assumptions: Perceived usefulness (PU), Perceived ease of use (PEOU). TAM attempts not only for prediction but also for explanation to help researchers and practitioners identify why a particular system may be unacceptable and pursue appropriate steps. Purpose of TAM is to assess the user acceptance of emerging information technology.

TAM is more specific and applies only to the use of computers (usage behavior). TAM addresses the human-computer interface (HCI).

An important factor in TAM is to trace the impact of external factors on internal beliefs, attitudes and intentions. Two particular beliefs are addressed through TAM. The first is Perceived usefulness (PU). Prospective user's subjective probability is that a specific application system will increase his or her job performance within an organizational context. The second is that a perceived ease of use (PEOU) that Degree to which the prospective user expects the target system to be free of effort. TAM presents a comprehensive nomological network of the determinants of individuals' IT adoption and use, as shown in Figure 1.

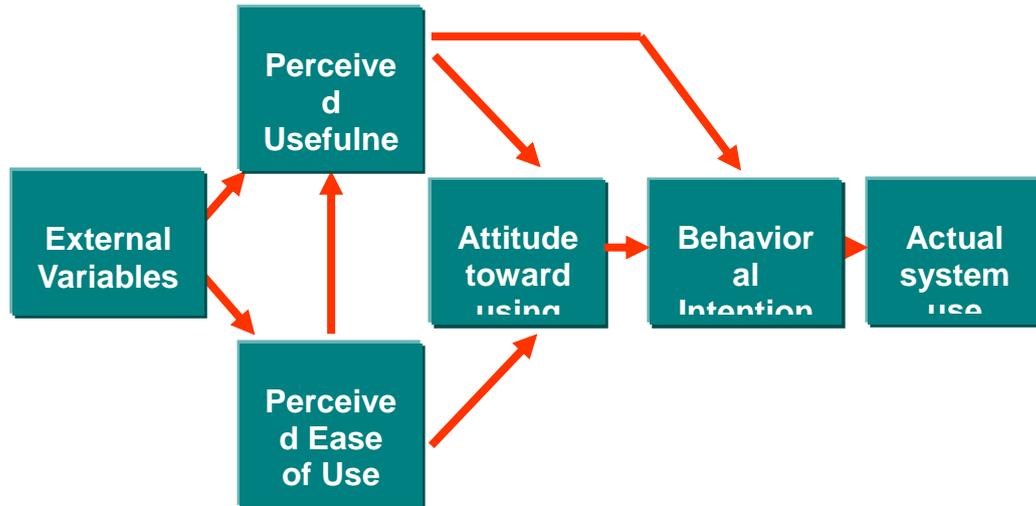


Figure 1. TAM (Technology Acceptance Model)

TAM is used in various research fields (Business field and education field). Moreover, TAM is a basic framework to study learning and learning method application. TAM is a theoretical framework now considered as appropriately by some authors to predict student satisfaction in blended learning context, since it has been shown that the TAM variables significantly influence student satisfaction in education environments (Tselios *et. al.*, 2011).

2.3. PLS-SEM

Structural Equation Modeling (SEM) is a second-generation multivariate data analysis method that is often used in business research because it can test theoretically supported linear and additive causal model (Statsoft, 2013). SEM can be used in tackling research problem to treat unobservable, hard-to-measure latent variable (Wong, 2013).

There are two approaches to SEM: The first approach is the widely applied covariance-based SEM (CB-SEM). CB-SEM has been widely applied in the field of social science during the past several decades, and is still the preferred data analysis method today for confirming or rejecting theories through testing of hypothesis, particularly when the sample size is large, the data is normally distributed, and most importantly, the model is correctly specified. That is, the appropriate variables are chosen and linked together in the process of converting a theory into a structural equation model (Hair *et. al.*, 2011). PLS handle all types of data, from nonmetric to metric, with very minimal assumptions about the characteristics of the data (Hair *et. al.*, 2010). Also it handles both reflective and formative constructs and all recursive models are identified. However, many industry practitioners and researchers note that, in reality, it is often difficult to find a data set that meets these requirements. Furthermore, the research objective may be exploratory, in

which we know little about the relationships that exist among the variables. In this case, researchers can consider PLS. The second approach is Partial Least Squares (PLS), which focuses on the analysis of variance and can be carried out using PLS-Graph, VisualPLS, SmartPLS, and WarpPLS. PLS is a soft modeling approach to SEM with no assumptions about data distribution. Thus, PLS-SEM becomes a good alternative to CB-SEM when the following situations are encountered (Wong, 2010):

- Sample size is small.
- Applications have little available theory.
- Predictive accuracy is paramount.
- Correct model specification cannot be ensured.
- Definition of Normal Distribution is free.

It is important to note that PLS-SEM is not appropriate for all kinds of statistical analysis. Researchers also need to be aware of some weaknesses of PLS-SEM, including:

- High-valued structural path coefficients are needed if the sample size is small.
- Problem of multicollinearity if not handled well.
- Since arrows are always single headed, it cannot model undirected correlation.
- A potential lack of complete consistency in scores on latent variables may result in biased component estimation, loadings and path coefficients.
- It may create large mean square errors in the estimation of path coefficient loading.

In spite of these limitations, PLS is useful for structural equation modeling including formative indicators in applied research projects especially when there are limited participants and that the data distribution is skewed, *e.g.*, surveying female senior executive or multinational CEOs (Wong, 2011). PLS-SEM has been deployed in many fields, such as behavioral sciences, marketing, organization, management information system, and business strategy.

3. Research Model and Research Hypothesis

Based on the presented literature review, a research model was proposed. In this research model was collaborated by SERQUAL (Fitzsimmons, Fitzsimmons, 2011), and TAM (Davis (1986). Outer factors are usefulness, Importance, Convenience, and Interest. Inner factors are customer satisfaction and intention to business newspaper. This research model is in line with similar researches conducted for the education field (see. Figure. 2).

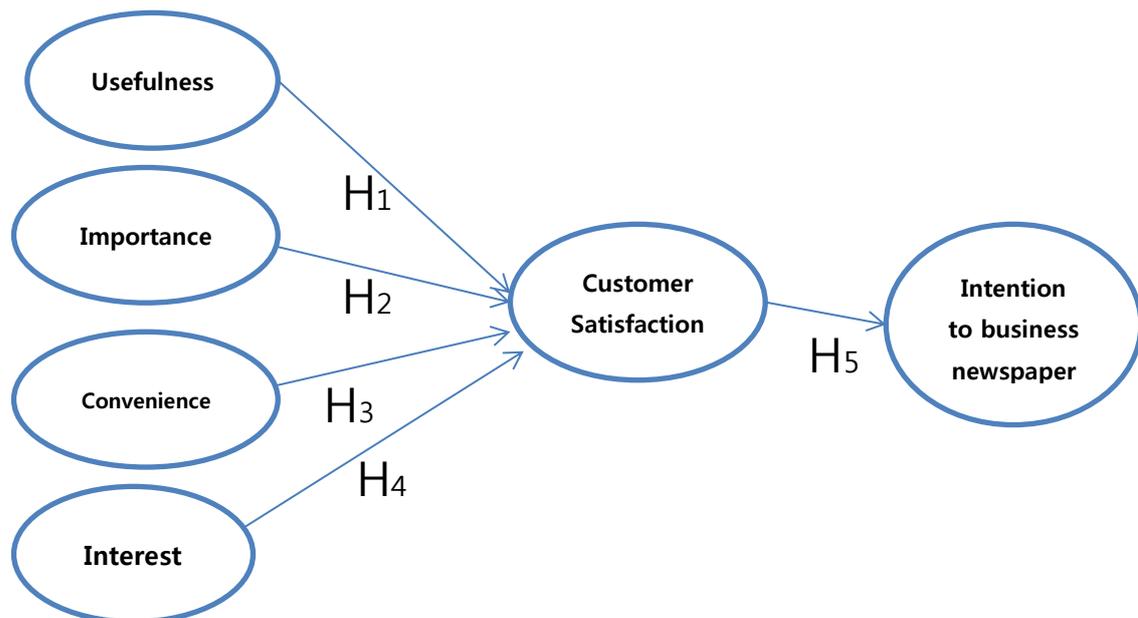


Figure 2. Research Model

Consequently, research hypothesis regard the acceptance and intention to business newspaper reading. Business newspaper reading, what once seemed like a boring thing to do will turn into student that is enjoyable and helps you pass time. The habit of soaking in general knowledge will keep you busy going through news websites, newspapers, magazines or just about anything in sight that is food for a brain. There are few things in life that can be habit forming, harmless, fun and useful at the same time. In view of that, research hypotheses are as follows:

- H1: Perceived usefulness will have a positive effect on customer satisfaction.
- H2: Perceived importance will have a positive effect on customer satisfaction.
- H3: Perceived convenience will have a positive effect on customer satisfaction.
- H4: Perceived interest will have a positive effect on customer satisfaction.
- H5: Perceived interest will have a positive effect on customer satisfaction.

4. Methodology

This research is part of a business newspaper in education project that aimed to increase business newspaper. Many business management professors in Korea used business newspaper as an auxiliary textbook. To test our hypotheses data were collected from students who used business newspaper in class through a google drive (n=120). But there were missing data (n=20). Missing data were removed by list-wise method. Valid sample were 100.

To test the research model, this study draws on SmartPLS 3.0, applying the path weighting scheme. We adopted two step approaches (Anderson & Gerbing, 1988). The first step is a confirmatory factor analysis. In this step research researcher can confirm reliability and validity. The second step is to analyze the structural equation model in order to assess the research hypotheses.

4.1. Indicator Reliability and Validity

It is essential the reliability and validity of the latent variables to complete the examination of the structural model. The following tables shows the various reliability and validity items that we check and report when conducting a PLS-SEM (see Table 1).

Table 1 Results Summary for Reflective Outer Model

Latent variables	Indicators	Loading	Composite Reliability	AVE
Usefulness	x1	0.902	0.949	0.756
	x2	0.835		
	x3	0.855		
	x4	0.880		
	x5	0.879		
	x6	0.865		
Importance	x7	0.793	0.902	0.697
	x8	0.871		
	x9	0.880		
	x10	0.791		
Convenience	x11	0.921	0.95	0.827
	x12	0.941		
	x13	0.871		
	x14	0.903		
Interest	x15	0.882	0.966	0.849
	x16	0.944		
	x17	0.944		

	x18	0.890		
	x19	0.945		
Customer Satisfaction	x20	0.844	0.917	0.733
	x21	0.817		
	x22	0.880		
	x23	0.883		
Intention to business newspaper reading	x24	0.824	0.939	0.794
	x25	0.917		
	x26	0.929		
	x27	0.891		

The first one to check is “Composite Reliability”. It can be seen that all of indicators values are shown to be larger than 0.6, so high level of internal consistency reliability have been demonstrated among latent variables. To check convergent validity, each latent variable’s AVE (Average Variance Extracted) is evaluated. It is found that all of AVE values are greater than the acceptable threshold of 0.5, so convergent validity is confirmed.

To confirm the discriminant validity we followed Fornell and Laker (1981) method. Fornell and Larcker (1981) suggest that the square root of AVE in each latent variable can be used to establish discriminant validity, if this value is larger than other correlation values among the latent variables. To do this, a table is created in which the square root of AVE is manually calculated and written in bold on the diagonal of the table. The correlations between the latent variables are copied from the “Latent Variable Correlation” section of the default report and are placed in the lower left triangle of the table (see Table 2).

Table 2. Fornell-Lacker Criterion Analysis for Discriminant Validity

	#1	#2	#3	#4	#5	#6
#1 Usefulness	0.869					
#2 Importance	0.925	0.835				
#3 Convenience	0.880	0.848	0.909			
#4 Interest	0.834	0.786	0.874	0.922		
#5 Customer satisfaction	0.842	0.819	0.804	0.809	0.856	
#6 Intention to business newspaper reading	0.921	0.868	0.848	0.842	0.925	0.891

The latent variable usefulness’s and Intention to business newspaper reading AVE are found to smaller than the correlation values in the column. Similar observation is also made for the latent variables in matrix. The result indicates that partial discriminant validity is well established.

4.2. Structural Equation Modeling Result

PLS program can generate *T*-statistics for significance testing of both the inner and outer model, using a procedure called bootstrapping. In this procedure, a large number of subsamples (*e.g.*, 5000) are taken from the original sample with replacement to give bootstrap standard errors, which in turn gives approximate *T*-values for significance testing of the structural path. The Bootstrap result approximates the normality of data. After the bootstrapping procedure is completed, Results can get as the following.

Table 3. Result of PLS-SEM

Paths	Original Sample (O)	Sample Mean(M)	Standard Error (STERR)	T Statistics (O/STERR)	P-value
H1: Usefulness->Customer Satisfaction	0.685	0.69	0.213	3.208	0.001
H2: Importance->Customer Satisfaction	0.114	0.119	0.148	0.767	0.443
H3: Convenience->Customer Satisfaction	-0.002	0.011	0.157	0.014	0.989
H4: Interest ->Customer Satisfaction	0.143	0.122	0.171	0.839	0.402
H5: Customer Satisfaction->Intention to business newspaper reading	0.884	0.889	0.024	36.888	0.000

After reviewing the path coefficient for the inner model, we can explore the outer model by checking the *T*-statistic in the “Outer Loadings (Means, STDEV, *T*-Values)” window. As presented in table 3, two of the *T*-Statistics are larger than 1.96 so we can say that the outer model loadings are highly significant. So H1 and H5 are adopted. All of these results complete a basic analysis of PLS-SEM in our research. PLS-SEM result is shown in Figure 3.

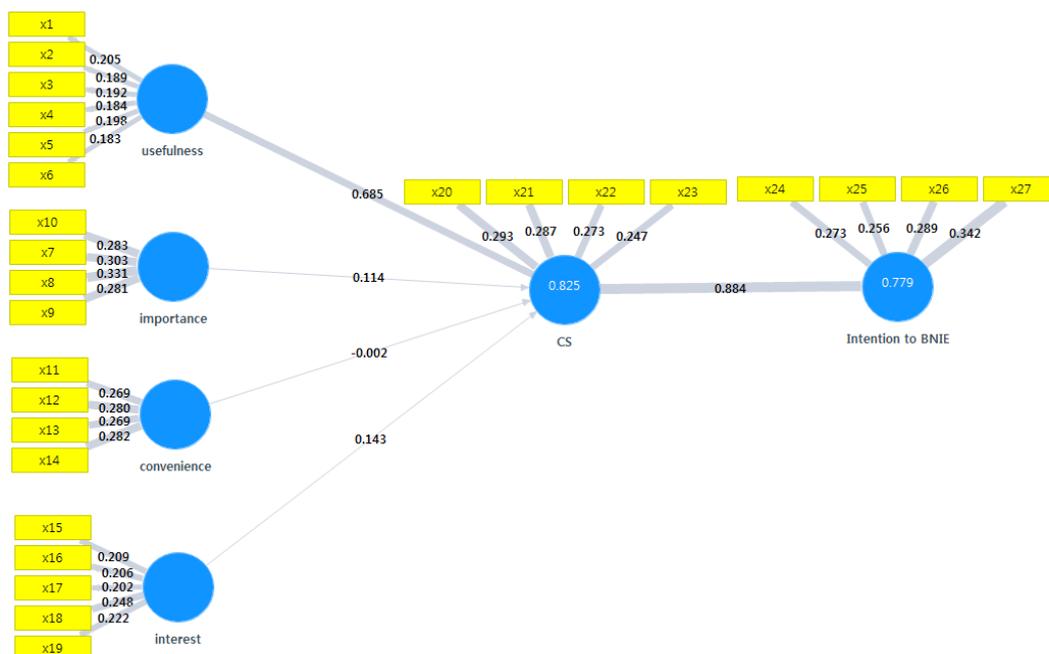


Figure 3. Path Model and PLS-SEM Estimate

5. Conclusion and Implication

The purpose of this example is to demonstrate how a restaurant manager can improve his/her business by understanding the relationships among Usefulness, customer satisfaction (SAT) and Intention to business newspaper reading. Through a survey of the BNIE student and the subsequent structural equation modeling research model was confirmed. Like this result, professor sustainably stresses the reading business newspaper in education. Reading is a starting point of knowing and creativity. In fact, Reading is not urgent thing but important thing. To foster T-talent, Professor needs to consider using business newspaper in class.

This paper has discussed the use of a second-generation multivariate data analysis method called Partial Least Square Structural Equation Modeling (PLS-SEM) for Business research, with a focus on Partial Least Squares (PLS) which is an emerging path modeling approach. PLS-SEM is capable of handling data inadequacies such as non-normal data and accommodates formatively measured constructs, the latter of which have recently gained increasing prominence. In this research, Researcher confirmed that PLS-SEM is fit for the analysis. In this case circumstances are limitation, applications have little available theory Predictive and accuracy is paramount.

A simulated restaurant example is presented using the SmartPLS software to help research master the basics of PLS-SEM quickly in a step-by-step manner.

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