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The European Customer Satisfaction Index (ECSI) Model: Development of, and Testing the Validity, Reliability, and Independence of the Constructs in, an Instrument for Explaining Student Satisfaction in the Context of Universities in Uganda

By

*Martha Kyoshaba (PhD)¹ & Fred E.K. Bakkabulindi (Professor)²

Mbarara University of Science and Technology (MUST)¹

East African School of Higher Education Studies and Development (EASHESD),
College of Education and External Studies (CEES), Makerere University²

*Corresponding author: Email: mkyoshaba@must.ac.ug

Telephone: +256 706294362; +256 788738285

Abstract

The European Customer Satisfaction Index (ECSI) model suggests that the satisfaction of students as customers of universities is predicted by University Image (UI), Student Expectations (SE), Service Quality of Infrastructure and Tangible Service Elements (SQITSE), Service Quality of People and Processes (SQPP) and Perceived Value of Investment (PVI). In turn, PVI is predicted by UI, SE, SQITSE and SQPP. Furthermore, Student Loyalty (SL) is predicted by Student Satisfaction (SS), UI and SQPP; and finally, SE is predicted by UI. In this paper we developed an instrument on the explanatory constructs of the ECSI model. After which we sought to answer two questions: (i) to what extent was each of the explanatory constructs in the instrument on the ECSI model valid and reliable and (ii) were the explanatory constructs in our instrument on the ECSI model independent? A sample of 704 students from seven universities in Uganda responded to our self-administered questionnaire (SAQ). For analysis, we applied the (i) confirmatory factor analysis (CFA) and Cronbach alpha (α); and (ii) Pearson's linear correlation (PLC) for our two respective questions. Using CFA, we established that: (i) All the items of each of the five constructs (UI, SE, SQPP, PVI, and SL) in our instrument were valid but the construct SQITSE was only valid after we dropped some of its items. The alpha results showed that all the constructs in our instrument were reliable. (ii) However, our PLC results suggested that the explanatory constructs were significantly interrelated. Hence, we recommend that studies use our instrument with the view of refining it.

Keywords: Cronbach Alpha, ECSI, Factor Analysis, Instrument, Reliability, Satisfaction, Student, Validity, Uganda, Universities

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Introduction

The intention of this article is to show how the European Customer Satisfaction Index (ECSI) model works and how it has operated in Uganda. In this article we show how we developed an instrument on the explanatory constructs of the ECSI model. We then test the validity, reliability and independence of the ECSI constructs in the instrument.

Background

Theoretical perspective

The European Customer Satisfaction (ECSI) model (Figure 1) elucidates the relationship between customer satisfaction (CS), its antecedents, and its consequence.

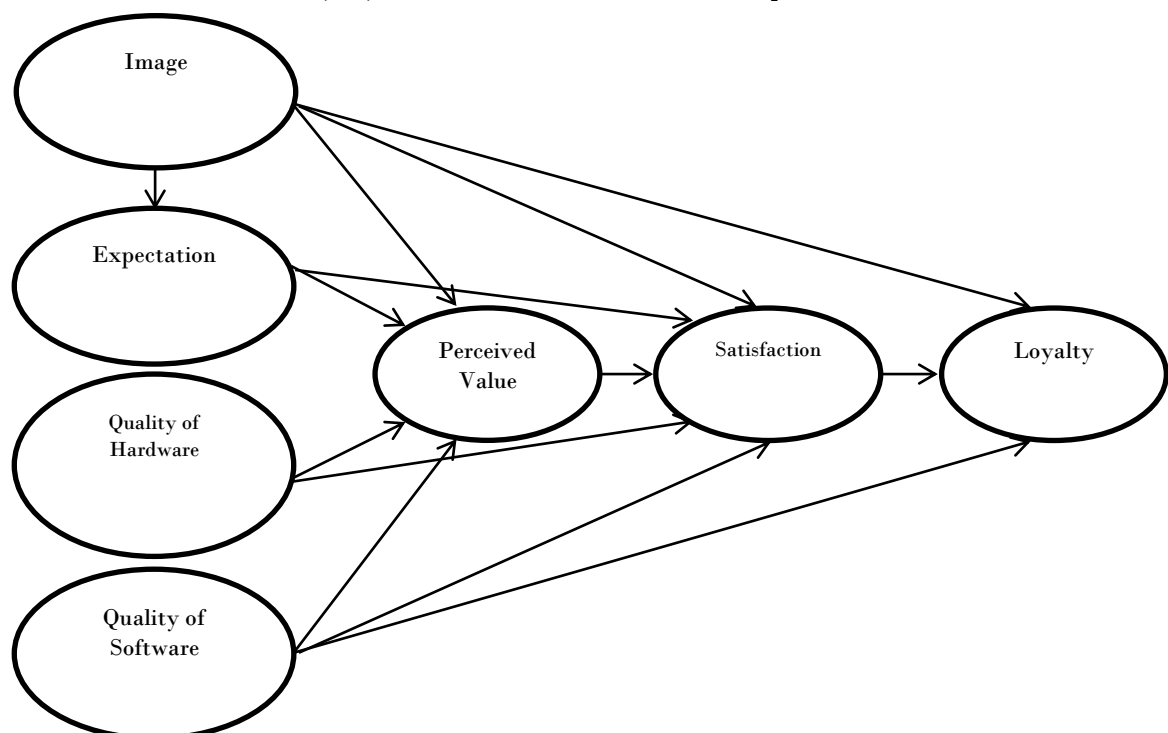


Figure 1: European Customer Satisfaction Index (ECSI) Model

(Source: Shahsavari and Sudzina, 2017, p. 4)

The ECSI model (Figure 1) which was developed by the European Organization for Quality (EOQ) Technical Committee in 1998 (Shahsavari & Sudzina, 2017) has customer satisfaction (CS) as the main variable. Angelova and Zekiri (2011) defined CS as an emotional reaction to the difference between what a customer anticipates and what they

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receive. The antecedents of CS as per Figure 1 are; image, expectation, and the quality of “hardware” and quality of “software.” Image is defined by Ciavolino and Dahlgaard (2007) as an organization’s brand name and the type of associations a customer gets from the organization. Ciavolino and Dahlgaard defined expectation as the level of quality that a customer expects to receive from an organization and is, a result of a prior consumption experience of a service. The terms quality of “hardware” and quality of “software” refer to service quality (SQ), where SQ is the comparison between a customer’s service expectation and their perception of actual performance (Shahsavari & Sudzina, 2017). “Hardware” refers to infrastructure and tangible service elements of the organization, while “software” refers to people offering the service; and the processes related to the service (Brown & Mazza, 2006).

The ECSI model (Figure 1) postulates that the four antecedents of CS (i.e., image, expectation, quality of “hardware” & quality of “software”) influence CS through perceived value (PV) of investment in service. PV according to Caruana, Money, and Berthon (2000) is a “consumer’s overall assessment of the utility of a product based on perceptions of what is received and what is given” (p. 1342). PV directly influences CS. The ECSI model (Figure 1) further postulates that customer loyalty (CL) is a consequence of CS. CL according to Douglas, McClelland and Davies (2008) is a customer’s willingness to recommend a product or service to other customers. CL as seen in Figure 1 is directly influenced by two antecedents of CS namely; image and quality of “software.” Lastly, the ECSI model (Figure 1) posits that image directly influences expectations.

Statement of the Problem

Student satisfaction (SS) is a key aspect in the survival of any university. Why? Because among several reasons, SS boosts student loyalty (Oliver, 2015) and the image of the university, giving it competitive advantage (Karna & Julin, 2015) thus enhancing profitability (Guilbault, 2017). In spite of the importance of SS, universities in Uganda continue to grapple with student dissatisfaction manifested in student strikes (Mayega, 2015). Student dissatisfaction stems from failure by universities to meet students’ expectations (Mayega, 2015). If the challenge of student dissatisfaction in the universities persists, there may be a decline in student loyalty; damaged images of the respective universities which in turn might compromise the universities competitive advantages; hence reduce their profitability. It was therefore necessary to use the ECSI model to find the antecedents of SS and its consequent in these universities. In so doing we developed an instrument based on the explanatory constructs of the ECSI model. Hence, test the validity, reliability and independence of the constructs.

Research Questions

- (i) To what extent was each of the explanatory constructs in the instrument on the European Customer Satisfaction Index (ECSI) model valid and reliable?
- (ii) Were the explanatory constructs in our instrument on the ECSI model independent?

Conceptual Perspective

Based on the European Customer Satisfaction Index (ECSI) model (Figure 1), we operationalized each construct of the ECSI model. We operationalized: Image as university image (UI), expectations as student expectations (SE); quality of hardware as service quality

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of infrastructure and tangible service elements (SQITSE); quality of software as service quality of people and processes (SQPP); perceived value as perceived value of investment in a university (PVI) and loyalty as student loyalty (SL). In this paper, we developed an instrument on the explanatory constructs of the ECSI model as we had operationalized them. We then tested the validity of the constructs in our instrument. We also tested its reliability to check for internal consistency (Tavakol & Dennick, 2011). In addition, we tested the independence of the explanatory constructs of our instrument so that we could ascertain if they measured different things. From the literature on the ECSI model, we noted that several scholars had carried out their studies in universities in developed countries hence we carried out our study in the context of universities in Uganda, a developing country.

Review of Related Literature

Researchers have carried out empirical studies to explain student satisfaction (SS). Some of them used the European Customer Satisfaction Index (ECSI) model. Some even developed instruments based on the ECSI model and tested their instrument's validity and reliability as part of their main studies. In this section, we discuss those empirical studies. Alves and Raposo (2007) tested the validity, reliability and correlation of the explanatory constructs of the ECSI framework as part of a main study. They administered their self-administered questionnaire (SAQ) to 2687 students. Their results showed that the constructs (University Image [UI], Student Expectations [SE], Perceived Value of Investment [PVI], Service Quality [SQ], and Student Loyalty [SL]) among others scored high average variances extracted (AVEs) as measures of validity ranging from a minimum 0.648 for SQ to a maximum of 0.728 for SE. Therefore, regarding the AVEs of all the constructs, "it can be seen that the constructs always explain[ed] more than 50%, minimum value recommended" (p. 1270).

Regarding reliability, the constructs scored high composite reliabilities (CRs) as measures of reliability ranging from a minimum 0.828 for SL and a maximum of 0.883 for PVI. Thus "all the constructs exceed the level of minimum reliability of 0.7 ... showing that the specified indicators are sufficient in [their] representation of inherent constructs" (p. 1268). Regarding correlations, they did not explicitly state that they were testing the independence of the constructs however they stated that "... all the indicators are statistically significant to a level of significance of 0.05, thus ...[they] are significantly related to their specific constructs" (p. 1267). Whereas they did not report about gaps, they recommended an area of research "to find alternative indicators to measure the constructs, namely indicators that present a lower individual reliability ... in order to succeed in obtaining scales of reliability above 90% for all constructs" (P. 1277)

Duarte, Raposo and Alves (2012) tested the validity, reliability and correlation of explanatory constructs of the ECSI as part of a main study. They distributed a self-administered questionnaire (SAQ) to 412 continuing students in their first phase of the study in 2002 and to 150 alumni in the second phase in 2008. Hence in phase One, the constructs (UI, SE, PVI, SQ and SL) scored high average variances extracted (AVEs) as measures of validity ranging from a minimum 0.571 for SE to a maximum of 0.744 for SL. In phase Two, the constructs scored even higher AVEs ranging from a minimum 0.640 for SE and SQ; to a maximum of 0.854 for SL. Hence all the AVEs were "above the minimum threshold of 0.5" (p. 11) in both phases.

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Regarding reliability, the constructs scored high composite reliabilities (CRs) as measures of reliability ranging from a minimum 0.888 for SE and a maximum of 0.925 for PVI. In phase Two, the constructs scored even higher CRs ranging from a minimum 0.914 for SE and SQ; to a maximum of 0.959 for SL. Hence all the CRs were “exceeding the minimum benchmark of 0.707” (p. 11) in both phases. With regard to the correlation among the constructs, without citing actual figures, Duarte et al. (2012) “... some constructs (e.g., image quality and satisfaction) show[ed] strong correlations among them, which [were] not surprising” (p. 11). Duarte et al. (2012) did not raise any relevant gaps concerning the validity, reliability and correlation of the explanatory constructs of their instrument.

Eurico, Pinto, Silva and Marques (2018) tested the validity, reliability and correlation of explanatory constructs in their instrument on the ECSI as part of a main study. They administered their SAQ to 166 tourism graduates. Hence the constructs UI, SE, PVI, Service Quality [SQ] of People and Processes [SQPP], SQ of Infrastructure and Tangible Service Elements [SQITSE] and SL, scored high AVEs as measures of validity ranging from a minimum 0.533 for UI to a maximum of 0.903 for SQPP. Hence an “[AVE] exceeding 0.5 is another indication of convergent validity” (p. 217).

Regarding reliability, the constructs scored high composite reliabilities (CRs) as measures of reliability ranging from a minimum 0.871 for UI and a maximum of 0.949 for SQPP. In addition, the constructs scored high on Cronbach alpha (α) as measures of reliability ranging from a minimum 0.823 for UI and a maximum of 0.893 for SQPP. Hence all the CRs and α values were “above the recommended thresholds ... ($Cr > 0.7$; $\alpha > 0.7$)” (p. 216). Regarding correlations, their correlations matrix showed that the constructs were correlated. They reported their limitation as being that they had used an “instrument where all items [were] measured by the same respondent and using the same scale which [could] can be sources of common method bias” (p. 223).

Ostergaard and Kristensen (2005) tested the validity and reliability of the explanatory constructs of the ECSI as part of a main study. They administered a self-administered questionnaire (SAQ) to 1300 students. The constructs UI, SE, PVI, SQITSE, SQPP and SL scored high AVEs as measures of validity ranging from a minimum 0.53 for SQITSE to a maximum of 0.67 for PVI. Hence “the average variance for the ... constructs [was above] 0.53... so overall there is good reason to be satisfied” (p. 11). Regarding reliability, the constructs scored high composite reliabilities (CRs) as measures of reliability ranging from a minimum 0.81 for SQITSE and a maximum of 0.92 for UI. Hence the “reliability for all the ... constructs [was] above 0.8 which is good or very good” (p. 11). Regarding the correlation of the explanatory constructs, they did not report any results. Ostergaard and Kristensen did not raise any gaps on the validity, reliability and correlation of the explanatory constructs of their instrument.

Shahsavari and Sudzina (2017) tested the validity, reliability and correlation of the explanatory constructs of the ECSI model as part of a main study. Using both online survey and hardcopies, they distributed the self-administered questionnaire (SAQ) to 1,030 students. Thus except for the construct UI which had a low AVE score of 0.474, the rest of the constructs SE, SQITSE, SQPP, PVI and SL scored high AVEs as measures of validity with PVI having the highest at 0.763. However, they stated that “all AVE’s [were] greater than 0.4, the threshold” (p. 10).

Regarding reliability, the constructs scored high composite reliabilities (CRs) as measures of reliability ranging from a minimum 0.832 for SQPP to a maximum of 0.866 for

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SL. As for the Cronbach alpha results, the construct SE had an alpha score of 0.634 which was below the threshold of 0.7. However, Shahsavar and Sudzina claimed that “since Cronbach Alpha is not a good measure of internal consistency when a scale consists of only a few items, the value of 0.63 should be rather compared to 0.50, the threshold ... for scales consisting of three or four items” (p. 10). Regarding correlations, without details, they stated that the “indicators of each latent variable [were] highly correlated” (p. 9). Shahsavar and Sudzina did not reveal any relevant gaps concerning the validity, reliability and correlation of the explanatory constructs of their instrument.

Temizer and Turkyilmaz (2012) tested the validity, reliability and correlation of explanatory constructs of the ECSI as part of a main study. They used a self-administered questionnaire (SAQ) which they administered to 454 graduates. Without giving the actual values of validity scores, they stated that the principal component analysis tests [led] to an acceptance of the uni-dimensionality of all blocks” (p. 3806). Regarding reliability, they also stated that “Cronbach’s alpha and Dillon-Goldstein’s p values of each block [were] (greater than 0.80) hence confirmed reliability of the items of their constructs. They did not mention any gaps concerning the validity, reliability and correlation of the explanatory constructs of their instrument.

In summary, out of the six studies, two studies were rather recent (i.e., Eurico et al., 2018; Shahsavar & Sudzina, 2017) and four were old (i.e., 2005 to 2012). Hence the need for more recent studies. While all the six studies were based on the ECSI model, they did not primarily intend to test the validity, reliability and independence of the explanatory constructs of ECSI but did it as a by-the-way. Thus, our study on the validity, reliability and independence of the explanatory constructs of ECSI is significant in that it contributes to narrowing that gap. Regarding the sample size, the sample was between 150 respondents (Duarte et al., 2012) to 2687 respondents (Alves & Raposo, 2007) with three studies having university continuing students as respondents (Alves & Raposo, 2007; Ostergaard & Kristensen, 2005; Shahsavar & Sudzina, 2017) and the rest having university graduates as respondents. The authors carried out these studies in Europe (i.e., Denmark, Portugal and Turkey). This raised a geographical gap hence the need for a study from the developing world which our study contributed to narrowing since we conducted it in Uganda,

Regarding analysis for validity, except Temizer and Turkyilmaz (2012) who did not reveal how they analyzed validity, the rest of the studies applied the average variance extracted (AVE) method. Regarding analysis for reliability, all six studies applied either composite reliability (CR) index or Cronbach alpha (α) or both. Regarding analysis of independence of the constructs, none of the six studies revealed their measures of independence, an issue which our study will address. In terms of the results, except Temizer and Turkyilmaz who did not show the results of validity of the constructs of their instrument, and Shahsavar and Sudzina whose UI construct had an AVE score of 0.474, the rest of the studies had constructs with high AVE scores above the threshold of 0.5 as measures of validity. As of reliability, except for Shahsavar and Sudzina whose SE construct had an alpha value of 0.634, the constructs in all the other five studies scored high CRs and α above the threshold of 0.7 as measures of reliability. Regarding independence of the explanatory constructs of the ECSI model, we noted that the studies did not show the computations of correlations among the constructs however, three studies (i.e., Duarte et al., 2012; Eurico et al., 2018; Shahsavar & Sudzina, 2017) stated that their explanatory constructs were correlated.

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Concerning gaps, only Eurico et al. raised one. They reported that they had used an “instrument where all items are measured by the same respondent and using the same scale which can be sources of common method bias [CMB]” (p. 223). We however noted the following gaps which our study attempted to narrow: (i) Some studies were rather old. (ii) The studies did not explicitly set out to develop an instrument on the explanatory variables of ECSI and test the validity, reliability, and independence of the constructs. (iii) The geographical context of the studies was European. (iv) The studies applied mainly one method of analysis, (AVE) score to check for validity of the constructs. Hence our study narrowed the gaps by: (i) adding to new and recent knowledge concerning the validity, reliability and independence of the explanatory constructs of ECSI. (ii) Developing an instrument based on the explanatory constructs of the ECSI and testing the validity, reliability, and independence of the constructs. (iii) We carried out our study in Africa (Uganda). (iv) We applied the confirmatory factor analysis (CFA) to check for validity and Pearson’s linear correlation (PLC) for the independence of the constructs.

Methodology

Sample

Our sample comprised 704 students whom we selected from seven universities in Uganda. Table 1 shows the detailed characteristics of our sample. Our typical respondent was a male (51.3%) Ugandan student (97%), from the western region (64.2%) aged 20 and above but below 25 (72.3%). He was from Makerere University (36.2 %) undertaking bachelor’s degrees (85.2%), and in his first year of study (46.9%).

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Table 1: Characteristics of the Sample

Description	Category	Frequency	Percentage
Gender	Female	341	48.7
	Male	359	51.3
Nationality	Ugandan	672	97
	International	21	3.0
Region if Ugandan	Central	127	11.9
	Eastern	86	12.8
	Northern	27	4.0
	Western	431	64.2
Age	Below 20	88	12.8
	20 and above but below 25	498	72.3
	25 and above	103	14.9
University of Study	Bishop Stuart	52	7.5
	Kabale	56	8.1
	Kampala International	57	8.2
	Makerere	257	36.2
	Mountains of the Moon	97	14.0
	Mbarara University of Science and Technology	129	18.6
	Uganda Christian University	51	7.4
Level of study	Diploma	55	7.8
	Bachelors	597	85.2
	Postgraduate Diploma	6	0.9
	Masters	30	4.3
	PhD	13	1.9
Year of study	First	322	46.9
	Second	175	25.5
	Third	135	19.7
	Fourth	51	7.4
	Fifth	4	0.6

Source: Respondents from the universities

Data Collection Instrument

We developed a questionnaire by adapting scales already used by researchers and whose psychometric properties (validity and reliability) had been tested. Table 2 shows the number of items we adapted from the respective instruments and their reliabilities. The instrument has six explanatory constructs which we operationalized with four to eight items (see Table 2). We scaled the items using a five-point Likert scale from a minimum of one for strongly disagree (SD) or very poor (VP) to a maximum of five for strongly agree (SA) or very good (VG).

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Table 2: Constructs in the Instrument

Construct	Number of items adapted	Source of Instrument, number of items and their reliability (α value)
University Image (UI)	06	Ostergaard & Kristensen (2005), 06 items ($\alpha = 0.92$)
Student Expectations (SE)	04	Shahsavari & Sudzina (2017), 04 items ($\alpha = 0.63$)
SQ of Infrastructure & Tangible Service Elements (SQITSE)	08	Lai et al. (2015), 08 items ($\alpha = 0.80$)
SQ of People and Processes (SQPP)	04	Ostergaard & Kristensen (2005), 04 items ($\alpha = 0.82$)
Perceived Value of Investment (PVI)	05	Duarte et al. (2012), 05 items ($\alpha = 0.958$)
Student Loyalty (SL)	04	Duarte et al. (2012), 04 items ($\alpha = 0.959$)

Source: Various Instruments

Data Analysis

We computed the validities of the six explanatory constructs of the European Customer Satisfaction Index (ECSI) model using confirmatory factor analysis (CFA) and the reliabilities of the same using Cronbach alpha. We then computed the Pearson's linear correlation (PLC) analysis to find out if the constructs were independent. The six constructs of the ECSI model (see Figure 1) were university image (UI), student expectations (SE), service quality of infrastructure and tangible service elements (SQITSE), service quality of people and processes (SQPP), perceived value of investment (PVI) and student loyalty (SL). We present the results in Tables 3 to 8.

Results

Research Question 1. To What Extent was each of the Explanatory Constructs in our Instrument on the ECSI Model Valid and Reliable?

To test for validity of the constructs, we carried out a confirmatory factor analysis (CFA) adopting the Kaiser-Guttman rule (Schmidt, Baran, Thompson, Mishra, Koelher & Shin, 2009) which posits that a factor is considered significant if it has an eigen value with a magnitude of at least one. We decided on the most valid items based on the rotated component matrix whose results are readily interpreted (Mvududu & Sink, 2013). We considered as most valid items which loaded highly on the first factor (Kahn, 2006) with a loading of at least 0.5 (Matsunaga, 2010). Using the Cronbach alpha, we determined reliability, and considered reliable, items with a reliability index of at least 0.7 (Tavakol & Dennick, 2011).

University Image (UI)

Our results in Table 3 show that the confirmatory factor analysis (CFA) reduced the seven items on University Image (UI) to one factor with an eigen value of 3.127, implying that the factor accounted for $3.127/7 \times 100 = 44.671$ of the total variance of the seven items. All the

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seven items of UI (UI1-UI7) loaded highly on the first factor (all loadings above 0.5) hence all of them were valid measures of UI. The seven items had a Cronbach alpha of 0.792 which being large (greater than 0.7) suggested that the items were also reliable measures of UI.

Table 3: Loadings and Cronbach Alpha on the Factor on University Image (UI)

Items*	Description	Factor Loadings	Cronbach alpha (α)
UI1	The reputation of my university is good	0.638	0.792
UI2	My university is a place of new thinking	0.655	
UI3	My university is trustworthy	0.652	
UI4	My university is involved in social activities	0.699	
UI5	My university has established contacts to the community	0.713	
UI6	My university is internationally open	0.625	
UI7	My university adapts easily to its surrounding society	0.691	
Eigenvalue		3.127	
%variation explained		44.671	

*All items were valid

Student Expectations (SE)

Our results in Table 4 show that the confirmatory factor analysis (CFA) reduced the six items on student expectation (SE) to one factor with an eigen value of 3.024, implying that the factor accounted for $3.024/6 \times 100 = 50.407$ of the total variances of the six items.

All the six items of SE (SE1-SE6) loaded highly on the first factor (all loadings above 0.5) hence all of them were valid measures of SE. The six items had a Cronbach alpha of 0.799 which being large (greater than 0.7) suggested that the items were also reliable measures of SE.

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Table 4: Loadings and Cronbach Alpha on the Factor on SE

Items*	Description	Factor Loadings	Cronbach alpha (α)
SE1	The lecturer's teaching ability met my expectations	0.720	0.799
SE2	The lecturer's contribution to my career growth met my expectations	0.731	
SE3	The services of administrative staff met my expectations	0.685	
SE4	The structure of the academic programmes met my expectations	0.757	
SE5	The range of courses offered met my expectations	0.685	
SE6	The facilities for practical courses met my expectations	0.679	
Eigenvalue		3.024	
%variation explained		50.407	

*All items were valid

Service Quality of Infrastructure and Tangible Service Elements (SQITSE)

Our results in Table 5 show that the confirmatory factor analysis (CFA) reduced the eight items on Service Quality of Infrastructure and Tangible Service Elements (SQITSE) to two significant factors with 3.726 and 1.108 as their eigen values. The two factors 1 and 2 accounted for $3.726 / 8 * 100 = 46.575\%$ and $1.108 / 8 * 100 = 13.851\%$ respectively of the total variance among the eight items. Table 6 also shows that items SQITSE1-SQITSE5 loaded highly on the first factor (loadings above 0.5) making them the most valid items of SQITSE. Items SQITSE6-SQITSE8 loaded highly on the second and less significant factor and therefore we did not consider them as valid items of SQITSE. The five most valid items (SQITSE1-SQITSE5) had a Cronbach alpha (α) of 0.802 which being large (greater than 0.7) suggested that the items were also reliable measures of SQITSE.

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Table 5: Loadings and Cronbach Alpha on the Factor on SQITSE

Rotated Component Matrix				
Items	Description	Loadings		Cronbach Alpha (α)
		Factor 1	Factor 2	
SQITSE1*	The quality of computer facilities	0.820		0.802
SQITSE2*	The quality of laboratory facilities	0.790		
SQITSE3*	The quality of online learning facilities	0.755		
SQITSE4*	The quality of sports facilities	0.610		
SQITSE5*	The quality of dining/restaurant facilities	0.608		
SQITSE6	The quality of library facilities		0.527	
SQITSE7	The quality of the curriculum (i.e., courses of the program)		0.847	
SQITSE8	The quality of assessment (i.e., coursework and examinations)		0.833	
Eigenvalue		3.726	1.108	
%variation explained		46.575	13.851	

*Valid items

Service Quality of People and Processes (SQPP)

Our results in Table 6 show that the confirmatory factor analysis (CFA) reduced the four items on Service Quality of People and Processes (SQPP) to one factor with an eigen value of 2.719, implying that the factor accounted for $2.719/4 \times 100 = 67.966$ of the total variance of the four items. All the four items of SQPP (SQPP1-SQPP4) loaded highly on the first factor (all loadings above 0.5) hence all of them were valid measures of SQPP. The four items had a Cronbach alpha of 0.842 which being large (greater than 0.7) suggested that the items were also reliable measures of SQPP.

Table 6: Loadings and Cronbach Alpha on the Factor on SQPP

Items*	Description	Loadings	
		Factor	Cronbach alpha (α)
SQPP1	The quality of academic staff at my university	0.784	0.842
SQPP2	The quality of service rendered by academic staff at my university	0.831	
SQPP3	The quality administrative staff at my university	0.850	
SQPP4	The quality of service rendered by administrative staff at my university	0.831	
Eigenvalue		2.719	
%variation explained		67.966	

*All items were valid

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Perceived Value of Investment (PVI)

Our results in Table 7 show that the confirmatory factor analysis (CFA) reduced the five items on Perceived Value of Investment (PVI) to one factor with an eigen value of 2.590, implying that the factor accounted for $2.590/5 \times 100 = 51.797$ of the total variance of the five items. All the five items of PVI (PVI1-PVI5) loaded highly on the first factor (all loadings above 0.5) hence all of them were valid measures of PVI. The five items had a Cronbach alpha of 0.759 which being large (greater than 0.7) suggested that the items were also reliable measures of PVI.

Table 7: Loadings and Cronbach Alpha on the Factor on PVI

Items*	Description	Factor Loadings	Cronbach alpha (α)
PVI1	The experience I get from my university will help me get a good job	0.685	0.759
PVI2	My choice to study at this University is a good investment	0.724	
PVI3	My university provides value for money	0.763	
PVI4	Organizations want to employ students from my university	0.721	
PVI5	The fees I pay matches with the quality of teaching and infrastructure at my university	0.703	
Eigenvalue		2.590	
%variation explained		51.797	

*All items were valid

Student Loyalty (SL)

Our results in Table 8 show that the confirmatory factor analysis (CFA) reduced the four items on Student Loyalty (SL) to one factor with an eigen value of 2.736, implying that the factor accounted for $2.736/4 \times 100 = 68.396$ of the total variance of the four items. All the four items of SL (SL1-SL4) loaded highly on the first factor (all loadings above 0.5) hence all of them were valid measures of SL. The four items had a Cronbach alpha of 0.835 which being large (greater than 0.7) suggested that the items were reliable measures of SL.

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Table 8: Loadings and Cronbach Alpha on the Factor on SL

Items*	Description	Factor Loadings	Cronbach alpha (α)
SL1	If I have to apply afresh as a first-year student, I would choose this University again	0.825	0.835
SL2	I will choose this University for another program	0.765	
SL3	I am proud of my university	0.851	
SL4	I will recommend this University to friends	0.863	
Eigenvalue		2.736	
%variation explained		68.396	

*All items were valid

Research Questions 2: To What Extent Were the Six Explanatory Constructs in our Instrument on the ECSI Model Independent?

Our research question two was to establish the extent to which the six constructs of the ECSI model were independent. We calculated the average indexes for the valid items of each construct and thereafter correlated the constructs using the Pearson's linear correlation (PLC). Table 9 shows that all the six constructs of ECSI were significantly inter-related with the highest correlation between PVI and SL ($r = 0.573$) and the lowest between SQITSE and SL ($r = 0.333$). Table 9, third column also shows that SQITSE had the lowest correlation with other constructs.

Table 9: Inter-correlations of the Six Explanatory Constructs of ECSI

ECSI constructs	UI	SE	SQITSE	SQPP	PVI	SL
UI						
SE	0.565**					
SQITSE	0.431**	0.424**				
SQPP	0.462**	0.493**	0.396**			
PVI	0.523**	0.500**	0.420**	0.543**		
SL	0.464**	0.357**	0.333**	0.452**	0.573**	

** Correlation is significant at the 0.01 significance level

Discussion

In this paper, we sought to answer two questions. We answered the first question by carrying out confirmatory factor analysis (CFA) of each of the explanatory constructs. Our results showed that all the items in the constructs UI, SE, SQPP, PVI and SL were valid measures of their constructs with loadings above the threshold 0.5. Our results are similar to the results of four studies (i.e., Alves & Raposo, 2007; Duarte et al., 2012, Eurico et al., 2018; Ostergaard & Kristensen, 2005) whose AVE scores implied that their constructs were valid. However, the results in Table 5 showed that we had to drop three items (SQITSE6-SQITSE8) in favor of only five items (SQITSE1-SQITSE5) as valid items of SQITSE. Shahsavar and Sudzina (2017) on the other hand reported that the construct UI had an AVE score of 0.474 below 0.5 however; they considered it valid because they adopted a threshold of 0.4.

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Regarding reliability of our explanatory constructs, our Cronbach alpha results showed that all the items in our instrument were reliable measures of their respective constructs with alpha values greater than the threshold 0.7 (see Tables 3-8) with the minimum value at 0.759 of PVI and the maximum value at 0.842 for SQPP. Our results support the findings of Eurico et al. (2018) whose Cronbach alpha results revealed that the explanatory constructs were reliable with values as large as 0.8 (greater than 0.7). Shahsavar and Sudzina (2017) on the other hand who also reported that all the items in their instruments were reliable measures of their respective explanatory constructs had some Cronbach alpha results of SE and PVI below 0.7 however they reported the items as reliable considering a threshold of 0.5 for internal consistency for constructs with few items.

We answered our second question by using Pearson's linear correlation (PLC). Our PLC results suggested that the constructs (UI, SE, SQITSE, SQPP, PVI and SL) were significantly inter-related (see Table 9). Our results support the studies of (Eurico et al., 2018; Duarte et al., 2012; and Shahsavar & Sudzina, 2017) reported and showed that their explanatory constructs significantly correlated. Constructs which are highly correlated could signify multicollinearity meaning that they probably measure the same thing. However, Siegal (2016) contends that mild or moderate multicollinearity is not usually a problem.

Conclusion

In this paper we developed an instrument on the six explanatory constructs of the ECSI and tested its validity and reliability. We carried out this study to narrow the gaps which were: (i) Some studies were rather old. (ii) The studies did not explicitly set out to develop an instrument on the explanatory variables of ECSI and test the validity, reliability and independence of the constructs. (iii) The geographical context of the studies was European. (iv) The studies applied mainly one method of analysis, (AVE) score to check for validity of the constructs.

Hence to narrow the gaps, our study sought to answer two questions. One, on the extent to which each of the explanatory constructs in the instrument on the ECSI model were valid and reliable. Two, whether the explanatory constructs in our instrument on the ECSI model were independent? We did this by using confirmatory factor analysis (CFA) and Cronbach alpha (α); to answer our first question and used Pearson's linear correlation (PLC) to confirm the independence of the explanatory constructs of ECSI. We established that all the items of each of the five constructs (UI, SE, SQPP, PVI and SL) in our instrument were valid but the construct SQITSE was only valid after we dropped some of its items. The alpha results showed that all the constructs in our instrument were reliable. Our results supported the findings of the six studies we cited which reported that the items in their instruments on their explanatory constructs of ECSI were valid and reliable. We further established that our PLC results suggested that the explanatory constructs were significantly interrelated. Our limitation was that our study was in one African country and hence our findings are hard to generalize to other countries. Hence, we recommend that studies use our instrument in other contexts with the view of refining it.

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