



Impact of quality antecedents on taxpayer satisfaction with online tax-filing systems—An empirical study

Ching-Wen Chen *

National Kaohsiung First University of Science and Technology, 2, Juoyue Rd., Kaohsiung 811, Taiwan, ROC

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ABSTRACT

This paper discusses taxpayer satisfaction with an online system for filing individual income tax returns. Online tax-filing system quality encompasses information, system, and service qualities, which are the antecedents of user satisfaction with any system. To measure online tax-filing system quality, a second-order measurement model was tested using higher-order confirmatory factor analysis. Hierarchical factor analysis supported the measurement model of IS quality in the research setting. Path analysis using structural equation modeling confirmed that the quality antecedents strongly influenced taxpayer satisfaction with the online tax-filing system. Furthermore, the factors of information and system quality were more important than service quality in measuring taxpayer satisfaction, demonstrating the importance to taxpayers of system outputs and processing ability. Based on the findings, implications for online tax-filing systems are discussed. Finally, limitations are presented.

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1. Introduction

With the emergence of information and communication technologies (ICTs) there has been intensified competition and stimulated growth of most organizational functions and processes. Many organizations and governmental agencies are exploring the potential of using ICTs for service delivery. Today, e-government uses ICTs to promote citizen participation, publish information, provide services, and administer governmental systems. Government-to-citizen (G2C), government-to-business (G2B), and government-to-government (G2G) applications are becoming commonplace.

Taiwan has recently promoted several types of e-applications in its government agencies to provide their citizens direct access to service supporting systems (online services), for tax-filing, electronic motor vehicle and driver applications, public safety, health care, and electronic utilities. However, since Taiwan is expending considerable effort to provide enhanced services to citizens, it is critical that it knows whether the e-applications are meeting the citizen's needs. Specifically, we believed that user satisfaction with online service systems should be a key concern of government agencies or administration authorities, since these systems are intended to improve social services. We therefore studied taxpayer satisfaction with an online tax-filing system.

1.1. Electronic individual income tax-filing system in Taiwan

The National Tax Administration (NTA), the Taiwan government tax agency, is responsible for collecting both individual and corporate taxes, and offers individuals three main methods for filing their current personal income tax: manual, Internet, and two-dimensional (2D) bar-code.

Manual filing is the traditional method. During the May filing season, citizen taxpayers complete a standard government printed form by hand, and deliver it to the tax agency either personally or by mail. The tax agency then enters the tax return data into its computers either manually or via image processing. Data entry is tedious and it can take several weeks or months to complete the task accurately and correctly [9]. Citizens have become used to manually completing tax returns.

NTA initiated *two-dimensional bar-code filing*, similar to the 1040PC filing provided by the IRS of the U.S., simultaneously with *Internet filing*. A bar-code is simply a series of stripes (usually black) on a light background that can be scanned and read directly by a computer. Bar-codes are interpreted virtually instantaneously and without errors by a bar-code reading system. Two-dimensional (2D) symbols encode data by both their height and width, and thus a single symbol can store significantly more data than a one-dimensional symbol. For example, a symbol having a size of a large postage stamp can potentially store thousands of alphanumeric characters. The taxpayer can use tax software to enter the relevant data, and then simply use the program to perform the required calculations. Upon task completion, a two- to three-page paper tax return and the 2D bar-code symbol can be printed using any ink jet

* Tel.: +886 7 6011000x4111; fax: +886 7 6011042.

E-mail address: chingwen@ccms.nkfust.edu.tw.

Table 1
The number of personal income taxpayers of tax-filing methods.

| Fiscal year | 2004 | 2005 | 2006 | 2007 | 2008 |
|----------------------------------|------------------|------------------|------------------|------------------|------------------|
| Internet filing | 1,021,629 21% | 1,713,441 35% | 2,230,074 45% | 2,456,424 47% | 2,689,042 55% |
| Manual and 2D Bar-code filing | 3,854,782 79% | 3,239,829 65% | 2,691,884 55% | 2,743,457 53% | 2,228,593 45% |
| Total number | 4,876,411 | 4,953,270 | 4,921,958 | 5,199,881 | 4,917,635 |
| Total (%) | 100% | 100% | 100% | 100% | 100% |

or laser printer and mailed to the tax office. During filing, the 2D bar-code system works like a paper disk or paper electronic data interchange to store and transmit data. Additionally, a bar-code scanner transmits the 2D bar-code into the agency system, following the arrival of the tax return at the tax authority. This system offers clear benefits, since the scanning process is error-free and the data is captured quickly. Furthermore, most direct entry and indirect costs – to both taxpayers and the government – are eliminated. Furthermore, since some taxpayers have not obtained a government issued public key certificate, the system provides an alternative to filing electronically [7].

However, even though 2D bar-code is an electronic tax-filing method, it still requires taxpayers to print the tax return and deliver it to the tax agency. Since the government has invested considerable resources in building e-government infrastructure, including creating the Government Service Network (GSN) as the backbone network for e-government, we focused on the Internet tax-filing system, which can save resources by enabling paperless tax-filing.

With the rapid development and wide application of Internet and wireless telecommunications technology, as well as the initiation of a backbone network in 1997, Taiwan began using its online taxation system in 1998. As many as 2,690,000 taxpayers filed online in 2008, representing 54.7% of all filings. Table 1 shows that the number of individual income tax returns filed online increased from 1.02 million (21% of all taxpayers) in 2004 to over 2.68 million (55%) in 2008.

The Internet filing tax system helps tax agencies save money on printing and distribution, accelerate processing, and increase tax collection accuracy. Additionally, the system offers faster refunds on overpayments.

2. Literature review

2.1. User satisfaction with information systems

The measurement of information system success has been a focus of research interest since the mid-1960s. Studies examining methods of measuring information system success date back to the early 1970s and focused on the search for identifiable and easily measured surrogate parameters and constructs [21].

Based on an extensive review of publications on IS effectiveness, many researchers concluded that the development of a single convergent measure of IS was unlikely. However, a model of IS success was introduced; it incorporated six aspects: system quality, information quality, use, user satisfaction, individual impact, and organizational impact [5]. Information quality and system quality, representing semantic and technical levels, respectively, were postulated as the two key antecedents of user satisfaction. *Information quality* is typically assessed by measuring information attributes, while *ease of use* is assumed to represent *system quality* [6,18].

DeLone and McLean re-examined their model using 144 relevant data sets and added service quality to their original model. DeLone and McLean also recognized that measures of IS success should include service quality as an additional antecedent

to user satisfaction. Consequently, their newer model is shown as Fig. 1. This adopted information quality, system quality, and service qualities as the main antecedents of user satisfaction, a measure of recipient response to the use of the output of an information system. Furthermore, the revised model adopted information quality as the measure of information system output. The measure of the information processing system itself was termed *system quality*. Finally, *service quality* was used to measure the quality recognition of special services on the IS.

The updated model, provided a useful starting point for assessing the benefits of IS, since it was considered accurate in measuring IS success. Additionally, because of their inherent face validity and the availability of reliable measurement instruments, such as satisfaction questionnaires, measures of user satisfaction became the most widely utilized indicators of system success. Our study thus examines and measures user satisfaction with online tax-filing system using the same factors.

2.2. Quality antecedents

Information quality depends on user perceptions of the value of the IS output. Thus, most of its measures are perceptual, including accuracy, precision, currency, output timeliness, reliability, completeness, conciseness, format, relevance, understandability [10]; report usefulness, etc.

Livari [11] and DeLone and McLean [3] characterized system quality as the degree to which an information system possesses desired characteristics, and measured it using four scales: convenience of access, system flexibility, system integration, and response time. Since system quality measures the information processing system itself, the background characteristics of the system under study need to be outlined before developing measuring instruments.

Service quality is an elusive and abstract construct. In marketing research, SERVQUAL was developed to assess general service quality. Since IS includes a significant service component, SERVQUAL, consisting of five dimensions (tangibles, reliability, responsiveness, assurance, and empathy), was found to be applicable to IS.

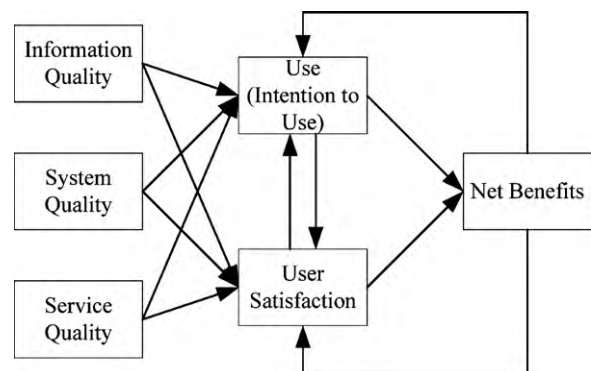


Fig. 1. Revised IS success model of DeLone and McLean.

3. Research model

Before studying taxpayer satisfaction with the Taiwanese online tax-filing system, the system attributes must be outlined.

3.1. Background considerations

e-Government involves using IT to improve the delivery of government services. Government-to-citizen (G2C) operations include, such as online tax-filing, Internet licensing, and web-based vehicle registration. Taiwanese taxpayers use the online tax-filing system only once a year, for 1–3 h, depending on taxpayer skill in operating the system. Thus the number of usages is irrelevant in assessing taxpayer satisfaction with the system. Therefore the intent was to ensure high user satisfaction with the process rather than encourage its use. Also the tax-filing system is provided by the requisite government agency, and thus citizens assume the operations and system security are guaranteed; thus leaks of personal information are not a consideration, and the issue of system reliability is not a critical issue.

3.2. Measurements of taxpayer satisfaction

Based on a review of the literature on IS effectiveness, measures of user satisfaction, which are considered particularly useful in the case of online tax-filing, were assessed using the constructs of information quality, system quality, and service quality.

3.2.1. Information quality

We adopted our measures of information quality from the literature and recommendations from senior system analysts of NTA. We assumed information quality involved three factors: accuracy, timeliness, and completeness [15]. Tax agencies are interested in maximizing tax revenue, and thus wish to ensure no taxable income is overlooked, while taxpayers typically wish to ensure no deductible expenditures are missed so as to minimize tax paid. Therefore, information completeness contributes to information quality in determining taxpayer satisfaction with the IS.

Since online tax-filing systems are designed to increase the efficiency of filing tax returns, information unrelated to taxable income and deductible expenditures is irrelevant in measuring information quality. Thus, the factors of relevance and reliability are excluded from our analysis, because normally citizens do not suspect information provided by government.

3.2.2. System quality

System quality is a measure of the information processing system itself. Similar to information quality, system quality depends on three factors: accessibility, interactivity, and ease of use. Accessibility refers to access speed and system availability, which are adopted as a measure of system quality. Interactivity is another important aspect of system quality. When using the Web-based taxation system for tax-filing, taxpayers must interact with the proxy of the tax agency – the website – for all communication. The Internet is interactive and dynamic, and users can manipulate specific event outcomes by filling out a form, requesting a particular Web page, or completing an online survey. Ultimately, the Internet supports direct and continual response to user requests. Interactivity positively affects online system quality by providing two-way communication and is associated with website success [1,16].

Tax agencies hope that taxpayers will be able to operate the Web-based taxation system with minimal difficulty. The literature contains many studies that show that *ease of use* is important. We therefore concluded that it is justified and appropriate to adopt ease of use as a measure of system quality.

3.2.3. Service quality

Service quality is a multi-dimensional construct that has often been measured by using the SERVQUAL instrument, developed by marketing researchers as a measure of IS service quality. SERVQUAL measures the service dimensions of tangibles, reliability, responsiveness, assurance, and empathy. Considering the dimensions of service quality identified by SERVQUAL, assurance is guaranteed since the tax-filing system is government-owned. Consequently, we excluded the sub-dimension of assurance [12]. Additionally, most taxpayers use their personal computers to file their income tax returns either at home or at the office. Therefore, our framework for service quality only included reliability, responsiveness, and empathy.

Reliability denotes the ability to perform promised services dependably and accurately. For example, both central and local tax service centers provide online help (i.e. on-site, telephone, and Internet) during regular office hours. Such help services must be operated as promised without interruption. Responsiveness denotes willingness to help taxpayers and provide prompt service. Empathy requires individualized attention given to taxpayers and the willingness of personnel to help taxpayers and resolve their problems constructively.

3.2.4. Measures of user satisfaction

Appendix A presents the constructs and corresponding measurement items for our study. All items were obtained from previously validated instruments.

Prior to conducting confirmatory factor analysis (CFA) and structural model analysis, we conducted a pilot study with factor analysis to identify the sub-dimensions of quality antecedents. Because completeness and timeliness were loaded together, we further combined items from each construct and tested them together as a single construct. Fig. 2 shows the research model.

Our hypotheses were:

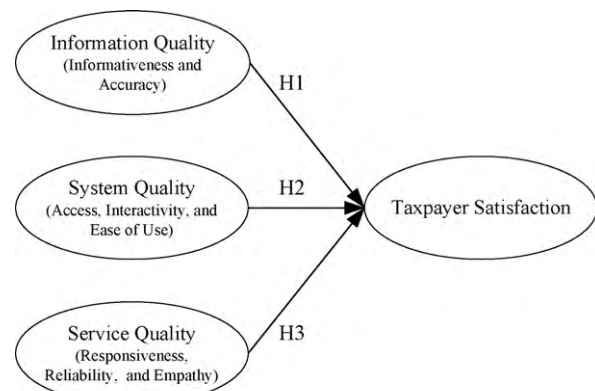
H1: Information quality is positively associated with taxpayer satisfaction when using the online taxation system.

H2: System quality is positively associated with taxpayer satisfaction when using the online taxation system.

H3: Service quality is positively associated with taxpayer satisfaction when using the online taxation system.

3.3. Model and constructs for measuring user satisfaction

In Taiwan, income tax returns can be filed under one of several filing statuses: single, married and filing jointly, married and filing



Note: Because completeness and timeliness loaded together, we combined items from each construct and tested it as one construct (informativeness).

Fig. 2. The impact of quality dimensions on of taxpayers satisfaction with online tax-filing system.

separately, and head of household. Individual taxpayers are not obliged to file income taxes personally provided someone authorized to do so files on their behalf; e.g., members of a single household can choose to file their income taxes together. In this case, the head of the household files the income tax return on behalf of the entire household. These different tax-filing statuses make it difficult to assess the tax-paying population. Additionally, income tax returns are confidential, and thus cannot be accessed directly by outsiders except with special permission from the tax authority. Consequently, no appropriate sampling frame for random samples can be obtained without assistance from the tax agency. To obtain a large random sample with high response rate, we sampled the alumni of one middle-high school and one university. The total number of alumni exceeded 20,000, and sample members were scattered throughout the country. However, the sampling frame only included alumni with local mailing addresses, obtained from the alumni foundation. Data was collected over 4 weeks during the May income tax-filing season, and a total of 324 completed questionnaires were obtained, of these, 278 questionnaires were considered valid (after excluding those with missing values or inconsistent responses).

The initial draft of the questionnaire contained nine items dealing with information quality, 11 for system quality, and 12 for service quality. However, one information quality item, two system quality items and four service items were eliminated because after using CFA that revealed insignificant loading coefficients of the eliminated items. Senior MIS staff of the NTA helped review the questionnaire, after which it was translated into Chinese. Measures of information quality were adapted from the rather old work of Bailey and Pearson [2], Doll and Torkzadeh, and Rai et al. Moreover, items measuring system quality were adapted from Bailey and Pearson [2], Doll and Torkzadeh, and Rogers et al. [19]. Additionally, items assessing service quality, which is a multidimensional construct, was adapted from Bailey and Pearson, Pitt et al. [17], and Rodgers et al. To derive valid measures of user

satisfaction with IS, items assessing user satisfaction were adapted from Magal and Strouble [13], Bhattacharjee [4], and Livari. The measurements are detailed in Appendix A.

4. Results

4.1. Demographics and descriptive statistics

Of the 278 taxpayers sampled, 74% were male. Respondent mean age was 41 years old, reflecting the higher receptiveness of younger and middle-aged taxpayers to online tax-filing. Regarding educational level, 100% of sampled taxpayers had senior high school diplomas, 91% had Bachelors degrees, 46% had Masters degrees, and 9% had post-Masters degrees. Respondents worked in various sectors, with 19% in government, 32% in manufacturing industries, 38% in service industries, and the remaining 11% in non-profit organizations.

Before testing our research hypothesis, any significant differences in mean scores correlated with educational level, occupation and age had to be analyzed. No significance differences were found in mean scores for the categories of educational level and occupation using ANOVA. However, marginally significant ($p = 0.047$) differences in mean score were observed among age categories (29 years old and under, 30–39 years old, 40–49 years old, 50–59 years old, and 60 years old and over). The mean scores of system quality for taxpayers aged over 60 were slightly higher than those for taxpayers below 60. However, the significance of this difference was uncertain, since the average age of the sample was 41 years and only 4% were over 60.

4.2. Scale validation

We assumed that three latent constructs were the antecedents of taxpayer satisfaction. Specifically, we proposed a measurement model that comprised three second-order factors and eight first-

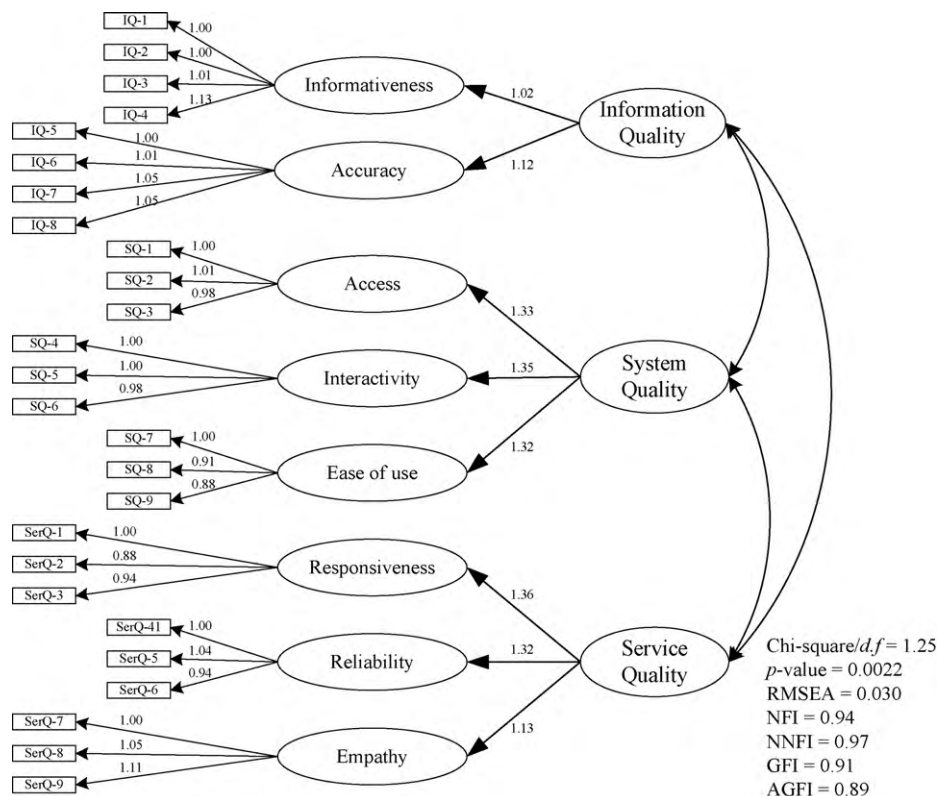


Fig. 3. Proposed model instrument: eight first-order factors and three second-order factors.

order factors. The three second-order factors were latent constructs reflecting system, information, and service quality. The eight first-order factors were loaded onto one of the second-order factors while the first-order factors were measured using their respective multiple indicator variables, see Appendix A. The second-order measurement model was tested via higher-order CFA.

Hierarchical CFA indicated that the second-order factor model adequately fit the observed data. Fig. 3 shows the analytical results. χ^2 is sensitive to sample size and likely to be significant for a large sample. Thus, p values alone should not be a factor when the sample size exceeds about 100. To examine the goodness of fit of the overall CFA model, the χ^2 normalized by degrees of freedom (χ^2/df) should not exceed 5. Also the goodness of fit index (GFI) and normed fit index (NFI) should exceed 0.90, and the adjusted goodness of fit index (AGFI) and non-normed fit index (NNFI) should exceed 0.80 [14].

For the current CFA, (χ^2/df) was 1.25, NFI was 0.94, NNFI was 0.97, GFI was 0.91, and AGFI was 0.89, suggesting adequate model fit [8]. Additionally, the root mean square error of approximation (RMSEA) was 0.03, also indicating adequate model fit. Generally, these statistics indicated good fit for the second-order measurement. Furthermore, all first-order and second-order factor loadings were significant ($p < 0.001$), indicating convergent validity, which we used to assess the agreement among different measurement methods, per the suggestion of Rogers et al.

All the parameters shown in Fig. 3 were LISREL estimates obtained using maximum likelihood estimation. Table 2 lists standardized parameter estimates, which are often more interpretable in the case of social science data than are unstandardized estimates; we also included the associated t -values and squared multiple correlations, or proportion of explained variance (R^2). Notably, the t -values were all significant and the R^2 values ranged from 0.48 to 0.81, indicating acceptable reliability for all factors.

The second-order measurement model was further assessed by comparing it with an alternative measurement model, a three-factor first-order measurement model. Table 3 lists the fit indices of the alternative measurement models. The results obtained reveal poor fit indices for the three-factor first-order measurement model. Therefore, the measurement model of quality antecedents was confirmed.

To assess the strength of measurement between the items and the associated construct, we also tested the measurement model of taxpayer satisfaction. In Fig. 4, the fit measures and parameters indicate that the measurement model of taxpayer satisfaction exhibited good fit for the sample: for this CFA χ^2/df was 1.44, NFI was 1.00, NNFI was 1.00, GFI was 0.99, AGFI was 0.97, and RMSEA was 0.04.

Similarly, all of the unstandardized factor loadings were LISREL results using maximum likelihood estimation. Table 4 lists interpretable standardized parameter estimates associated t -values and R -squares. Notably, the t -values were all significant and the R^2 values ranged from 0.58 to 0.81, indicating acceptable model reliability in achieving taxpayer satisfaction.

4.3. Hypotheses testing and assessment of structural model fit

The hypotheses were tested collectively using structural equation modeling (SEM), and LISREL was applied. Model fit was assessed by examining the analytical results. The hypothesized model included the second-order measurement model and paths among latent constructs. Similar to the assessment of the CFA model, the structure model χ^2/df had a value of 1.08, while RMSEA was 0.016, GFI was 0.91, NFI was 0.93, AGFI was 0.89, and NNFI was 0.98. These met the recommended threshold levels, demonstrating adequate fit between the hypothesized model and the observed data.

Table 2
Standardized parameter estimates and t -value for confirmatory second-order factor analysis.

| Observed variables | | | Latent variables | | |
|--------------------|-------------------|-------|------------------|----------------------------|-------|
| Item | Factor loading | R^2 | Factor | Std. structure coefficient | R^2 |
| IQ-1 | 0.77 ^a | 0.59 | Informativeness | 0.68 (7.18) | 0.48 |
| IQ-2 | 0.77 (12.98) | 0.59 | | | |
| IQ-3 | 0.76 (12.74) | 0.57 | | | |
| IQ-4 | 0.89 (14.91) | 0.79 | | | |
| IQ-5 | 0.78 ^a | 0.61 | Accuracy | 0.72 (7.40) | 0.51 |
| IQ-6 | 0.81 (14.15) | 0.65 | | | |
| IQ-7 | 0.84 (14.73) | 0.70 | | | |
| IQ-8 | 0.86 (15.14) | 0.74 | | | |
| SQ-1 | 0.80 ^a | 0.64 | Access | 0.84 (11.78) | 0.71 |
| SQ-2 | 0.79 (13.31) | 0.62 | | | |
| SQ-3 | 0.79 (13.37) | 0.63 | | | |
| SQ-4 | 0.77 ^a | 0.60 | Interactivity | 0.9 (12.02) | 0.81 |
| SQ-5 | 0.76 (12.11) | 0.57 | | | |
| SQ-6 | 0.77 (12.26) | 0.59 | | | |
| SQ-7 | 0.90 ^a | 0.81 | Ease of use | 0.77 (11.98) | 0.59 |
| SQ-8 | 0.79 (14.99) | 0.62 | | | |
| SQ-9 | 0.75 (14.04) | 0.56 | | | |
| SerQ-1 | 0.83 ^a | 0.69 | Responsiveness | 0.83 (11.44) | 0.69 |
| SerQ-2 | 0.72 (11.84) | 0.52 | | | |
| SerQ-3 | 0.74 (12.12) | 0.55 | | | |
| SerQ-4 | 0.82 ^a | 0.68 | Reliability | 0.83 (11.50) | 0.69 |
| SerQ-5 | 0.84 (14.94) | 0.71 | | | |
| SerQ-6 | 0.78 (13.83) | 0.61 | | | |
| SerQ-7 | 0.75 ^a | 0.56 | Empathy | 0.77 (9.79) | 0.60 |
| SerQ-8 | 0.74 (10.85) | 0.54 | | | |
| SerQ-9 | 0.78 (11.24) | 0.60 | | | |

^a Indicates a parameter fixed at 1.0 in the original solution. t -value for item factor loadings and factor structural coefficients are indicated in parentheses.

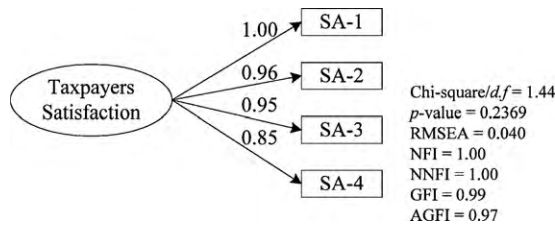


Fig. 4. Measurement model of taxpayer satisfaction.

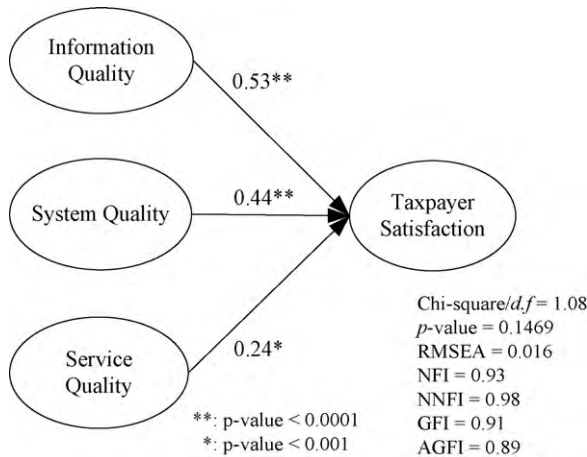


Fig. 5. Path coefficient of the hypothesized model of taxpayer satisfaction.

Path analysis was used to examine the significance and strength of the hypothesized effects in the research model. Taxpayer satisfaction with the online filling system was predicted using information, system, and service qualities, and three path coefficient-related hypotheses were examined. Fig. 5 shows the path coefficients and path significances.

Analysis using SEM revealed a significant path from information quality to taxpayer satisfaction, with a path coefficient of 0.53 ($\gamma_1 = 0.53, p < 0.0001$), supporting Hypothesis 1. Similarly, the path coefficient of factors between system quality and taxpayers satisfaction is 0.44 ($\gamma_2 = 0.44, p < 0.0001$), which was also significant, supporting Hypothesis 2. Finally, the path from service quality to taxpayer satisfaction with online tax-filing system was also significant, and had a path coefficient of 0.24 ($\gamma_3 = 0.24,$

Table 3
Fit statistics of the measurement models.

| Fit measures | Second-order model | First-order model |
|--------------|--------------------|-------------------|
| χ^2/df | 1.25 | 4.59 |
| p value | 0.0022 | <0.0001 |
| RMSEA | 0.030 | 0.114 |
| NFI | 0.94 | 0.84 |
| NNFI | 0.97 | 0.86 |
| GFI | 0.91 | 0.73 |
| AGFI | 0.89 | 0.68 |

Table 4
CFA of taxpayer satisfaction.

| Item | Factor loading | R ² |
|--------|-------------------|----------------|
| SerQ-1 | 0.90 ^a | 0.81 |
| SerQ-2 | 0.85 (19.12) | 0.73 |
| SerQ-3 | 0.84 (18.43) | 0.70 |
| SerQ-4 | 0.76 (15.71) | 0.58 |

^a Indicates a parameter fixed at 1.0 in the original solution. *t*-values for item factor loadings are indicated in parentheses.

Table 5
Hypothesis testing.

| | Variable | Coefficient | <i>t</i> -value | Significant | Support |
|----|---------------------|-------------|-----------------|-------------|---------|
| H1 | Information quality | 0.53 | 5.18 | <0.0001 | Yes |
| H2 | System quality | 0.44 | 4.44 | <0.0001 | Yes |
| H3 | Service quality | 0.24 | 2.81 | <0.001 | Yes |

$p < 0.001$), supporting Hypothesis 3. Meanwhile, the R² value was 0.59. Table 5 summarizes the results of the hypothesis testing.

5. Discussion

IS quality involves the complex interplay of many factors; previous studies have measured it in several different ways. We analyzed it in terms of information, system, and service qualities, which are the antecedents of user satisfaction with IS. CFA was used to measure information system quality. The first-order factors are measured by their respective multiple indicator variables. The proposed second-order measurement model was also tested using higher-order CFA. The hierarchical factor analysis of our data supported the use of the measurement model of IS quality in our work.

SEM and path analysis was applied to test the influences of the quality antecedents to user satisfaction with IS. Path coefficients provided a measure of the importance of each quality antecedent. The three hypotheses were all supported.

5.1. Information quality

The largest path coefficient in our model was that between information quality and user satisfaction, as expected.

When taxpayers were asked questions about whether they “generally received sufficient information for filing income tax returns”, they responded neutrally, suggesting that the tax-filing system provides enough help. However, personal information regarding expenditures on tax deductible items (donations and education) is seldom provided simultaneously. Taxpayers must offer proof to support their tax claims. To maximize deductions, taxpayers must keep their receipts all year long. Imbalances and asymmetrical information concerning taxpayer incomes and deductible expenditures may damage online tax-filing system information quality, thus reducing taxpayer satisfaction.

5.2. System quality

Because the path from system quality to user satisfaction was significant, Hypothesis 2 was supported. We measured system quality using the three sub-dimensions of access, interactivity, and ease of use. Currently, interactive filing is the basic approach to online tax-filing in Taiwan and it involves the taxpayer interacting directly with a Web-based application to file their tax online.

Perceptions of Web-based interactivity are influenced by delivery and processing speeds and response speed is a key concern of both providers and users. Interactivity allows users to navigate large quantities of information quickly to find what they need. Therefore, NTA should make greater efforts to increase delivery and processing speeds.

According to Yang et al. [20], website accessibility involves two aspects, availability and responsiveness. Taxpayers focus particularly on ease of access and loading speed. Although the tax-filing period covers the entire month of May, many taxpayers delay filing their returns until the last few days of the month, partly to delay the payment of taxes for as long as possible. Maintaining system responsiveness during the end of May is thus a key concern for the NTA.

5.3. Service quality

Service quality is also an important determinant of user satisfaction with the tax-filing system. We considered only reliability, responsiveness, and empathy.

The sub-dimension of tangibles refers to service-related infrastructure; it was not included in measuring service quality in our study, because taxpayers require a satisfactory system to file their tax returns, not a provided interface: most taxpayers use their computers, at home or work, though the Taxpayer Service Center (TSC) in every branch of NTA offers computer facilities for public use.

Analytical results from the SEM show that the path from service quality to taxpayer satisfaction with the tax-filing system was significant, supporting Hypothesis 3. Taxpayers viewed reliability as more important than responsiveness and empathy. To respond to service requests appropriately and promptly, the tax agency realized that TSCs were required. Individuals may use these centers to seek assistance in filing returns, pay taxes, view income tax transactions, and update their account information. Meanwhile, responsiveness reflects customer perception that the provider is willing to provide service, and empathy reflects the personal attention afforded to taxpayers. These two sub-dimensions of service quality also impact taxpayer satisfaction.

6. Implications for management

In Taiwan, individual taxable income includes: income from dependent activities and emoluments (e.g., wages, salaries, and director fees); property transference; interest/dividend; leasing, and other income (e.g., remuneration received by authors). However, profits from trading of stocks and bonds are free of capital gains tax. About 75% of all income taxes in Taiwan come from wages and salaries of blue and white-collar workers. Thus, reporting personal income is not complicated for most Taiwanese taxpayers. Actually, they pay more attention to exemption and deduction data (rental expenses, insurance premiums, tuition, and fees, and donations to non-profit organizations or charities) than to non-deduction income data. If the online tax-filing system could help keep taxpayer deductible information up-to-date, then filing income tax returns would be less tedious.

The sub-dimensional factor of accessibility in system quality should be reinforced. If 25–30% of taxpayers choose to file their income tax online during the last 3 days of the filing period, there is a severe strain of system capacity. When taxpayers are forced to queue in the system, accessibility, a sub-dimension of system quality, is threatened. Capacity expansion of the tax-filing system is one solution. However, a more financially efficient option might be to solve the accessibility problem through appropriate management. For example, the tax agency could encourage taxpayers to utilize the online tax-filing system during off-peak hours (00:00–08:00) to spread system load more evenly. Furthermore, the tax agency should motivate taxpayers to file their income taxes early by providing incentives such as early tax rebates. Such actions could increase the accessibility of the tax-filing system and user satisfaction.

When taxpayers dial toll-free numbers to get instant help, personnel providing help services are expected to respond immediately to taxpayer requests relating to filing their tax returns online. Besides the on-site help from tax officers at TSCs, personalized assistance should be provided both by phone and email. When taxpayers email tax agencies for help, service personnel should reply to their emails quickly.

With proper assistance from the tax-filing system and service centers, people are gradually becoming accustomed to filing income taxes online. However, the main concern of our study was

to show how to increase the use of the tax-filing system by increasing taxpayer satisfaction with it. Information and system quality are important in doing this.

7. Limitations

This study had some limitations. One was the failure to obtain an appropriate sampling frame for random samples. The other limitation related to non-response bias normally associated with a survey. It was possible to determine how respondents differed from non-respondents. Individuals in Taiwan can use three tax-filing methods for filing their personal income tax and benefit returns, and non-response may occur if taxpayers are not using an online tax-filing system for their personal income tax.

Online tax-filing facilitates tax payment using credit cards, and has significantly reduced back office processing time. Thus, every year government tax agencies should urge taxpayers in Taiwan to take advantage of the 24-h online tax-filing program to file their taxes in May. For the tax administration, the success or effectiveness of the system is evaluated by the number of tax payers who utilize it. However, user satisfaction is a key determinant of IS success and is widely accepted as a surrogate measure of information system success; consequently the study used it as a measure of online tax-filing system success.

Appendix A

A.1. System quality (SQ in abbreviation)

Access

SQ-1: I can get the tax-filing information needed from the system in time.

SQ-2: When I prepare and file my tax return, the response of Internet filing system is quick.

SQ-3: The system I use makes information immediately accessible.

Interactivity

SQ-4: Interacting with the system does not require a lot of mental effort.

SQ-5: The Internet tax-filing system has natural and predictable screen changes.

SQ-6: My interaction with the Internet tax-filing system is clear and understandable.

Ease of use

SQ-7: Learning to use the Internet tax-filing system is easy for me.

SQ-8: When I prepare and file my tax return, I can navigate the system to finish my tax-filing easily.

SQ-9: I find it easy to get the Internet tax-filing system I use to file my income tax return.

A.2. Information quality (IQ in abbreviation)

Informativeness

IQ-1: The Internet tax-filing system can provide the precise information I need for filing my income tax.

IQ-2: I have generally received sufficient information for filing my income tax return.

IQ-3: The Internet tax-filing system provides up-to-date and relevant information.

IQ-4: The output of the Internet tax-filing system is presented in a useful format.

Accuracy

IQ-5: The Internet tax-filing system is an accurate source of information to me.

IQ-6: The information content is consistent with my previous filing experience.

IQ-7: The information from the Internet tax-filing system is clear.

IQ-8: The information content is ease of understanding for filing my income tax return.

A.3. Service quality (*ServQ* in abbreviation)

Responsiveness

ServQ-1: NTA staff can give prompt service to Internet tax-filing users.

ServQ-2: NTA staff can tell Internet tax-filing users exactly when services will be performed.

ServQ-3: IS employees of NTA will never be too busy to response to Internet tax-filing users' requests.

Reliability

ServQ-4: When Internet tax-filing users have a problem, these IS employees can show a sincere interest in solving it.

ServQ-5: NTA provides its services at the times it promises to do so.

ServQ-6: These IS employees are dependable.

Empathy

ServQ-7: NTA's IS staff can give the Internet tax-filing users personal attention.

ServQ-8: NTA's IS staff can have the Internet tax-filing user's best interests at heart.

ServQ-9: The IS employees of NTA can understand the specific needs of taxpayers.

A.4. User satisfaction (*SA* in abbreviation)

How do you feel about your overall experience of using Internet tax-filing systems?

SA-1: Very dissatisfied/very satisfied.

SA-2: Very displeased/very pleased.

SA-3: Very frustrated/very contented.

SA-4: Absolutely terrible/absolutely delighted.

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Ching-Wen Chen is an associate professor in the Department of Information Management and the Director of IMBA program at the National Kaohsiung First University of Science and Technology, Taiwan. He earned a Ph.D. in production and operations management (area of information systems and quantitative sciences) from Texas Tech University and an MBA from Oklahoma State University. His researches include quality management, managerial decision-making and management of information systems. Dr. Chen's articles have appeared in journals such as *Quality Engineering*, *International Journal of Quality & Reliability Management*, *Engineering Economist*, *Expert Systems with Applications*, *Journal of Electronic Commerce in Organizations* and *International Journal of Innovative Computing, Information and Control*.