
MANAGERIAL DECISION IN INNOVATIVE EDUCATION SYSTEMS STATISTICAL SURVEY BASED ON SAMPLE THEORY

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Abstract

Before formulating the statistical hypotheses and the econometric testing itself, a breakdown of some of the technical issues is required, which are related to managerial decision in innovative educational systems, the educational managerial phenomenon tested through statistical and mathematical methods, respectively the significant difference in perceiving the current qualities, knowledge, experience, behaviour and desirable health, obtained through a questionnaire applied to a stratified population at the end, in the educational environment, either with educational activities, or with simultaneously managerial and educational activities. The details having to do with research focused on the survey theory, turning into a working tool the questionnaires and statistical data that are processed from those questionnaires, are summarized below.

Key words: innovative education process, managerial competence, methods in descriptive statistics, econometric testing.

The survey was organized and carried out in five high schools from Arges county, Romania.

Survey objective was to find out the differences and to identify the opinions of teachers, manager teachers and usual population from education system (teachers and manager teachers). The survey pursued by means of methods from descriptive statistics to identify some significant differences regarding the main estimators from those three types of samples, associations and correlations to perceive the qualities, knowledge, behavior expertise and health, as well as evaluations based on specific correlation matrix.

The educational strata selected thematically (the subpopulations and the samples selected from them): they represented the subpopulation and the respective samples for teachers, the subpopulation and sample taken for the teachers-managers, and the general population and the sample taken for the education system, consisting of both teachers and teachers-managers.

The size of the population investigated: Specifically, a research was conducted that was oriented around the opinions and views expressed by three populations (three samples), i.e. a general one, consisting of a group of 97 teachers (hereinafter abbreviated as E97), an ambivalent one, included in the general sample, yet restricted to only 24 people, who simultaneously had the capacity of teachers and that of managers in the innovative education system (abbreviated as E24), and a final sample, encompassing 73 people who were only teachers (abbreviated as E73). Overall, the research thus included 97 teachers (including teachers who were also managers).

Size of the populations selected in the investigation and the practical testing

Type of samples	Abbreviations used	School year 2011-2012 – High school level
Sample of teachers and managers	E24	$n_1 = 73$ teachers
Sample of teachers (exclusively)	E73	$n_2 = 24$ teachers
Sum total of population selected	E97	97 teachers

The specific investigation instrument was a questionnaire. For all the persons that were investigated, i.e. E97, a questionnaire was piloted and completed which contained topics strictly related to the management in innovative educational systems, yet slightly different in terms of personal management involvement (questionnaire 1 for E24), or in terms of assessing the manager's quality (questionnaire 2 for E73)

Discriminant filter question in questionnaires 1 and 2, devoted samples E24 and E73

Questionnaire 1 devised for managers-teachers – E24	Questionnaire 1 devised for teachers – E73
1) Which competences help you in decision-making? a) technical competences / skills; b) interpersonal competences; c) self-improvement competences.	1) What kind of decisions does the manager in your school make? a) right decisions; b) wrong decisions.

The common body of the questionnaires was structured in keeping with five detailed and scaled specifications:

- *qualities* (intelligence, memory, sense of observation, vision, insight and perspective, flexibility of thinking, positive character traits, powerful and balanced temperament, which generated, by processing, the data series from SER01 to SER07);

- *knowledge* (political and ideological, professional, managerial,

psychological, legal, economic, which generated, after processing, the data series from the SER13 SER08);

- *experience* (in management, professional, political, in the profile of the unit, which generated, by processing, the data series from SER14 to SER17);

- *behaviour* (sociability, principled conduct, responsiveness, politeness / courtesy, proper dress, morality, which generated, by processing, the data series from SER18 to SER23);

- *health* (good, which generated, by processing, the data series SER24).

The scaling was performed in four steps, from indifferent (1 point), desirable (2 points) needed / necessary (3 points), and absolutely necessary (4 points), which enabled us to assess the average score of each alternative response.

The respondents involved in the questionnaire research: The decision-making managerial activity in innovative educational processes was investigated among the teachers in high schools, which represented the location where the research was conducted, and also among the managers in the innovative educational system who were involved in the management of educational entities.

Processing the results of the questionnaire survey: The results of the statistical and mathematical tests were processed using the software package EViews (available as demo version at website: <http://www.eviews.com>, drawing on the descriptive statistics, histograms and Kernel type graphs of this program, which describe and rigorously approximate the statistical distribution of frequencies based on specific probability densities; and to do the statistical and mathematical testing, the *z* test was used, by means of which the averages of the experimental sample (pre and post experiment) were compared with the control sample, starting from the relatively large size of two of the three samples ($n > 30$ for both E73 and E97). To test the normality of the empirical data distributions the Jarque–Bera test was exploited, as determined with the EViews software package, in addition to the values of the descriptive statistics. The Jarque–Bera test is a test devised to check the normality hypothesis of a data series (Jarque – Bera, 1987). The admissible hypotheses of the test are: H_0 , i.e. the data series follows a normal distribution, and H_1 : the data series does not follow a normal distribution, while the test statistic is given by: $JB = \frac{n-k}{6} + (S^2 + \frac{(K-3)^2}{4}) \frac{n-k}{6} + (S^2 + \frac{(K-3)^2}{4})$, where: n = number of observations, k = number of explanatory variables, S = coefficient of asymmetry (skewness), K = coefficient of vaulting (kurtosis). The statistic

of the Jarque–Bera test (JB) asymptotically follows the χ^2 distribution with 2 degrees of freedom. The critical value of the Jarque-Bera test for a statistical significance level of 0.05 is 5.99, and for 0.01 it is 9.21, i.e., if JB statistic calculated for all series or distributions of empirical data of the note variable greater than 5.99, the null hypothesis is rejected (H_0 : the series is normally distributed), with a confidence level in 95 cases out of 100; and for values higher than 9.21, the normality hypothesis is rejected for the data series with guaranteed probability in 99 cases out of 100.

The final report of the way the research was conducted includes the synthesis of the approach and procedures, the conclusions of the test and the whole of the statistical investigation, from which the key issues were extracted, including the major conclusions concerning the argumentation, based on the processed data of the questionnaire, of the significant differences between the opinions of the teachers-managers in E24 and those of the teachers in E73, with clear reference to the need for specialized studies that homogenize and differentiate, very much as the present experiment successfully did, the subpopulation of teachers-managers from the subpopulation of teachers. In the practical framework of the present research, the authors opted for the extensive econometric testing, consisting of ten steps, that of the statistical hypothesis of the existence of significantly different views in the population of teachers-managers in relation to the population of teachers.

The results obtained by statistical research and related discussions

Collecting and processing the data, as well as estimating the parameters useful for the econometric testing was done, eventually, by means of the Eviews software package, in a detailed manner, for the three selected populations, abbreviated as E24, E73 and E97.

Collecting and processing the data, and estimating the parameters useful for the testing in E24 (SER01-12)

	SER01	SER02	SER03	SER04	SER05	SER06	SER07	SER08	SER09	SER10	SER11	SER12
Mean	3.791667	3.541667	3.500000	3.416667	3.416667	3.166667	3.333333	1.958333	3.916667	3.666667	3.416667	2.750000
Median	4.000000	4.000000	4.000000	4.000000	4.000000	3.000000	4.000000	2.000000	4.000000	4.000000	3.500000	3.000000
Maximum	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	3.000000	4.000000	4.000000	4.000000	4.000000
Minimum	2.000000	2.000000	2.000000	1.000000	1.000000	1.000000	2.000000	1.000000	3.000000	3.000000	2.000000	1.000000
Std. Dev.	0.508977	0.658005	0.589768	0.829702	0.775532	0.816497	0.816497	0.624094	0.282330	0.481543	0.653863	0.846990
Skewness	-2.377734	-1.090707	-0.649519	-1.362931	-1.430903	-0.797794	-0.670872	0.022204	-3.015113	-0.707107	-0.639912	-0.383742
Kurtosis	7.788205	3.040230	2.437500	4.211967	5.005806	3.260870	1.882798	2.669659	10.09091	1.500000	2.419132	2.685950
Jarque-Bera	45.54139	4.760188	2.003906	8.899190	12.21319	2.613956	3.048420	0.111097	86.64463	4.250000	1.975355	0.687658
Probability	0.000000	0.092542	0.367162	0.011683	0.002228	0.270637	0.217793	0.945966	0.000000	0.119433	0.372441	0.709050
Sum	91.00000	85.00000	84.00000	82.00000	82.00000	76.00000	80.00000	47.00000	94.00000	88.00000	82.00000	66.00000
Sum Sq. Dev.	5.958333	9.958333	8.000000	15.83333	13.83333	15.33333	15.33333	8.958333	1.833333	5.333333	9.833333	16.50000
Observations	24	24	24	24	24	24	24	24	24	24	24	24

Soft used: Eviews

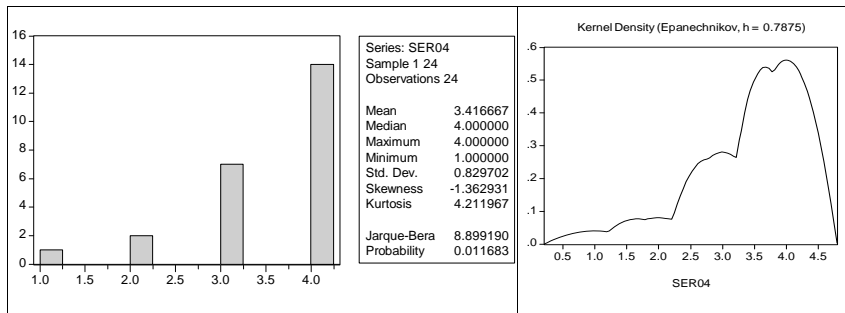
**Collecting and processing the data, and estimating the parameters
useful for the testing in E24 (SER12-24)**

	SER13	SER14	SER15	SER16	SER17	SER18	SER19	SER20	SER21	SER22	SER23	SER24
Mean	2.375000	3.083333	3.750000	2.083333	3.458333	3.500000	3.416667	3.333333	3.125000	3.250000	3.583333	3.500000
Median	2.500000	3.000000	4.000000	2.000000	4.000000	4.000000	4.000000	3.000000	3.000000	3.000000	4.000000	4.000000
Maximum	3.000000	4.000000	4.000000	3.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000
Minimum	1.000000	2.000000	3.000000	1.000000	2.000000	1.000000	1.000000	1.000000	1.000000	1.000000	3.000000	1.000000
Std. Dev.	0.710939	0.717282	0.442326	0.583592	0.679028	0.722315	0.880547	0.701964	0.797414	0.846990	0.503610	0.834058
Skewness	-0.660484	-0.117007	-1.154701	0.006207	-0.986707	-1.767767	-1.693144	-1.312546	-0.747265	-0.931944	-0.338062	-1.607478
Kurtosis	2.261186	2.027574	2.333333	2.997284	2.414836	6.750000	5.288584	5.937716	3.353715	3.214876	1.114286	4.734375
Jarque-Bera	2.290802	1.000375	5.777778	0.000161	4.236779	26.56250	16.70457	15.52128	2.358732	3.520251	4.013061	13.34399
Probability	0.318096	0.606417	0.055638	0.999919	0.120225	0.000002	0.000236	0.000426	0.307474	0.172023	0.134454	0.001266
Sum	57.00000	74.00000	90.00000	50.00000	83.00000	84.00000	82.00000	80.00000	75.00000	78.00000	86.00000	84.00000
Sum Sq. Dev.	11.62500	11.83333	4.500000	7.833333	13.95833	12.00000	17.83333	11.33333	14.62500	16.50000	5.833333	16.00000
Observations	24	24	24	24	24	24	24	24	24	24	24	24

Soft used: Eviews

As one can see, there is a dominance of normally distributed data sets as a result of processing the E24 questionnaires, i.e. 17 of the 24 real data sets of statistics have values of the Jarque – Bera test (JB) that are lower than 9.21, which leads us to accepting the hypothesis of normality of these data series with guaranteed probability in 99 cases out of 100. Similarly, comparing the value of the standard deviation from the mean, the fact is found that all series are homogeneous, having a moderate asymmetry, and, in the same proportion of about 2/3, the data series are moderately arched / vaulted. The population of teachers-managers who were selected and interviewed is homogeneous, and show a mindset with a high degree of similarity, according to the opinions processed from the questionnaire survey. The Kernel type histograms and graphs of probability density distributions reinforce the normality and the homogeneity of the opinions and views of the persons making up the sample (E24). This can be illustrated easily by using two data sets out of the 17 normally distributed ones, situated at the maximum and minimum limits of asymmetry (eccentricity and normality of data).

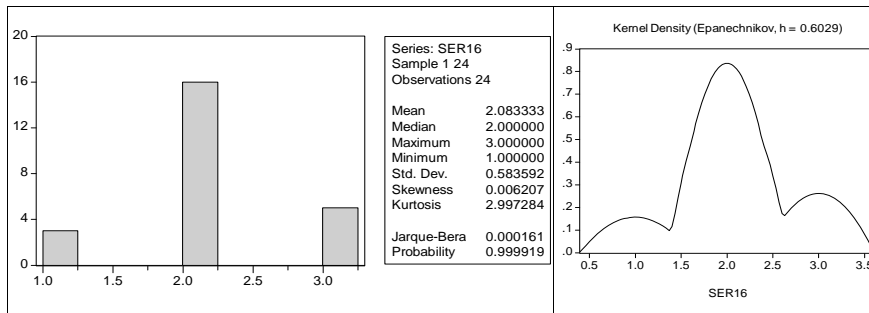
**Histogram and Kernel graph
(SER04 = management quality “vision and perspective”)**



Soft usedt: Eviews

The histogram and the Kernel type graph / chart emphasize the normality of the distribution (its homogeneity, the more pronounced asymmetry, etc.), and identifies a cluster of opinions in the area of the view / opinion that the quality of vision and perspective is essential (4 points)

**Histogram and graph kernel
(SER16 = managerial experience: experience in politics)**

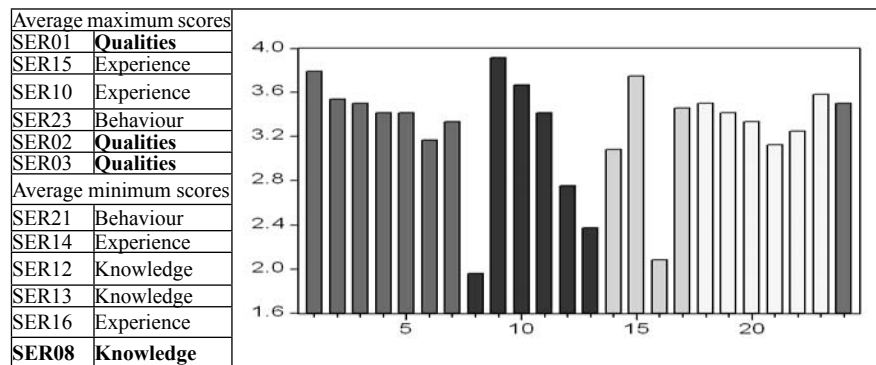


Soft usedt: Eviews

Similarly, the histogram and the Kernel type graph / chart emphasize the normality of the distribution (homogeneity, symmetry and almost perfect arching, etc.), while also identifying a cluster of opinions in the area corresponding to the view / opinion that managerial experience, through its “political experience” component, is less significant, or at best a desirable

quality (2 points). The manner in which the final scores of the E24 opinions are hierarchically ordered is a special analysis of the homogeneity and discrimination specific to managerial thinking in this distinct sample of teachers-and-managers, where the maximum average scores are assigned especially to qualities, and the minimum average scores – to knowledge (the data sets that were not normally distributed, according to the testing, were not considered).

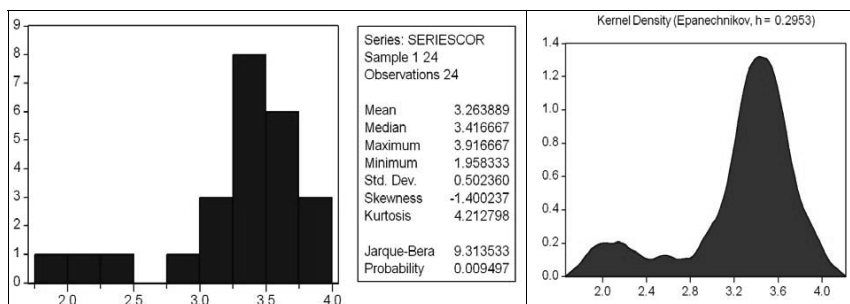
Hierarchies of the opinions of the teachers-managers as to the average scores (E24)



Soft used: Eviews

The columns chart and summarize the 24 variables assessed by those who compose the sample E24 (teachers-managers) through the average score that is structured in keeping with five specifications: a) *qualities* (SER01 – SER07: intelligence, memory, sense of observation, vision, insight and perspective, flexibility of thinking, positive character traits, powerful and balanced temperament); b) *knowledge* (SER08 – SER13: political and ideological, professional, managerial, psychological, legal, economic); c) *experience* (SER14 – SER17: in management, professional, political, in the profile of the unit); d) *behaviour* (SER18 – SER23: sociability, principledness, responsiveness, politeness / courtesy, proper dress, morality); e) *health* (SER24: good).

Histogram and Kernel graph / chart of the average scores data series in E24



Soft used: Eviews

The data series of the average scores, which is less volatile, is close to the limit of normality; it is obviously more homogeneous, and the Kernel type graph / chart shows that the E24 samples of teachers-managers have opinions / views more concentrated or closer.

The manager of the complex educational processes of an innovative type is defined by the high level and importance of their management qualities, focusing on intelligence, by knowledge and experience that are almost exclusively professional, and not least by behaviour focusing on moral issues. Managerial skills and managerial experience are considered important, while the less desirable aspects or skills of this type of manager are related to the political environment (political-ideological knowledge and political experience).

The descriptive statistics of the E73 sample, which includes teachers (exclusively), describes a selected population that is completely opposite to that of the teachers-managers, in accordance with the opinions scaled analogously, and show a dominant of the abnormality of distributions in the data series (i.e. in 20 out of the 24 data series), an overwhelming heterogeneity in over 9/10 of the series (for a maximum limit of 35% of the performance homogeneity coefficient value), an almost totally negative asymmetry, and a very low level of arching / vaulting (describing 23 flattened series), and only one effectively average vaulted or eccentric series.

**Collecting and processing the data, and estimating the parameters
useful for testing in E73 (SER01-12)**

	SER01	SER02	SER03	SER04	SER05	SER06	SER07	SER08	SER09	SER10	SER11	SER12
Mean	2.986301	3.164384	3.027397	3.164384	2.958904	2.945205	3.068493	2.273973	3.123288	3.232877	3.041096	3.000000
Median	4.000000	4.000000	4.000000	4.000000	3.000000	3.000000	4.000000	2.000000	4.000000	4.000000	4.000000	3.000000
Maximum	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000
Minimum	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
Std. Dev.	1.359056	1.178673	1.246914	1.166830	1.252091	1.177219	1.146598	1.157827	1.235417	1.136766	1.218359	1.190238
Skewness	-0.710525	-1.038975	-0.831027	-1.009432	-0.734385	-0.716511	-0.802255	0.262797	-0.992240	-1.208343	-0.821081	-0.746455
Kurtosis	1.609237	2.434822	1.981276	2.396399	1.850111	1.993465	2.118499	1.615393	2.242341	2.873407	2.015482	1.978662
Jarque-Bera	12.02554	14.10514	11.55900	13.50544	10.58356	9.327764	10.19413	6.671549	13.72464	17.81322	11.15068	9.952066
Probability	0.002447	0.000865	0.003090	0.001168	0.005033	0.009430	0.006115	0.035587	0.001046	0.000135	0.003790	0.006901
Sum	218.0000	231.0000	221.0000	231.0000	216.0000	215.0000	224.0000	166.0000	228.0000	236.0000	222.0000	219.0000
Sum Sq. Dev.	132.9863	100.0274	111.9452	98.02740	112.8767	99.78082	94.65753	96.52055	109.8904	93.04110	106.8767	102.0000
Observations	73	73	73	73	73	73	73	73	73	73	73	73

Soft used: Eviews

**Collecting and processing the data, and estimating the parameters
useful for testing in E73 (SER12-24)**

Table no. 4B.

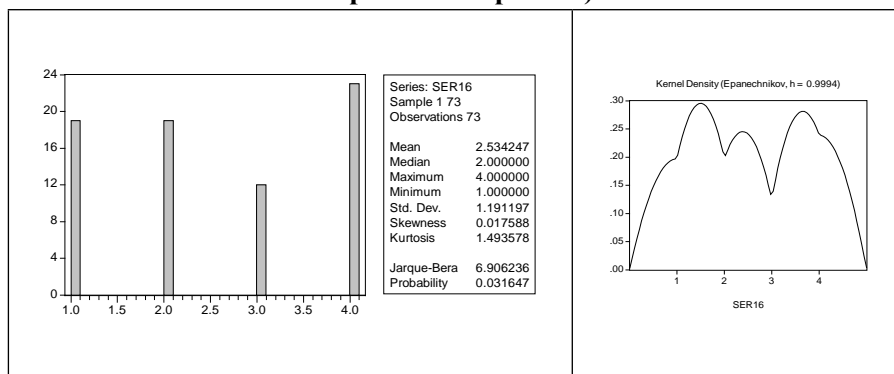
	SER13	SER14	SER15	SER16	SER17	SER18	SER19	SER20	SER21	SER22	SER23	SER24
Mean	2.698630	2.643836	3.260274	2.534247	3.109589	3.000000	3.054795	3.178082	3.136986	2.931507	3.054795	2.917808
Median	3.000000	3.000000	4.000000	2.000000	4.000000	4.000000	4.000000	4.000000	4.000000	3.000000	4.000000	4.000000
Maximum	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000	4.000000
Minimum	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
Std. Dev.	1.138773	1.182862	1.105886	1.191197	1.208323	1.258306	1.200583	1.097250	1.096903	1.239722	1.245998	1.309722
Skewness	-0.355934	-0.296277	-1.272290	0.017588	-0.924750	-0.800219	-0.881452	-1.119224	-1.036211	-0.662343	-0.884801	-0.631852
Kurtosis	1.735068	1.598318	3.097260	1.493578	2.176951	1.921053	2.155583	2.834227	2.682778	1.783468	2.061244	1.615725
Jarque-Bera	6.408207	7.043989	19.72322	6.906236	12.46493	11.33182	11.62181	15.32432	13.36984	9.839003	12.20546	10.68588
Probability	0.040595	0.029540	0.000052	0.031647	0.001965	0.003462	0.002995	0.000470	0.001250	0.007303	0.002237	0.004782
Sum	197.0000	193.0000	238.0000	185.0000	227.0000	219.0000	223.0000	232.0000	229.0000	214.0000	223.0000	213.0000
Sum Sq. Dev.	93.36986	100.7397	88.05479	102.1644	105.1233	114.0000	103.7808	86.68493	86.63014	110.6575	111.7808	123.5068
Observations	73	73	73	73	73	73	73	73	73	73	73	73

Soft used: Eviews

Even in the four normally distributed series (SER08, SER13, SER14, SER16) according to the Jarque–Bera (JB) statistic, through its values lower than 9.21, there is not a single series of homogeneous data. The major conclusion drawn from descriptive statistics is the complete lack of

homogeneity of the opinions of the teachers in the sample E73; that excessive diversity / lack of homogeneity fails to find homogenization factors in the specific, concrete management training (which is mostly non-existent), or in the experiences of managerial decision-making in innovative educational processes). The population selected and interviewed of the teachers (exclusive) offers no opinions of statistical validity. The histograms and the Kernel type graphs of probability density reconfirms the heterogeneity of all five series of apparently normally distributed data in this sample (E73), out of which, as in the case of the sample of teachers-managers (E24), only two series of data were selected, which were situated at maximum and minimum asymmetry limits (i.e. eccentricity and normality of data).

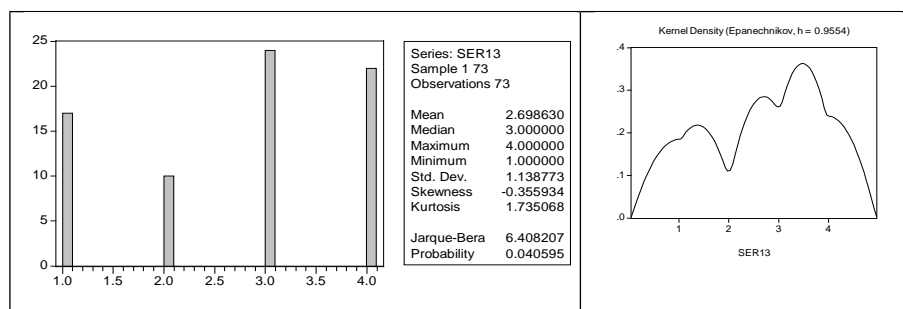
Histogram and Kernel graph (SER16 = managerial experience: experience in politics)



Soft used: Eviews

The histogram and the Kernel type graph emphasize the limit normality of the distribution (meaning more markedly different subpopulations, etc.), and identifies a polarization of opinions in the areas represented by the extreme opinions that the management experience component, through its “political experience”, is less significant, at best desirable (2 points), or absolutely necessary (4 points).

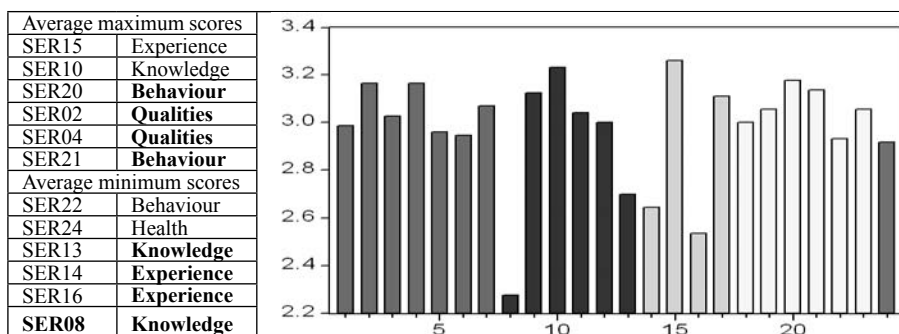
Histogram and Kernel graph (SER13 = economic knowledge)



Soft used: Eviews

The histogram and the Kernel type graph of this data series strongly points to a similar limit normality of distribution, and also to polarization, according to which economic knowledge is the best desirable (1 -2 points), or absolutely necessary (4 points). The way in which the final scores of the opinions / views in E73 are hierarchically ordered reveals interesting conclusions concerning their lack of homogeneity, and the discrimination specific to the thinking of this distinct sample group of teachers, where the maximum average scores are assigned simultaneously and indecisively both to behaviour and to certain attributes of the manager in innovative educational processes, and the minimum average scores characterized by knowledge and experience are assigned in an equally undecided manner (all the major data series were considered, which were abnormally distributed in keeping with the test).

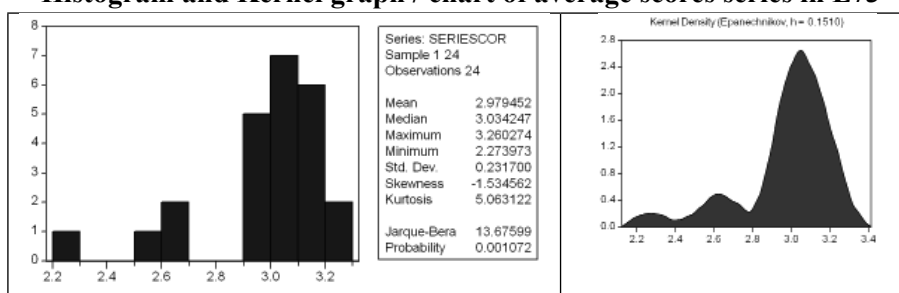
Hierarchies of the opinions / views of the teachers (exclusively) in keeping with the average scores (E73)



Soft usedt: Eviews

The columns represent the same 24 standard variables assessed by those who make up the E73 sample, including teachers (exclusively), through the average score, divided in accordance with the same specifications.

Histogram and Kernel graph / chart of average scores series in E73



Soft usedt: Eviews

Although less volatile, the data series of mean scores significantly exceeds the normality limit, but it remains more homogeneous with respect to individual values as expected; instead, asymmetry and excess vaulting are steeper, while the Kernel type graph / chart shows that the E73 sample of teachers (exclusively) express opinions that are much more varied, or rarely similar opinion, (triple graphic polarization for the teachers, instead of the classical visual polarization for the teachers-managers), giving no substance and statistical credibility to decision-making management in processes innovative educational.

The manager of complex educational processes of an innovative type is defined, paradoxically and alternatively, by the population of the teachers selected in E73, through their professional experience as the first criterion (which can describe, by extension, a long-term continuance of the manager in the system, a fact that has long-term negative effects, as we have to do here with essentially innovative educational processes), and also in an ambiguous manner, between the requirements of behaviour and appropriate qualities. Memory, along with vision and perspective, are amalgamated undecidedly, in the educational manager's decision-profile, with purely formal behavioural or communication aspects (receptiveness and politeness). However, managerial skills and managerial experience are important within this profile, but the less desirable aspects or competences / skills of this type of manager are, in the opinion of the teacher included in E73, correct, appropriate dress, economic knowledge, good health and management experience, and those related to the political environment (political-ideological knowledge and political managerial experience) are maintained.

Step 2. The statement of the admissible hypotheses consists in formulating the null hypothesis and the alternative hypothesis.

The null hypothesis to be tested in this investigation may take the form: H_0 : mean score E24 = average score E73, suggests that the two types of opinion as to the average score of 24 issues analysed are relatively similar, and the alternative hypothesis is transcribed by: H_1 : mean / average score E24 \neq mean / average score E73 supports the opposite view, i.e. the mean scores of the opinions in E24 and E73 samples are significantly different. The target of this applied research is to demonstrate that the teachers-managers' opinions in E24 are significantly different from those of the teachers (exclusively) in E73. This has become a valid alternative hypothesis, which substantially supports the idea that manager training and experience in innovative educational processes enable the performance and efficiency of contemporary education.

It follows that a change of opinion can be obtained from the teachers only through training (*knowledge*) in the field of management and decision-making, and the *experience* acquired in keeping with the example of innovative educational project management, especially where there are both the qualities, and the behaviour specific to a potential manager.

Therefore, the aim of this research, conducted in order to test, by econometric means, the null hypothesis formulated and the adequate statistical decision, is actually seeking to reject the null hypothesis in favour of the alternative one, for the purposes of validating a significant difference in the average score of the teachers-managers in E24 compared to the teachers in E73.

Step 3. Selecting a test based on the empirical distribution investigated and confirming the theoretical distribution assimilated to the test is a

subiteration exemplified below by choosing test t instead of test z (the *Student* distribution instead of the *low or normal* distribution).

Step 4. Clarification of option for a significance level (α) and the type of test, unilateral or bilateral. The option for the level of signification or relevance / materiality also involves the option for the type of test, unilateral or bilateral (*one- or two-tailed*), in relation to which the region of rejection is defined. In general, a 5% error level is considered adequate for general research (its relevance / materiality may be $\alpha = 0.05$). The test applied was two-tailed / bilateral (alternative hypothesis H_1 : mean / average score E24 \neq mean / average score E73).

Step 5. Customizing the rejection region through limit values or critical values is done for a given significance level (α), and as a result of consulting the theoretical (table) values of that test (in this case, the z test), finally identifying the value of z_{tabled} . Calculating the degrees of freedom is identical with the sample size or the number of notes decreased by 1, or $(n-1)$, and in the experiment, a 5% significance level can be considered sufficient for the experiment ($\alpha = 0.05$), for which the level of guaranteeing the results, as the cumulative probability level, would be $(1-\alpha) = 0.95$. At this stage, the critical value of the z test or the critical score of z for $\alpha = 0.05$ is ± 1.64 and ± 2.23 for $\alpha = 0.01$, respectively.

Step 6. The calculation of the value of the test statistics based on actual data is completely different not only from one test to another, but also within the same test with the admissible hypotheses stated. *The classical test of normal distribution, or z test* is frequently used for large samples (> 30 u.s.). In the z test, between two estimators the random variable $z \in N(0,1)$, hence it follows a normal (standard) distribution. *The specific calculation relation of the z test statistic (the formula for the practical assessment of z calculated) is specific to the situation where there are two unequal, independent samples of normal or high volume (E24 and E73), with unequal variances:*

$$z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{S_1^2/n_1 + S_2^2/n_2}}$$

The regulation of the decision to reject the null hypothesis H_0 is provided by the following situations: $\frac{\bar{x}_1 - \bar{x}_2}{\sqrt{S_1^2/n_1 + S_2^2/n_2}} < -Z_{\alpha/2}$ sau $\frac{\bar{x}_1 - \bar{x}_2}{\sqrt{S_1^2/n_1 + S_2^2/n_2}} > Z_{\alpha/2}$. Twenty-four tests are required for all twenty-four mean scores of the two samples.

The values of the statistic of the z test tabled or theoretical, and z calculated for the 24 data series

The scaled qualitative variable – data serie with an equivalent average score			z calculated	z tabled or theoretical
Qualities	Intelligence	– SER01	4,2390	±1,64
	Memory	– SER02	1,9595	±1,64
	Sense of observation	– SER03	2,4891	±1,64
	Vision and perspective	– SER04	1,1596	±1,64
	Flexibility of thinking	– SER05	2,1220	±1,64
	Positive character traits	– SER06	0,9825	±1,64
	Powerful balanced temperament	– SER07	1,2377	±1,64
Knowledge	Political and ideological	– SER08	-1,6971	±1,64
	Professional	– SER09	5,0970	±1,64
	Managerial	– SER10	2,6224	±1,64
	Psychological	– SER11	1,9229	±1,64
	Legal	– SER12	-1,1260	±1,64
	Economic	– SER13	-1,6425	±1,64
Experience	Managerial	– SER14	2,1951	±1,64
	Professional	– SER15	3,1032	±1,64
	Political	– SER16	-2,4589	±1,64
	In the profile of the unit	– SER17	1,7611	±1,64
Behaviour	Sociability	– SER18	2,3993	±1,64
	Principledness	– SER19	1,5861	±1,64
	Responsiveness	– SER20	0,8069	±1,64
	Courtesy	– SER21	0,2788	±1,64
	Proper attire	– SER22	1,4111	±1,64
	Morality	– SER23	2,9623	±1,64
Health	Good	– SER24	2,5413	±1,64

Step 7. Comparing the calculated value of the test statistic with theoretical or tabled value (standardized normal distribution z). The critical region is bounded distinctly in the following cases: a) two-tailed test ($z_{\text{calculated}} < -z_{\text{tabled}}$ or $z_{\text{calculated}} > z_{\text{tabled}}$); and z tabled is ± 1.64 ; in the region of acceptance of the null hypothesis there are only eight data series referring to as many variables: SER04, SER06, SER07, SER12, SER19, SER20, SER21 and SER22.

The remaining 16 data series, obtained by comparison with the critical region, are placed to the left of the value $-z_{\text{tabled}}$ or -1.64 , or to the right of the value z_{tabled} , respectively 1.64. In the example given for SER01 $z_{\text{calculated}} = 4.2390 > z_{\text{tabled}} = 1.64$; the null hypothesis is rejected and the alternative hypothesis is accepted, i.e. that there are significant differences between the opinions of the teachers-managers and those of the teachers (exclusively), with reference to: a) *the following qualities*: intelligence, memory, sense of observation and flexibility of thinking; b) *the following pieces of knowledge*: political and ideological, professional, managerial, psychological and

economic; c) *the experience* in management, professional experience, political experience, experience in the profile of the unit; d) *the behaviour* described by sociability and morality; e) good *health*.

Step 8. Regulation of the statistical decision, by establishing detailed rules for validation of the null hypothesis, assumes an unambiguous formulation of sets of distinct interpretations in relation to the bilateral test in this concrete case. For variables SER04, SER06, SER07, SER12, SER19, SER20, SER21 and SER22 the null hypothesis was accepted, the opinions of the samples of teachers-managers and teachers (exclusively) being similar in terms of the procedure of econometric testing of the the statistical hypotheses formulated, with the value of the statistic of the z test $z_{\text{calculated}}$ placed within the acceptance region, i.e. within the range (-1.64, 1.64). The 16 remaining data sets assume values of the $z_{\text{calculated}}$ test statistic in the critical region, i.e. are placed to the left of the value $-z_{\text{tabled}}$ or -1.64 , or to the right of the value of z_{tabled} , i.e. 1.64, the null hypothesis being rejected.

Step 9. Assuming the statistical decision concerning the hypotheses formulated (acceptance or rejection) will be done in accordance with the comparable values, and with the probability that is commonly communicated by the specialized computer software packages. *However, it can be concluded that the defining element in taking the final decision is the fact that, up to 66.7% of the opinions of the teachers-managers differ from the opinions of the teachers (exclusively) on both the decision and the management of innovative educational processes.*

Step 10. Formulating the final decision and the consequences in educational terms represent the practical essence, the very core of the econometric testing of the statistical hypotheses. The null hypothesis was rejected at the level of 16 variables out of 24 variables; the opinions of the teachers-managers, who make up a distinct population compared with the teachers (exclusively) are, in a dominant proportion, convergent, normally distributed, homogeneous and slightly asymmetrical. They describe the need that, in the specific managerial decision of the innovative educational processes, there should occur a change of opinion (converging towards the teachers-managers) which may be obtained from the teachers (exclusively) either by managerial and decision-making training (*knowledge – significantly different, in terms of mean score, between E24 and E73*), and the experience (*fully and significantly different at the level of the attributes as a mean score between E24 and E73*), an experience that can be gained according to the example of innovative educational project management, especially where there are both qualities and behaviour specific to a potential manager.

Conclusions

This practical application, which sought to evaluate the significantly different opinions of the managers-teachers compared with those of the teachers (exclusively) also allowed a nuanced approach to the concepts of innovation and invention, which can be adapted to education as an innovative process, rethinking innovation in general, and transforming the industrial exploitation specific to technical and economic innovations (Roberts, 2007), into a practical (innovative) application to the educational process. Thus, innovation in innovative education is also composed of two parts: generating an idea or an invention in the educational process, followed by turning that idea into an application useful in education, the new thinking is translated into contemporary education through the synthesizing scheme: educational innovation = invention in education + practical (innovative) application in the educational process. The invention process involves all the decision-making and managerial efforts to stimulate the creation of new ideas and obtaining functional ones, and the process of practical application refers to the innovative efforts to develop, in the educational practice, ideas or inventions, their application and transfer, including focusing ideas or inventions on specific educational objectives, the assessment of those objectives, possibly extensively using, disseminating and distributing the results according to the labour market and its educational expectations.

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