Evaluating the quality of the university educational process: *an application of the ECSI model*[1]

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Summary. In the university system, the students represent the end-user as well as the principal actors of the formative services offered to them by the institution. A measure of their perceived quality is essential for planning changes that would increase the level of the quality of these services. This perceived quality is generally analysed by the ECSI methodology (*European Customer Satisfaction Index*), which is based on the implementation of a structural equation model. The model should be able to represent the satisfaction of the students/end-user with some variables, typically latent variables, which will be gauged through a set of directly observable indicators. We decided to extend this methodology to information obtained from a survey on former students of the University of Florence (Italy) who had graduated in the year 2000 and who were in an employed status one year after graduation.
Keywords: Customer Satisfaction, ECSI, Structural Equation Models, Quality of University Education.

1. Introduction

If the statement 'customer satisfaction' means evaluating the product or the service a firm or a private/public organization offers (Fornell, 1992; Fornell et al, 1996), we can define the product or service as being of good quality if it satisfies the needs of the consumers/users. As a consequence, the development of appropriate interventions aimed at improving the degree of quality represents one of the main strategies of the firms and organizations designed to increase their productivity and competitiveness (Montgomery, 1996). Hence, studies dealing with satisfaction must be accomplished with the purpose of obtaining information; in particular, taking account of the causes

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The three authors of this paper contributed the initial idea, the structure and the design of the work, whereas Bini M. and Bertaccini elaborated and implemented the model.

and the consequences of the previous consumption or usage experiences, which must be used to improve the quality of the product /services offered.

During these past decades, analyses of customer satisfaction have revealed to be increasingly important due to the definition and use of new indices (CSI – *Customer Satisfaction Indices*) and barometers for the evaluation of large markets or, further still, of the entire production of a given country. These new tools derive from two particular kinds of analyses: *transaction-specific satisfaction* and *cumulative satisfaction* (Johnson M.D. et al, 2000). Initially, interest was focused on an approach based on the single episode of consumption then, more recently, it shifted towards to a newer approach embracing all the psychological aspects that induce satisfaction to be defined as the experience acquired over time by subjects after the consumption or use of a product/service; the corresponding assessments derive, therefore, from upgraded consumption/usage experiences due to continuous transactions between consumers/users and firms/organizations (Johnson et al., 2000).

The first model, according to this last criterion, was the barometer proposed in Sweden in 1989 (*SCSB* – Swedish Customer Satisfaction Barometer), which was followed a few years afterwards by the American index (*ACSI* – American Customer Satisfaction Index, 1994), then by the Norwegian barometer (*NCSB* – Norwegian Customer Satisfaction Barometer, 1996) and, finally, by the index used in the European Community (*ECSI* – European Customer Satisfaction Index, 1999).

The cores of these models, based on developed and validated theories concerning the consumers' behaviours, their satisfactions and the quality of the products purchased, consist in causal links expected among latent factors, each one representing the values of a specific set of measurable indicators. Their structure is continually undergoing review and is subject to modifications in relation to the different contexts; therefore, the differences among the several proposals present in the literature are exclusively due both to the number of the latent factors and to the number of the causal nexuses involved in the analysis.

The aim of this work was to extend the use of CSI indices to the university education framework; in particular, we considered the ECSI model, since its basic structure and the relative latent factors are more consistent with it. In order to delineate as completely as possible a picture of the elements used to evaluate the quality of the educational programmes adopted by universities, some aspects acquired from graduates who had obtained employment a year after graduation, concerning work conditions and their opinions of the education received, have been included in this analysis.

This strategy produced encouraging results, which demonstrate the validity of the approach of the analysis that highlights weaknesses of the educational programmes and services of the university system.

The most appropriate tool for estimating the effects considered in these models, characterized by a specific basic structure, is the approach proposed in the SEM context (*Structural Equation Models*). It must be emphasized that this technique initially suggested estimate latent variables in models CSI (Fornell, 1992), the so-called Partial Least Squares method (PLS, Wold, 1975)[2].

However, for the model estimation we decided to use the SEM approach, based on maximum likelihood estimation procedures, because, first of all, they are more flexible in the specification of the model parameters and allow testing the significance of omitted parameters, such as error co-variances and loadings on more than one latent variable; secondly, they are more general and flexible since they can include, for example, observed variables with an ordinal measurement level, latent and observed categorical variables and they also allow implementation of a two-level data structure and handling of missing data. Finally, recent developments by Müthen & Müthen (2003), who produced a new generation of software, allowed an easy implementation and computation of these models.

This work presents the ASCI/ECSI models in the second paragraph, while in the third it describes the data set used in the analysis, results of which are shown in the fourth paragraph. The last section is devoted to some concluding remarks.

2. Structure of the ACSI / ECSI model

The basic structure of the CSI model includes a number of latent factors, each of which explains variations of multiple indicators, usually observable. The feature of this approach is the linkage among latent factors that originate from a cause/effect system from the range of possible activators of satisfaction and its consequences.

The ECSI model has evolved from the ACSI one. In the ECSI model, the expectations of the consumer/user, the quality and value perceived, and the satisfaction and concept of loyalty take on a structural configuration very similar to that foreseen in the American model. Nevertheless, these models differ in two fundamental aspects: the ECSI does not foresee the incidence of complaint behaviour as a consequence of satisfaction, but it includes *corporate image* as one of the latent variables; this latter aspect is believed to exert a direct effect upon the consumer's expectation, satisfaction and loyalty.

[2] This proposal was based on the fact that alternative estimation procedures for latent variables were characterized by stronger specification hypotheses, concerning the normality of the distribution of the observations. The advantage of the PLS approach, although it may generate biased estimators, is that it yields optimal predictions of the dependent variable; in addition, empirical studies demonstrated that it maintains these characteristics both with small samples are with skewered distributions.

In detail, the causes of satisfaction foreseen in these models are:

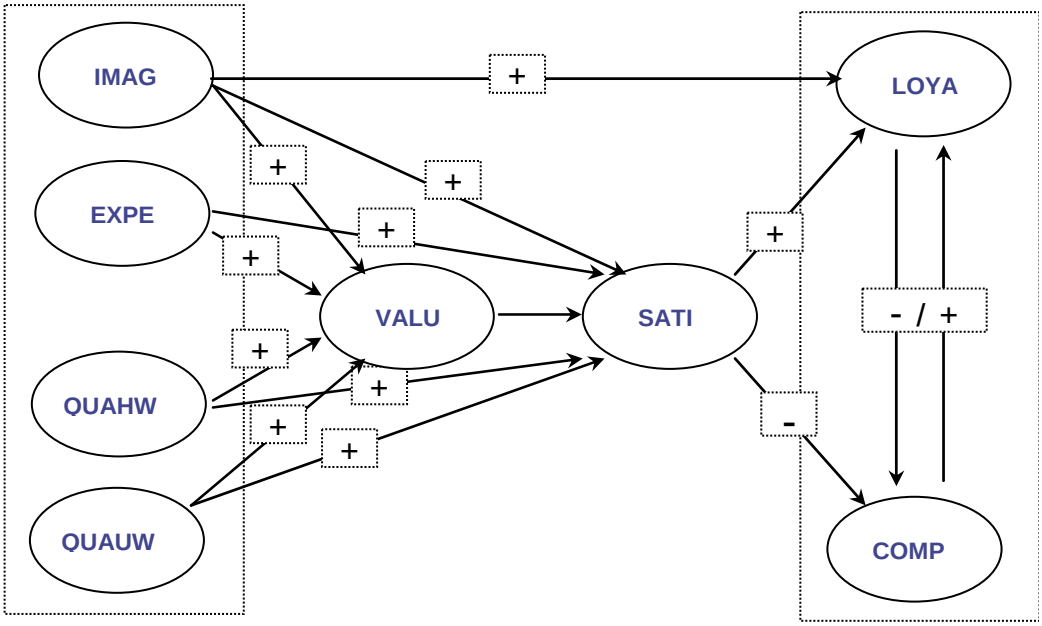
- *Perceived Quality (*QUA*)*: this refers to an assessment of recent consumer/user experiences concerning the characteristics of the product/service (*perceived quality of hardware* – QUAHW) and the assistance supplied both during and after the consumer/user experience (perceived quality of humanware – QUAUW). Both factors are presumed to exert a direct, positive effect on *overall satisfaction*;
- *Value (*VALU): represents the value of the quality perceived in relationship to the price paid. This factor is believed to be a positive cause of overall satisfaction and to be influenced by the quality perceived;
- *Image* (IMAG): this concerns the sphere of sensations generated by the product/brand/manufacturer association. It is suggested that this factor might positively influence value, overall satisfaction and loyalty; moreover, some Authors maintain that image can produce a direct effect on perceived quality as well, though the traditional ECSI model considers these two aspects to be exogenous factors;
- *Expectations* (EXPE): this is the level of quality that the purchaser/user expects to receive and generally it is the result of previous consumer/user experience. This is also believed to be an exogenous factor capable of positive influence on both value and overall satisfaction.

The consequences of satisfaction are:

- *Complaints* (COMP): this factor refers to the type and extent of the complaints and, above all, the manner in which they are dealt with. In the ACSI model, an increase in the level of overall satisfaction is expected to produce a decrease in the incidence of the complaints;
- *Loyalty* (LOYA): this is the last of the factors in the models and is considered a *proxy* of the power of profit of the organisation since it generates indexes such as intention to purchase again, tolerance of variation in price, intention to recommend the product or service to others. High levels of image and overall satisfaction are assumed to be capable of activating in the consumer what is known as the *loyalty process*.

Figure 1 gives a graphic representation of the above-mentioned features; that is, the latent variables and the expected relationships expressed in terms of causal links.

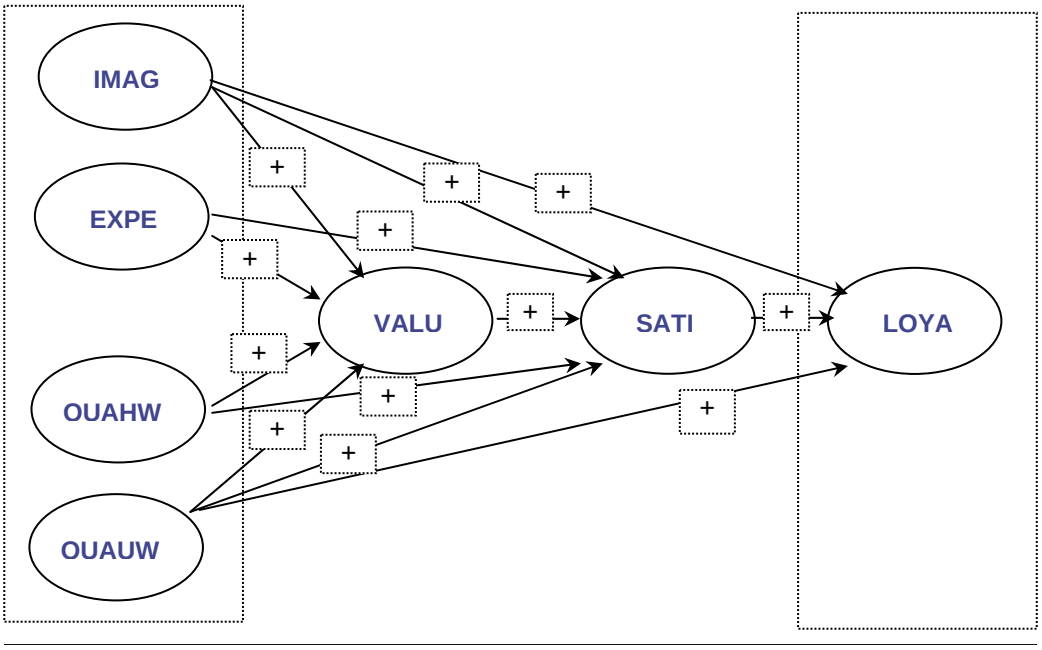
Figure 1. *ACSI / ECSI Model: structure and expected relationships.*



Bearing in mind the aim of this study, we purposely decided to employ the European version of the customer satisfaction index, since this was considered the most appropriate for representing the matter of interest in the study because of the sources available, which will be described in detail in the next paragraph.

Based on the information available and the preliminary analyses performed and, above all, on previous knowledge of the phenomenon, the structural section of the reference model for the following analyses is illustrated in *Figure 2*.

Figure 2. *ECSI model expectations for the assessment of the quality of university education.*



3. The database employed

Customer satisfaction studies are usually based on surveys that foresee the use of questionnaires, specifically devised for the purpose and aimed at covering all aspects that are considered in some way connected with the causes and/or consequences of the consumer/user experience.

In this particular study – an assessment of the quality of education issued by the University of Florence -, the lack of a similar survey tool led to the creation of a database containing information from both the ALMALAUREA survey on the 'Profile of Graduates' upon their graduation and from the survey carried out on *'Professional opportunities and Florence University students graduated in the year 2000'*, produced by the VALMON GROUP[3] in collaboration with the 'G. Parenti' Department of Statistics as an integrative part of the ALMALAUREA[4] project. In particular, this latter survey was carried out by means of telephone interviews lasting a maximum of 20 minutes and using the C.A.T.I technique *(Computer Aided Telephone Interviewing).* The choice of this type of survey tool is obviously justified by the

reduced duration of the investigation and by the high number of replies it can yield compared to other forms of interview[53].

In this context it would be superfluous to discuss further the cognitive requirements that resulted in the elaboration of these two surveys[6], requirements that were naturally completely different from those entailed in the assessment of customer satisfaction. What should be emphasised, however, is the wide range of information that can be drawn from the two questionnaires used – information that has allowed a complete picture of the *quality of the end product of the University*. In particular, the total availability of these sources has permitted a hypothetic model of overall assessment of the quality of university education, which contemplates not only information on the perception of the study experience at the time of graduation but also information concerning the perception of the quality of the employment status as well as on the study experience as evaluated in relationship to this employment.

However, the enticing prospect of being able to combine information surveyed at the time of graduation with that obtained one year afterwards (which also referred to certain aspects of the graduates' employment) actually meant excluding from the analysis all those subjects who had not found employment within a year after graduation.

The variables resulting from the questionnaires for the above-mentioned surveys that have been considered potentially capable of assessing certain aspects of satisfaction are:

- The reason for going to university and for choosing the particular subject;
- Evaluation of relationship with the professors, the assistant teachers, the non-

[3] The group coordinated by B. Chiandotto is made up of under-graduates, graduates taking doctor's degrees and professors of the Department of Statistics at Florence University and for several years has been studying and doing research on evaluation and monitoring of educational processes in the Florentine university.

[4] As already known, the surveys on Professional Opportunities carried out by ALMALAUREA involve students graduated only during the Summer session, who are monitored throughout the first three (or five) years after terminating their studies; the Florentine university then considered it opportune to extend the surveys carried out in the years 1998, 1999, 2000 and 2001 approximately one year after graduation to the entire number of students who graduated or obtained a diploma in every session of the corresponding solar year.

[5] The design of the survey also foresaw mailing an appropriately adapted questionnaire to all those who had not been contacted during the telephone-interview stage of the survey; the sole purpose of this was to compare any substantial differences emerging in the central topics of the survey with those resulting from the persons contacted by telephone.

[6] Those interested may refer to the publication by Chiandotto B., Bacci S., Bertaccini B. (2004): "Profile and Professional opportunities of graduates and diploma-holders in the Florentine university in the year 2000". University of Florence.

teaching staff, the fellow students;
- Evaluation of the university facilities (classrooms, laboratories, libraries, canteens);
- Satisfaction expressed regards both certain aspects of the employment (coherence with the studies performed, conformity with the subject's own cultural interests, acquisition of skills) and in overall terms;
- Opinions concerning the hypothesis of entering university again and doing the same subjects;
- Precise intention to continue with the studies and educational activities.

Nearly all the variables mentioned are dichotomic or ordinal if resulting from replies evaluated against a 1-5 scale. Due to the amount of the information and the number of subjects interviewed, it was considered more appropriate to apply procedures that would treat the missing data by eliminating all cases of incomplete information; thus, the subgroup of the selected cases totalled 1753.

Table 1 on the next page shows the measurement section of the theoretic ECSI model giving the presumed relationships between directly observed variables and the foreseen latent structures.

Table 1. *Description of the measurement section of the theoretic ECSI model*

Latent structures	**Observed variables**
IMAG:	*Reason for attending University: MOTISCR1, MOTISCR2, MOTISCR3*
EXPE:	*Reason for choosing specific subjects: MOTCOR1, MOTCOR2, MOTCOR3, MOTCOR4, MOTCOR6*
QUAHW:	*Evaluation of classrooms, libraries, laboratories and canteen (scale 1-5): STRAULE, STRBIB, STRLIB, STRMENSE*
QUAUW:	*Evaluation of relationship with professors, assistants, non-teaching staff, fellow students, and overall judgement (scale 1-5): RAPDOC, RAPCOL, RAPNDOC, RAPSTUD, GIUDIZIO*
VALU:	*Satisfaction for coherence with studies and conformity with own cultural interests (scale 1-5): SODDCOER, SODDICUL*
SATI:	*Satisfaction for acquired skills, and overall judgement (scale 1-5): SODDPROF, SODDTO*
LOYA:	*Hypothesis of re-attendance, intention to continue studies and educational activities: IPREISC, OKUNIV, OKCOR, INTSTUD, ATTFORM*

4. The ECSI model for assessing the quality of university education.

As frequently suggested in the literature (Bollen, 1989), a model for confirmative factorial analysis should be used initially to validate the structural equation model proposed[7]; that is, to evaluate the quality of the indicators employed as a gauge of the latent components and, at the same time, to eliminate aspects that also include sources of variability other than those contemplated. Nevertheless, the use of this procedure would have been inappropriate for the analyses in our investigation: in this case, the lack of a specific questionnaire necessitates the application of a preliminary

[7] The structural equation models originate from the convergence of two specific scientific traditions: *ergonometric*, from which the theory of a network of causal links between variables derived, and *psychometric*, from which the notion of latent variables came.
When considering structural equation models, the so-called LISREL model (*LInear Structural RElationship*) is usually referred to; this was developed by the Swedish school of psychometrics (Jöreskog, 1973; Jöreskog and Sörbom, 1984; Jöreskog, 1990). It is well known that the LISREL model features the presence of two components: a *structural* model, designed to explain the causal links between latent variables, and a *measurement* model for evaluating the variations detected on the variables observed. By referring to the usual notation, the LISREL may be expressed thus:

$$\eta = \mathrm{B}\eta + \Gamma\xi + \zeta \quad \textbf{\textit{parte strutturale}}$$
$$\left.\begin{aligned} x &= \Lambda_x\xi + \delta \\ y &= \Lambda_y\eta + \varepsilon \end{aligned}\right| \quad \textbf{\textit{parte di misurazione}}$$

where *y* and *x* are, respectively, endogenous and exogenous vectors of observed variables, $\boldsymbol{\eta}$ and $\boldsymbol{\zeta}$ are the vectors of the respective underlying latent variables, $\boldsymbol{B, \Gamma, \Lambda_y}$ ***and*** $\boldsymbol{\Lambda_x}$ are the matrices of the coefficients and $\boldsymbol{\varepsilon}$ and $\boldsymbol{\delta}$ are the terms of error of the measurement section (for further details, see Corbetta, 2002).
In the SEM it is normally presumed that the sampled data follow a normal multivariate distribution, so that the vector of the means and the matrix of covariance contain all the information required for the estimation procedure. In this respect, the method most commonly used for estimation in this case is the *Maximum Likelihood* (ML).
Nevertheless, there is a variety of estimation procedures that can be used in the presence of non-normal continuous data; in this case, these alternative procedures require the entire matrix of raw data. The most common of these procedures is that known as ADF (*Asymptotically Distribution Free*) or WLS (*Weighted Least Squares*).
The statistical tests designed to verify the degree of adaptation generally have the problem of depending their strength on the size of the set of samples; in other words, if the sample is very large, a statistical test based on chi-square will almost certainly result to be significant, suggesting rejection of the model even when it appears to be describing the data very satisfactorily. Likewise, when the set of samples is limited in size, there is a risk of accepting the model even if the adaptation is poor. A whole series of indices have been proposed in the literature for measuring the degree of proximity of the observations to the proposed model, indices that often only take into account the actual level of adaptation, but also the degree of simplicity, or frugality, revealed by the model itself (for a review of these indices see Hox, 1998).

explorative factorial analysis for identifying the most suitable number of latent structures and the *items* most appropriate for measuring them.

Once the measurement section of the model has been defined through identification of the corresponding relationships, the application of a confirmative-type factorial analysis followed by estimation of the effects detected then optimises it.

4.1. Explorative factorial analysis (EFA)

As already mentioned, the dual aim of this stage, on the basis of the information available, is to detect the optimal number of latent factors and, at the same time, to identify the subgroup of variables that prove to be the most appropriate for measuring them. Explorative factorial analyses foreseeing between 5 and 8 factors were performed, and the best number resulted to be 7.

Table 2 shows the relative factorial weights.

The variables that resulted to be unlinked to the factors are those marked with asterisks. All the other variables are clearly correlated with only one factor, with the exception of that concerning satisfaction regards coherence of the employment status with the studies carried out (SODDCOER). This particularly favourable situation permitted a preliminary identification of the measurement section of the model (see **Table 3**) as basis for the next analyses.

4.2. Confirmative factorial analysis (CFA)

A typical configuration of confirmative factorial analysis is merely a model of complete structural equations, which foresees all the possible links of covariance between the latent structures.

The purpose of this analysis is to assess the quality of the measurement structures of the model that have been identified in the previous step.

By applying the WLSMV estimation logarithm (*Weighted Least Square Mean and Variance*) recommended by the MPlus software and according to the types of indicators used, the model suggested by the explorative factorial analysis fails to reach the point of convergence; nevertheless, the resulting estimates are used as starting values for all the models contemplated in the next steps.

Table 2. *Factorial weights in the explorative factorial analysis using 7 factors.*

		A	B	C	D	E	F	G
	GIUDIZIO	-0,648	0,251	0,028	-0,018	0,101	0,028	0,122
	RAPDOC	0,842	-0,176	0,019	0,034	0,027	-0,013	-0,032
	RAPCOL	0,829	-0,154	-0,036	0,020	0,018	0,006	-0,012
	RAPNDOC	0,652	-0,201	-0,054	-0,036	-0,046	0,020	-0,010
	RAPSTUD	0,432	-0,139	-0,015	-0,022	-0,076	0,017	-0,053
	STRAULE	0,201	-0,749	-0,042	-0,036	-0,014	0,057	0,005
	STRLAB	0,286	-0,665	-0,066	-0,041	0,003	0,104	-0,010
	STRBIB	0,236	-0,513	0,042	0,009	-0,051	-0,030	-0,038
	SERMENSE	0,189	-0,329	0,025	-0,102	-0,045	0,006	0,021
	INT_STUD	0,038	0,008	-0,031	0,053	-0,040	-0,528	-0,033
	ATTFORM	-0,003	0,019	-0,118	0,014	0,070	-0,563	-0,011
	EFFESTER	-0,022	0,003	0,828	0,033	0,201	0,124	0,269
	MOTISCR1	-0,010	-0,006	0,005	-0,587	0,218	0,252	0,002
	MOTISCR2	0,065	-0,009	-0,014	0,937	-0,022	-0,028	-0,001
	MOTISCR3	-0,068	0,013	0,017	-0,773	-0,104	-0,099	0,005
*	MOTCOR1	0,056	-0,074	-0,014	-0,133	0,179	0,274	0,034
	MOTCOR2	-0,045	0,088	0,043	0,469	-0,184	-0,140	-0,005
*	MOTCOR3	0,077	-0,005	0,045	-0,220	0,014	0,073	-0,129
	MOTCOR4	-0,012	-0,067	-0,039	-0,433	-0,004	-0,072	0,063
*	MOTCOR6	0,057	-0,031	-0,050	-0,308	0,288	0,145	-0,114
	SODDCOER	0,056	-0,025	-0,531	-0,054	-0,181	-0,151	-0,583
	SODDICUL	0,039	-0,022	-0,184	-0,033	-0,128	-0,178	-0,728
	SODDPROF	0,042	-0,013	-0,102	-0,039	-0,087	-0,090	-0,791
	SODDTOT	0,070	0,017	-0,081	0,031	-0,106	0,090	-0,716
	COMPETEN	-0,066	0,010	0,932	-0,006	0,183	0,051	0,244
	OKUNIV	0,050	-0,103	-0,142	0,056	-0,840	-0,069	-0,230
	OKCOR	0,122	-0,050	-0,190	0,067	-0,881	0,022	-0,179
*	CERNWLAV	-0,039	0,008	0,185	-0,018	0,234	-0,246	0,393
	IPREISC	0,114	-0,052	-0,154	0,110	-0,739	0,005	-0,193

Table 3. *Measurement section suggested by the explorative factorial analysis*

A	Quality of relationship with professors, assistants, non-teaching staff, fellow students.
B	Evaluation of classrooms, libraries, laboratories, canteens.
C	Level of usage of skills acquired at university.
D	Reason for attending university and choosing particular subjects.
E	Opinion concerning the hypothesis of attending university again and studying the same subjects.
F	Intention to continue studies and educational activities.
G	Satisfaction regards coherence with the studies taken, conformity with own cultural interests, acquisition of skills, overall satisfaction of work carried out.

As an alternative, we performed a confirmative factorial analysis taking into account the results obtained with the explorative one, but certain modifications were applied according to the considerations that led to implementation of the ECSI model devised in the beginning (see *Table 4*).

Table 4. *CFA model modified according to the EFA one: description of the measurement section.*

IMAG:	MOTISCR1 MOTISCR2*-0.68 MOTISCR3*0.264
EXPE:	MOTCOR2 MOTCOR4 MOTCOR6
QUAHW:	STRAULE STRBIB*1.06 STRLAB*0.817 SERMENSE*0.568
QUAUW:	RAPDOC RAPCOL*0.98 RAPNDOC*0.815 RAPSTUD*0.554
VALU:	SODDCOER SODDICUL*0.884 SODDPROF*0.876 SODDTOT*.755
SATI:	OKUNIV OKCOR*1.006 IPREISC*.913
LOYA:	INT_STUD ATTFORM*1.163

The values given by normal adaptation indices denote a model that is capable of describing the matter in question in a more satisfactory manner (TFI = 0.984 e RMSEA = 0.028).

This result permitted us to consider sufficiently reliable the measurement section detected and, consequently, to concentrate solely on the structural section, estimating causal links between the latent components identified in order to verify the presence and intensity of the relationships expected initially and illustrated in **Figure 2**.

4.3. Structural Equation Models

The CFA model was therefore re-configured into a *complete* ECSI-SEM model, specifying the regression equations between the latent components. The term ‘complete’ is used to describe the particular configuration assumed by the causal links between the latent components, because of its typical temporal and sequential features. That is to say, in the complete model every factor on the left of the graph is presumed to be capable of exerting both a direct and an indirect influence on all the factors on its right; for example, all the theoretic causes of consumption experience (IMAG, EXPE, QUAHW, QUAUW) are believed to be able to explain both the actual components of the satisfaction (VALU e SATI) and the loyalty (LOYA) that

results as its immediate consequence. Moreover, since it is quite reasonable to presume that the consumption experience can activate a cognitive process whereby a value is attributed to a product or service 'purchased' before the arousal of actual feelings of satisfaction, it is consequently natural to consider VALU as having a direct effect on SATI and LOYA.

The implementation of a complete model required the addition of certain links with the model originally proposed (see **Figure 3** – the added links are in bold print). As expected, due to the extreme complexity of the structural section, the complete ECSI-SEM model does not converge within an acceptable number of iterations. The estimates produced by the software used are nonetheless useful guidelines for improving the model, since they suggest which causal links have to be eliminated.

Simplifications applied to the structural section for subsequent steps have generated the model shown in **Figure 4**. Even in this case, the values given by normal adaptation indices indicate that the model efficaciously describes the matter under investigation (TFI = 0.982 e RMSEA = 0.029).

Being aware that this procedure is a considerably tricky one and open to criticism, but wishing to define a more satisfactory model from an interpretative point of view, the links that did not result to be statistically significant were eliminated step by step.

Figure 3. *Complete ECSI - SEM model: structural section highlighting the added links.*

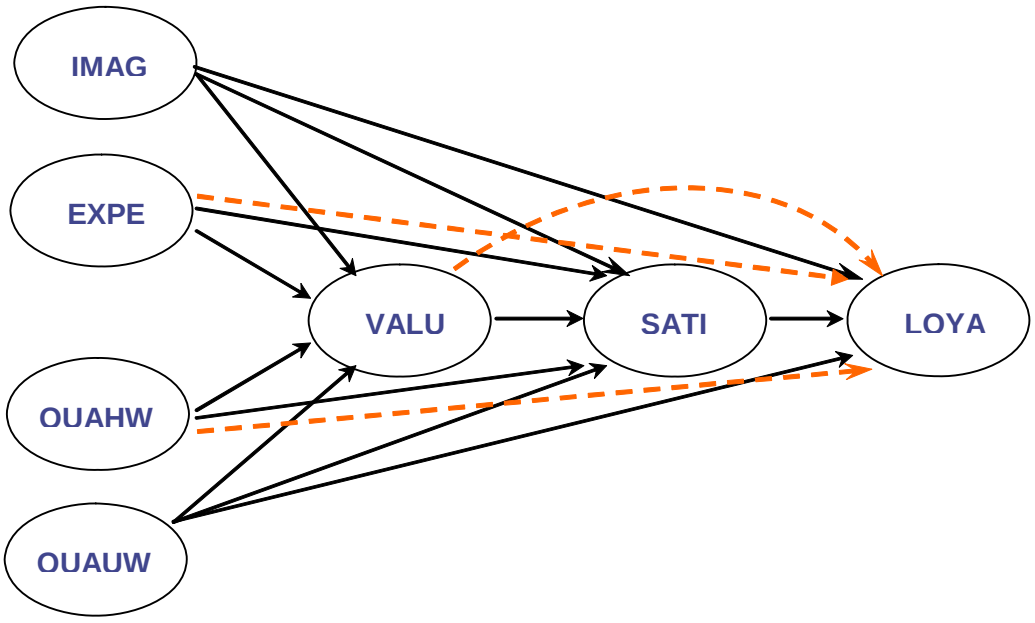
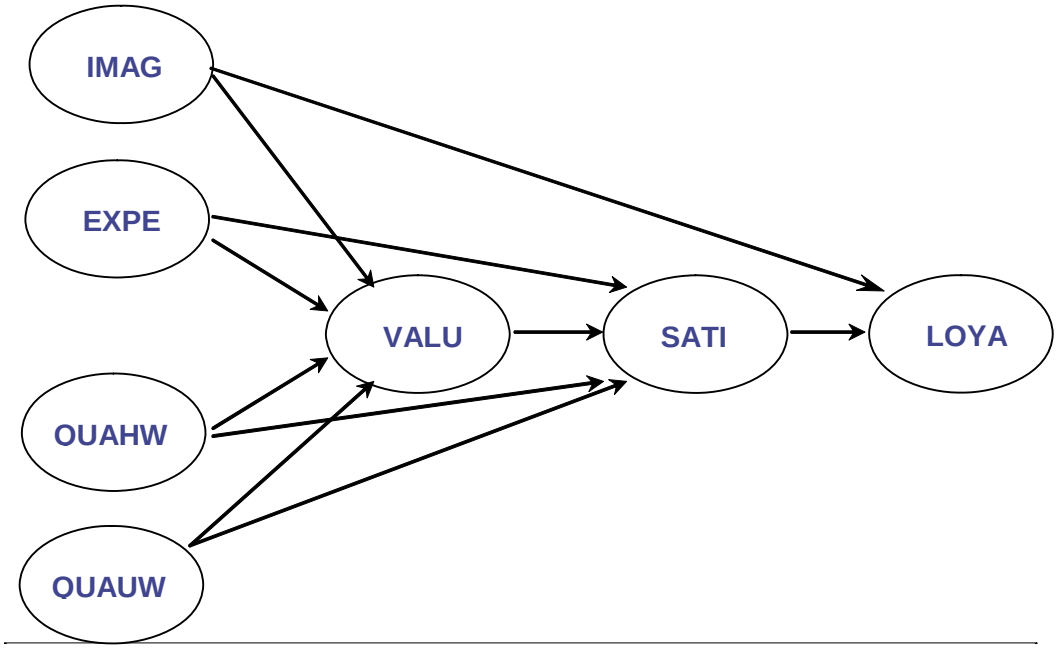


Figure 4. *Structure of the first ECSI-SEM convergence model.*



Not all of the results obtained during this step will be reported here since only the pre-selected result will be discussed; in this respect, it is sufficient to notice that the adaptation indices always emphasised sensitive modifications tending towards the value that represents perfect adaptation.

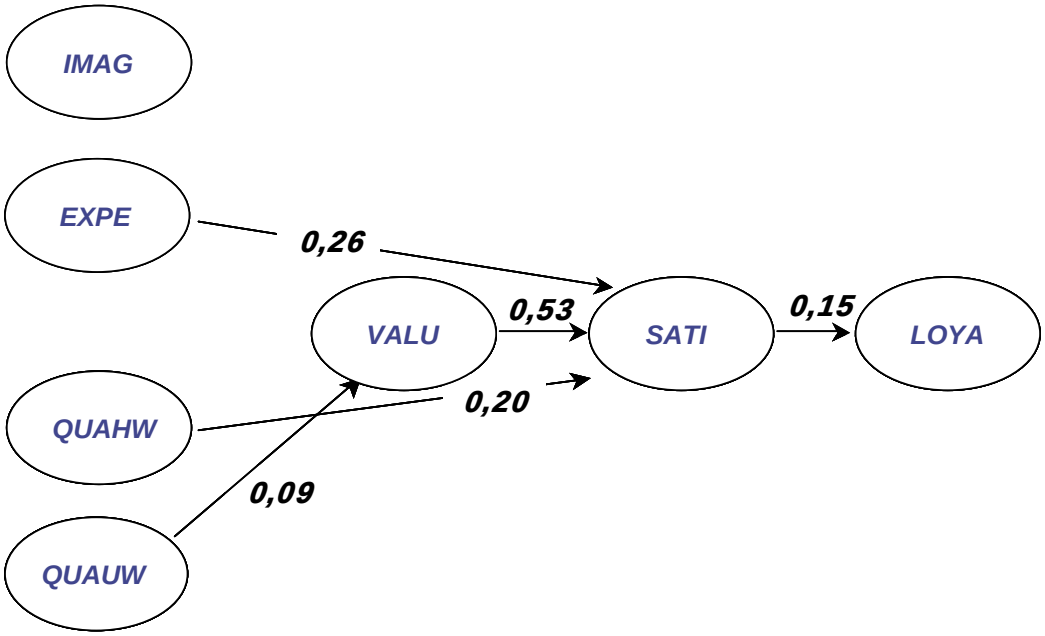
Figure 5 shows the final ECSI-SEM model; that is, the model for which no appreciable improvement resulted. The values of the estimated coefficients are shown on the arrows in the graph that represent the causal links differing from zero: note that the effects all go in the expected direction. This graph does not show the correlation relationships that nevertheless existed between the various latent components. Once again, the good adaptation of the model is substantiated by the values given by the TLI (0.985) and RMSEA (0.027) indices.

5. Conclusions

The subject of this survey on educational activities arose within the Italian university system following the introduction of specific laws (N°168/89 and N°537/93) which foresee internal controls on the efficiency and results – technically know as internal

and external efficacy – of university management. These controls are necessary both for compliance with a correct usage of the resources and for assessing the validity of the education offered. For the past ten years, and especially in recent years, numerous projects for the assessment of university education in terms of efficiency and efficacy have been proposed and performed.

Figure 5. *Structure of the first final ECSI-SEM model.*



Considering this latter aspect, it is quite rational to maintain that an assessment of the success achieved by young university graduates in the world of employment can be considered an acceptable reflection of the quality (external efficacy) of the educational process. This success may be under the form of objective evaluations, like salary and promotion, and subjective ones, such as satisfaction of the various facets of the work performed.

This work is a study on the first application of ECSI-SEM models for the analysis of university education as seen in this respect.

The results of this analysis not only confirm the validity of the application of ECSI-SEM models in this particular context but also stimulate interest towards the implementation of more detailed analyses which, after investigations for estimating this type of model have been devised, will also permit the development of the relative theoretical-methodological aspects.

To start with, a suitable questionnaire could be drawn up to collect opinions concerning satisfaction, to substitute the survey forms used for other types of investigations.

As far as the theoretical-methodological aspects are concerned, an evaluation of the effects caused by the presence of abnormal observations could be performed by a specific application of the forward search algorithm, and also by implementing new models for groups of graduates/under-graduates attending the same faculty, and/or the same courses, in order the verify the presences of peculiarities that cause specific causal links or specific situations of satisfaction. In fact, the authors of this paper intend to proceed in this manner.

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