A Higher-Order Formative E-Commerce Customer Satisfaction Index

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Abstract: - Customer satisfaction is commonly acknowledged as one of the useful proxy measures of e-commerce system effectiveness, which in turn leads to business success. This study proposes an effective e-commerce system development by means of the conceptualization and measurement of an e-commerce user satisfaction index. The proposed construct is defined and empirical validation of the index and its dimensionality is provided. This proposed instrument will be useful to researchers in developing and testing e-commerce systems theories, as well as to organizations in designing better-accepted e-commerce systems.

Key-Words: e-commerce, e-marketing, e-satisfaction, repurchase intentions, measurement, instrument development, formative model

1 Introduction
User satisfaction is commonly acknowledged as one of the useful proxy measures of system success in e-commerce literature [1]. It is considered pivotal in attaining key business outcomes such as e-trust, customer loyalty, positive referrals and customer retention [2], [3], [4].

Though several previous studies on the field agreed that e-commerce customer satisfaction (ECCS) is a higher order construct, they mostly use reflectively measured constructs to investigate website quality antecedents [5], [6], [7]. However, several scholars question how to appropriately conceptualize and operationalize latent constructs [8], [9].

Scholars have called for using more formative constructs in marketing [10], [11]. Despite the calls, the use of formative models in the marketing management literature remains limited [10]. To address the call, the current research proposes and empirically validates a first order reflective second order formative construct for ECCS measurement.

The benefits of the current study are twofold. First, the study extends the psychometric theory pertaining to e-commerce satisfaction and second the study tests a viable and empirically valid conceptualization of e-commerce user satisfaction.

2 Conceptualization of E-Satisfaction
Traditionally, several instruments were developed and validated to measure e-commerce service quality [12], Web customer satisfaction [13], [14], [15], and Web site quality [16]. These measures were primarily designed to measure user satisfaction by means of information quality, system quality, service quality and other variables [17], [18].

Based on the above studies, e-commerce customer satisfaction can be considered as higher order construct representing the summation of satisfactions with various attributes or items. A review of the literature on end-user computing satisfaction (EUCS), IT service quality, e-commerce service quality, Web customer satisfaction, and Web quality, revealed the existence of four major dimensions underlying the e-commerce customer satisfaction construct, which are the following: Technical Adequacy (TA), Web Content Quality (WCQ), Web Appearance (WA), and Service Quality (SQ) [16], [13], [19], [14], [12], [1]. WCQ was further separated in two dimensions [16]. The first represents product/service info content quality and it is called Content Quality (CQ), while the second one represents supplier’s policy and procedures info existence and it is called Specific Content (SC).

Most of the aforementioned studies in the field consider ECCS as a second order reflective construct, however, many scholars debate about reflectively measured constructs' appropriateness [20], [11].

Diamantopoulos and Winklhofer [20] stress a need to critically reflect on which approach is appropriate for the specific research question. Thorough theoretical considerations are imperative to decide the correct measurement perspective [20], [21]. An in-depth theoretical foundation is essential
due to fundamental differences between the two alternatives (see Table 1).

Table 1: Reflective vs. formative constructs characteristics (Source: [22])

<table>
<thead>
<tr>
<th>Reflective constructs</th>
<th>Formative constructs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construct is reflected in the indicators</td>
<td>Construct is a composite of indicators</td>
</tr>
<tr>
<td>Account for observed variance in the outcome model - error is assessed at the item level</td>
<td>Determine residuals in the structural relationship - error is assessed at the construct level</td>
</tr>
<tr>
<td>Identification achieved with three effect indicators</td>
<td>Identification is given only if the construct is embedded into a larger model</td>
</tr>
<tr>
<td>Important aspects:</td>
<td>Important aspects:</td>
</tr>
<tr>
<td>Internal consistency or reliability</td>
<td>Indicators examine different dimensions</td>
</tr>
<tr>
<td>Positive correlation between measures</td>
<td>Multicollinearity is a problem</td>
</tr>
<tr>
<td>Unidimensionality allows for removing indicators to improve construct validity without affecting content validity</td>
<td>Removing an indicator affects content validity</td>
</tr>
</tbody>
</table>

Given that a formative model specification is guided by five conditions that should prevail for a construct to be modeled as formative [11], the current study is proposing a first order reflective second order formative model for ECCS for the following reasons:

- The formative indicators of the five first order subdimensions are defining characteristics of the second order construct [22].
- Changes in any of the indicators are expected to cause changes in ECCS. As mentioned above ECCS relates to an overall summative assessment by users based on their perception about its five subdimensions. Thus, the direction of causality flows from the indicators to the construct.
- The indicators do not necessarily share a common theme. Traditionally ECCS has been measured reflectively, thereby implying a common theme. However, this is not a necessary condition. The literature does not specify a unifying theme across five proposed indicators; not forbidding a formative model specification.
- Eliminating an indicator may alter the conceptual domain of the construct. The literature on ECCS suggests that the five constructs comprise important facets of the construct [16], [1], [22]; thereby elimination of any one would indeed alter the construct’s meaning.
- The first order constructs are not expected to have the same antecedents and consequences.

Given that the five conditions for formative construct development are met the following hypothesis is forwarded:

H1: ECCS is a higher order formative construct having TA, CQ, SC, WA and SQ as its first order reflective subdimensions.

An additional step, for ECCS index conceptualization, concerns external validity assessment, aiming to evaluate its nomological validity. Bagozzi in p. 333 [23] points out that since assessing index’s appropriateness is problematic, “the best we can do … is to examine how well the index relates to measures of other variables”. This process requires correlating each indicator to a feasible, theory-based variable not part of the index [24]. A more common approach employs a multiple indicators and multiple causes (MIMIC) model linking the index as an antecedent to theoretical constructs [25]. A good fit of the MIMIC model suggests indicator suitability for the formative construct [20]. The current study is using two global reflective constructs representing e-commerce user general satisfaction (GS) and customers’ behavioral intentions (BI) to investigate ECCS index external validity, yielding the following hypotheses:

H2: ECCS index is positively related to e-commerce users GSAT
H3: ECCS index is positively related to e-commerce users BI

3 Research Methodology

The data for the study are collected using a cross-sectional survey of e-commerce consumers as the overall context. More specifically, an online questionnaire was posted on the Internet using Google-Docs facilities. To reach participants a “snowball” data collection technique was used. In order to guarantee the representativeness of the sample, quota stratification was employed taking as a basis the Greek e-commerce users’ profile resulted from the annual research conducted by Focus BARI broadband.cti.gr/download/WEBID_A08_id1138441.ppt during 2008. The sample was defined in accordance with two demographic criteria: gender and age. Fifty appropriately trained university students were used to approach 10 individuals each, satisfying the quota strata determined above, and asked them to participate in the online survey. The data were collected during May and July 2012.

The research work obtained 235 responses of which 25 were eliminated because they were incomplete, resulting in a net response rate of 44%. Among the 220 respondents, 53% were male. 28% of the subjects were in the 17-24 age group, 41% were in the 25-34 age group, 18% were in the 35-44
age group, 13% were more than 45 years old. 38% of the subjects were married. In terms of yearly income, 25% of the respondents had an income of less than €10,000, 38% had an income between €10,000 and €20,000, 29% had an income between €20,000 and €50,000, and 8% had an income of more than €50,000. 56% of the respondents had a university degree, 10% had some college education, and 33% had up to secondary school education. On a yearly basis, 18% of the research subjects spent less than €100 in online shopping, 46% between €100 and €500, 26% between €500 and €1,000 and 9% more than €1,000. Finally, 37% of the respondents used internet for shopping purposes less than 3 times a year; 34% between 4 and 6 times; 17% between 7 and 10 times and 13% more than 10 times a year.

Scales for ECCS index subdimensions were adopted from [16] and [1]. The measures for ECCS index external validity were also adopted from the existing literature. GSAT measurement scale was adopted from [18]. Customer’s BI construct, in accordance with Söderlund’s [26] suggestions, was modeled as a second order reflective construct having repurchase intentions (RI) and positive referrals spread intentions (WOM) as its subdimensions. All items were measured using a 7-point Likert response format with anchors ranging from “strongly disagree” to “strongly agree”.

Based on the above discussions the proposed modeling framework is illustrated in Figure 1.

Fig. 1: Proposed Model

4 Data Analysis Results

4.1 Method
The method of partial least squares (PLS) analysis [27], an implementation of structural equation modeling (SEM) with Smart PLS 2.0 M3 [28], was applied to test the measurement model and the proposed hypotheses. This approach was chosen since it fits small sample research and handles formative indicators [29]. In order to operationalize the second order factors under investigation, the repeated indicators approach was used [30]. This is suitable for PLS estimation and as such ECCS and BI second order constructs were measured by the indicators of their first order constructs.

4.2 First-order constructs assessment
With respect to the first order reflective constructs of the proposed model, Table 2 shows that the composite reliability for all constructs is greater than 0.87 and the average variance extracted (AVE) is greater than 0.55. Also, all item-loadings were greater than 0.70; therefore, providing strong support for the reliability and internal consistency of the latent constructs [31].

![Table 2: Psychometric properties of the first-order constructs](image)

![Table 3: Correlations of the first-order constructs](image)
Furthermore, as shown in Table 3, the square roots of the shared variance between the constructs (numbers in diagonal) were higher than the correlations across constructs, thus supporting first-order constructs’ discriminant validity [31].

4.3 Second-order constructs assessment

4.3.1 BI reflective construct assessment

As it is said previously, customers BI is modeled as a second-order reflective construct. In Table 4, the composite reliability (CR) and AVE measures of the BI constructs are provided. This show that CR equals to 0.91 and AVE equals to 0.64, which are well above the recommended thresholds of 0.7 and 0.5 respectively, providing evidence of reliable second-order constructs [30]. Finally all the loadings of the second-order construct on the first-order constructs are exceed 0.9 and are significant at p=0.01. All the above supports the validity of the hypotheses that customer’s BI is based on their perception on its pre-specified sub-dimensions of RPI and WOM.

<table>
<thead>
<tr>
<th>Paths</th>
<th>Loadings</th>
<th>Std Error</th>
<th>t-Stat.</th>
<th>CR</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI -&gt; RPI</td>
<td>0.94</td>
<td>0.01</td>
<td>135,50</td>
<td>0.91</td>
<td>0.65</td>
</tr>
<tr>
<td>BI -&gt; WOM</td>
<td>0.91</td>
<td>0.01</td>
<td>78,45</td>
<td>0.91</td>
<td>0.65</td>
</tr>
</tbody>
</table>

Table 4: Assessment of the BI higher-order construct

4.3.2 ECCS construct assessment

The measurement quality of the formative second-order constructs was tested in two steps [32], [20]. In the first step, the correlations between the first-order constructs of each ECCS dimension were examined. The correlations between first-order constructs of ECCS range from 0.29 to 0.63. These result support the hypotheses that ECCS is better represented as a formative second order construct and not as reflective ones, since a reflective second order construct would show extremely high correlation among its lower-order constructs (≥ 0.8) [33]. In the second step, the significance of the relationships between ECCS and its first-order dimensions were assessed. According to Table 5, all first-order dimensions were found to have significant path coefficients, which are positively affect ECCS formation. The coefficient of each subdimensions reveal its importance with respect to ECCS formation. The results revealed that TA and CQ are the most significant factors of customers’ e-satisfaction, followed by SQ, WA and SC. The variance inflation factor (VIF) for the first-order factors of each second-order construct was then computed to assess multicollinearity. VIF values greater then or equal to 10 would indicate the existence of excessive multicollinearity and raise doubts about the validity of the formative measurements [20]. As it can be seen in Table 5, there is no multicollinearity between the first-order constructs of ECCS, since their VIF values vary from 1.23 to 1.97.

<table>
<thead>
<tr>
<th>Path</th>
<th>Coefficient</th>
<th>t-Stat.</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>TA -&gt; ECCS</td>
<td>0.37</td>
<td>17,85</td>
<td>1.97</td>
</tr>
<tr>
<td>CQ -&gt; ECCS</td>
<td>0.34</td>
<td>15,26</td>
<td>1.85</td>
</tr>
<tr>
<td>SC -&gt; ECCS</td>
<td>0.18</td>
<td>7,69</td>
<td>1.23</td>
</tr>
<tr>
<td>WA -&gt; ECCS</td>
<td>0.22</td>
<td>11,12</td>
<td>1.36</td>
</tr>
<tr>
<td>SQ -&gt; ECCS</td>
<td>0.23</td>
<td>11,72</td>
<td>1.48</td>
</tr>
</tbody>
</table>

Table 5: Assessment of the ECCS higher-order construct

To further strengthen the validity of the proposed ECCS, the nomological of the ECCS index was assessed. Nomological validity was evaluated by testing hypotheses H2 and H3. A positive relationship was expected between the total score on the ECCS instrument and the two measures representing a global measure of e-commerce customer (GS) and customers BI respectively, if the instrument has nomological validity. The results of the PLS-PM implementation are given in Table 6. As it can be seen, ECCS index positively affects GS (b = 0.79; p < 0.05) and BI (b = 0.71; p < 0.05), explaining 62% of the variance in GS and 51% of the variance in BI.

<table>
<thead>
<tr>
<th>Path</th>
<th>Coefficient</th>
<th>t-Stat.</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECCS -&gt; GS</td>
<td>0.79</td>
<td>23,87</td>
<td>0.62</td>
</tr>
<tr>
<td>ECCS -&gt; BI</td>
<td>0.71</td>
<td>20,86</td>
<td>0.51</td>
</tr>
</tbody>
</table>

Table 6: Nomological validity assessment of the ECCS higher-order construct

In summary, the results of the above tests confirm H1 that ECCS is a valid e-commerce customer satisfaction index.

5 Conclusions, Limitations, Future Research

The purpose of the current study was the development and assessment of a higher order formative construct aiming to measure customer satisfaction in the e-commerce context. More specifically, this study has conceptually defined the domain of the ECCS construct, and further provided validation on it. The final instrument indicates adequate reliability. The generality of this proposed
instrument provides a common framework for the comparative analysis of results from various researches.

Even though the rigorous validation procedure allowed us to develop a general instrument for measuring user satisfaction with e-commerce systems, this work has some limitations. First, while the valid instrument was developed using the sample data gathered in Greece, a confirmatory analysis and cross-cultural validation using another larger sample, gathered elsewhere is required for further generalization of the instrument. Additionally, the sampling method has potential bias, since a quota sample may not be generalizable. Consequently, more randomly selected samples from different areas of Greece or other nations should be gathered to confirm and refine, the factor structure of the ECCS instrument, and to assess its reliability and validity.

Finally, this work encourages further discussion on which paradigm is more appropriate depending on research questions and theory backgrounds. This debate encourages for more indices development and leads to the utilization of more parsimonious measurement instruments for market research. An extensively validated and widely adapted website performance model facilitates further research and insights regarding online consumer behavior and preferences.

References:


