APPLICATION OF CHI SQUARE TEST IN MARKETING RESEARCH

CODRUȚA DURA, IMOLA DRIGĂ *

ABSTRACT: *The paper brings into focus the usefulness of chi square test in the field of marketing research. A chi square test represents a statistical tool based on the chi-square distribution of probability, which is easy to apply by a non-mathematician researcher in order to provide an efficient business solution. Therefore, the paper discusses chi-square test requirements and methodology, along with conditions that determine the researcher in marketing to reject or to retain the null hypothesis. Further on, we aim at solving a specific marketing problem with the help of the chi-square test. Our approach involves both" the classical" procedure employed in order to apply a chi-square test and the modern way of finding the solution, which implies the involvement of the SPSS soft.*

KEY WORDS: *chi square test, SPSS, null hypothesis, cross-tabulation.*

JEL CLASSIFICATION: *C14, M21, M31.*

1. INTRODUCTION

The gradual integration of statistical instruments into the practical management of companies of different sizes represents one of the most obvious trends nowadays, manifested strongly in the domestic business environment, but especially on the international business scene. The phenomenon of globalization is organically interwoven with the unprecedented expansion of information and communication technologies, on the background of the exponential growth of the amount of information that operates on all levels of economic and social life. Being in full process of the transition from the industrial society to the information society, humanity is facing the imperative of identifying efficient solutions for the scientific basis of the complex managerial decisions adopted at macro, meso or microeconomic level. This is why the analytical and predictive mathematical apparatus made available by statistical

* *Assoc. Prof., Ph.D., University of Petroşani, Romania, codrutadura@yahoo.com*
Assoc. Prof., Ph.D., University of Petroşani, Romania, imola.driga@gmail.com

science becomes an indispensable instrument of modern management. The necessity of using statistical analyses and modern forecasting instruments in the economic activity was the one that triggered the emergence of programs that offer the possibility of processing an impressive volume of data in an extremely short period of time and with insignificant processing errors. This is why, in our approach that represented the basis of the conception of the present paper, we chose a practical procedure that effectively serves the objectives of data analysis and processing in the economic field, based on both classical statistical solutions and the use of SPSS computer system.

2. CHI SQUARE MODEL

The χ^2 test is used in order to determine the relation of concordance or the significance of the connection between two variables in a certain dependency relation. In this way, we can determine whether a random distribution of a survey sample is in accordance with the theoretical χ^2 distribution associated with the variables under investigation. The application of the χ^2 test has the null hypothesis (H_0) as a starting point. According to this hypothesis, variable X does not depend on Y and the correlation coefficient between the two variables does not differ significantly from zero. Symbolically, we can write this as follows:

- **H_0**: There is no connection between variables X and Y (and the correlation coefficient *r = 0*);
- **H_1**: Variables X and Y are interdependent (correlation coefficient *r # 0*);

After applying the χ^2 test by performing the statistical calculations that the use of this method entails in the economic practice, we will be able to decide whether the null hypothesis can be accepted, or whether it should be rejected, taking into account, in this case, the alternative hypothesis H_1.

In order to perform such an analysis, the available data are systematized by means of a *contingency table* with *r* rows and *k* columns (see table 1).

Table 1. Contingency table for applying the χ^2 test

Y \ X	**X_1**	**X_2**	**…**	**X_j**	**…**	**X_k**	**Σ**
Y_1	O_{11} (A_{11})	O_{12} (A_{12})	… …	O_{1j} (A_{1j})	… …	O_{1k} (A_{1k})	**N_1**
Y_2	O_{21} (A_{21})	O_{22} (A_{22})	… …	O_{2j} (A_{2j})	… …	O_{2k} (A_{2k})	**N_2**
…	…	…	…	…	…	…	…
Y_i	O_{i1} (A_{i1})	O_{i2} (A_{i2})	...	O_{ij} (A_{ij})	...	O_{ik} (A_{ik})	**N_i**
…	…	…	…	…	…	…	…
Yr	O_{r1} (A_{r1})	O_{r2} (A_{r2})	…	O_{rj} (A_{rj})	…	O_{rk} (A_{rk})	**N_r**
Σ	**C_1**	**C_2**	**…**	**C_j**	**…**	**C_k**	**N**

In the economic practice, in order to apply a χ^2 test, one must complete the following steps:

1) *Formulation of the null hypothesis H_0,* according to which the frequencies of the studied populations do not show significant differences. Alternative hypothesis H_1 states that the frequencies are not all equal (so the survey distribution does not match the theoretical one or there is a connection between the analysed variables);

2) *Choosing of the level of significance α* (the maximum probability of error admitted, which, in general, for marketing studies is $\alpha = 0,05$);

3) *Extracting random samples from the studied populations and calculating the observed frequencies* (noted as O_{ij});

4) *Calculating the expected theoretical frequencies* (noted A_{ij}) assuming that the hypothesis H_0 would be true, with the help of the relation:

$$A_{ij} = \frac{N_i \cdot C_j}{N} \tag{1}$$

where:

N_i – the totals of the rows in the contingency table ($N_i = \sum_{j=1}^{k} O_{ij}, i = \overline{1,r}$);

C_j – the totals of the columns in the contingency table ($C_j = \sum_{i=1}^{r} O_{ij}$, $j = \overline{1,k}$);

N - the overall total of the contingency table. ($N = \sum_{i=1}^{r}\sum_{j=1}^{k} O_{ij}$)

5) *Calculating the critical value* χ^2_{calc} by using the formula:

$$\chi^2_{calc} = \sum_{i=1}^{r}\sum_{j=1}^{k} \frac{(O_{ij} - A_{ij})^2}{A_{ij}} \tag{2}$$

In practice, in order to make calculations easier, the equivalent relation is also used:

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{k} \frac{O_{ij}^{\ 2}}{A_{ij}} - N \tag{3}$$

6) *Comparing the value $\chi^2_{calculated}$ with the value $\chi^2_{theoretical}$* obtained from the χ^2 distribution table for a number of (r - 1) • (k-1) degrees of freedom.

The decision rule is as follows:

- **H_0** is accepted if $\chi^2_{calc} \leq \chi^2_{thoretical}$;
- **H_0 is rejected and H_1** is accepted if $\chi^2_{calc} > \chi^2_{theoretical}$.

In order to measure the degree of association between the variables of a contingency table (with more than two lines or two columns), the contingency coefficient C can be calculated with the relation:

$$C = \sqrt{\frac{\chi^2}{\chi^2 + N}} \tag{4}$$

The higher C is, the stronger the connection between variables. A minimum value of zero indicates total independence between variables. However, the maximum value can never be equal to 1 (which is one of the main disadvantages of using the contingency coefficient). Of course, there are other indicators by which the intensity of the link can be determined, indicators that we will exemplify in the section 4 of this paper.

3. THE CHI-SQUARE TEST APPLIED IN ORDER TO SOLVE A MARKETING PROBLEM - THE CLASSICAL APPROACH

We will consider in the following a research undertaken by the marketing department within a publishing house, during a book exhibition. The survey is performed on a sample of 800 people who participated in the event. The study aimed to obtain information on the consumer segments targeted by the book offer. The research provided the distribution of the respondents according to the level of education, the environment of origin and the status of buyer / non-buyer in relation with the offer of the publishing house (table 2).

We will apply the χ^2 test in order to verify a dependency relation between the quality of buyer / non-buyer and the environment of origin, respectively the level of education of the respondents. To verify the null hypothesis, we will consider a significance level $\alpha = 0.01$.

Table 2. Empirical data resulting from the research on the field undertaken by the marketing department of the publishing house

Specifications	The environment of origin		Total	Level of education			Total
	Urban	Rural		Elementary	Middle	Superior	
Buyers	280	145	425	100	135	190	425
Non-Buyers	220	155	375	140	125	110	375
Total	**500**	**300**	**800**	**240**	**260**	**300**	**800**

Source: Data considered to be obtained from the research on the field

From the data contained in the above table, it follows that the environment of origin and the level of education of the respondents exert a certain influence on the purchase decision; for example, the proportion of buyers is higher among people in urban areas compared to those living in rural areas (56% versus 48.3%). Similarly, the proportion of buyers is higher among the visitors with higher education level compared to the other categories.

However, since it is a selective research and not a total observation, it is to be determined whether the differences reported in terms of buyer / non-buyer of books status are statistically significant. The methodology of applying the χ^2 test will be repeated for the two criteria taken into consideration:

1) *Environment of origin*

Stage 1. *Formulation of H_0 hypothesis*: "*The decision to buy a book is not influenced by the environment of origin of the potential reader*". This hypothesis corresponds to the theoretical frequencies of A_{ij}.

Stage 2. *Calculation of expected values to occur according to the null hypothesis*. We shall apply the mathematical formula denoted by (1). The null hypothesis will be rejected if the theoretical frequencies differ significantly from the observed frequencies O_{ij}.

$$A_{11} = \frac{N_1 \cdot C_1}{N} = \frac{425 \cdot 500}{800} = 265{,}62$$

$$A_{12} = \frac{N_1 \cdot C_2}{N} = \frac{425 \cdot 300}{800} = 159{,}37$$

$$A_{21} = \frac{N_2 \cdot C_1}{N} = \frac{375 \cdot 500}{800} = 234{,}37$$

$$A_{22} = \frac{N_2 \cdot C_2}{N} = \frac{375 \cdot 300}{800} = 140{,}62$$

In the table 3, the expected frequencies were written in each box, together with the observed frequencies, resulting from the field research.

Table 3. Calculation of observed frequencies for the variable "environment of origin"

Specifications	Environment of origin		Total
	Urban	Rural	
Buyers	280 (265,62)	145 (159,37)	**425**
Non-Buyers	220 (234,37)	155 (140,62)	**375**
Total	**500**	**300**	**800**

Source: author's calculations

Stage 3. *Calculation of χ^2 statistics:*

$$\chi_c^2 = \sum_{i=1}^{r}\sum_{j=1}^{k} \frac{(O_{ij} - A_{ij})^2}{A_{ij}} = \frac{(280-265{,}62)^2}{265{,}62} + \frac{(145-159{,}37)^2}{159{,}37} + \frac{(220-234{,}37)^2}{234{,}37} +$$

$$+ \frac{(155-140{,}62)^2}{140{,}62} = 0{,}78 + 1{,}29 + 0{,}88 + 1{,}47 = 4{,}42$$

Stage 4. *The determination of the χ^2 theoretical value*

The theoretical value of χ^2 corresponds to a 99% guaranteed probability for the result and a level of significance α = 0.01. The number of degrees of freedom is equal to (r - 1) (k - 1) where with "r" and "k" represent the number of lines, respectively columns, of the contingency table (corresponding to the number of alternatives for each of the two variables). Since *(r - 1) (k - 1) = 1* and α = 0.01 -

significance level, we extract the sought value from the distribution theoretic table; this is $\chi^2_{tab1;0,01} = 6,235$

Stage 5. *Conclusion*

Since $\chi^2_{calc} \prec \chi^2_{tab1;0,01}$, the null hypothesis is accepted. We can therefore state, with a confidence level of 99%, that the theoretical frequencies do not differ significantly from those observed. Therefore, **there are no important differences between the readers from the urban and the rural ones regarding the decision to purchase a book**.

2) We will now consider the variable **Level of education** and go again through the steps of determining the value χ^2:

Stage 1. *Formulation of H_0 hypothesis*: „*The level of education of the potential reader does not influence the decision of purchasing books*".

Stage 2. *Calculation of expected values to occur according to the null hypothesis*:

$$A_{11} = \frac{N_1 \cdot C_1}{N} = \frac{425 \cdot 240}{800} = 127,50$$

$$A_{12} = \frac{N_1 \cdot C_2}{N} = \frac{425 \cdot 260}{800} = 138,25$$

$$A_{13} = \frac{N_1 \cdot C_3}{N} = \frac{425 \cdot 300}{800} = 159,37$$

$$A_{21} = \frac{N_2 \cdot C_1}{N} = \frac{375 \cdot 240}{800} = 112,50$$

$$A_{22} = \frac{N_2 \cdot C_2}{N} = \frac{375 \cdot 260}{800} = 121,87$$

$$A_{23} = \frac{N_2 \cdot C_3}{N} = \frac{375 \cdot 300}{800} = 140,62$$

In the table 4, a summary of the observed and expected frequencies was made for the second criterion in question - the level of training of the potential book reader.

Table 4. Calculation of the observed frequencies for the variable "level of education"

Level of education / Status	Elementary	Middle	Superior	Total
Buyer	100 (127,50)	135 (138,25)	190 (159,37)	**425**
Non-buyer	140 (112,50)	125 (121,87)	110 (140,62)	**375**
Total	**240**	**260**	**300**	**800**

Source: author's calculations

Stage 3. *Calculation of* χ^2 *statistics:*

$$\chi^2_{calc} = \sum_{i=1}^{2}\sum_{j=1}^{3}\frac{(O_{ij} - A_{ij})^2}{A_{ij}} = \frac{(100-127,50)^2}{127,50} + \frac{(135-138,25)^2}{138,25} + \frac{(190-159,37)^2}{159,37} +$$

$$+\frac{(140-112,50)^2}{112,50} + \frac{(125-121,87)^2}{121,87} + \frac{(110-140,62)^2}{140,62} =$$

$$= 5,93 + 0,07 + 5,88 + 6,72 + 0,08 + 6,66 = 25,34$$

Stage 4. *The determination of the* χ^2 *theoretical value*

χ^2 theoretical corresponds to a 99% guaranteed probability of for the result (the significance level is α = 0.01), as well as to a number of degrees of freedom equal to (r - 1) (k - 1) = (2 - 1) (3 - 1) = 2. Therefore, $\chi^2_{\text{tab } 2;0,01} = 9,2$

Stage 5. *Conclusion.*

Because $\chi^2_{\text{calc}} \succ \chi^2_{\text{tab } 2;0,01}$, the null hypothesis is rejected. Therefore, *it is accepted as a true hypothesis the existence of a dependency relation between the two variables analysed - the level of training and the purchase of books.*

4. THE APPLICATION OF CHI-SQUARE TEST IN MARKETING WITH THE HELP OF SPSS SOFTWARE

IBM SPSS (Statistical Package for Social Sciences) is one of the most powerful and used software for statistical data processing (so-called "Data Mining") and forecasting. The software was first created in the 1960s by the SPSS company, whose activity object included the mention "*software development for statistical data processing*" and has now reached version 24. In time, SPSS has become one of the most popular programs used in statistical analysis. This software offers a powerful interactive interface and includes many facilities for data management and statistical analysis, as well as presentation of the obtained results.

In the case of the problem presented in extenso in the previous paragraph, after the creation of the database with the answers offered by the 800 respondents, we proceed to apply the χ^2 test by following the Commands: *Analyse / Descriptive Statistic / Crosstabs*.

On the rows, we set the variable "*Client status*", and on columns, the variable "*Environment of origin*". We obtained the output from table 5, which reflects the interdependencies between the two categorical variables considered.

Based on this table, we can highlight the following aspects: of the 425 customers (i.e. 53.1%) who bought at least one book, 65.9% are from the urban area and 34.1% are from the rural area. For the 375 non-buyers (i.e. 46.9% of the total sample), the distribution is as follows: 58.7% come from the urban area and 41.3% live in the rural area. Moreover, table 5 also highlights the frequencies expected to appear if the null hypothesis were true, frequencies that are identical to those calculated in table

3. Table 6, generated by using the SPSS software, leads us to the value of the chi-square test.

Table 5. Crosstab between the environment of origin and the client's status of buyer/non-buyer

			Environment of origin		Total
			Urban	Rural	
Client's status	Buyer	Count	280	145	425
		Expected Count	265.6	159.4	425.0
		%within client's status	65.9%	34.1%	100.0%
		%within the environment of origin	56.0%	48.3%	53.1%
		Adjusted residual	2.1	-2.1	
	Non-Buyer	Count	220	155	375
		Expected Count	234.4	140.6	375.0
		%within client's status	58.7%	41.3%	100.0%
		%within the environment of origin	44.0%	51.7%	46.9%
		Adjusted residual	-2.1	2.1	
Total		Count	500	300	800
		Expected Count	500,0	300,0	800,0
		%within client's status	62.5%	37.5%	100.0%
		%within the environment of origin	100.0%	100.0%	100.0%

Source: author's calculations, using SPSS software

Table 6. The output of the chi-square tests[c] generated in SPSS

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point probability
Pearson Chi-Square	4.426[a]	1	.035	.040	.021	
Continuity Correction[b]	4.123	1	.042			
Likelihood Ratio	4.424	1	.035	.040	.021	
Fisher's Exact Test				0.40	.021	
Linear-by-Linear Association	4.420[d]	1	.036	0.40	.021	.006
N of valid Cases	800					

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 140.63
b. Computed only for a 2x2 table
c. For 2x2 crosstabulation, exact results are provided instead of Monte Carlo results
d. The standardized statistic is 2.102

Source: author's calculations, using SPSS software

Therefore, it follows that $\chi^2(1) = 4.426, p = 0.035$. This means that if we consider the same threshold for the significance level, α =0.01 we do not reject the null hypothesis; in other words, we can say with a 99% level of confidence that there

are no significant differences between the buyers' place of origin in relation with the decision to purchase a book.

If we consider the threshold α =0.05, then we could reject the null hypothesis and calculate the intensity of the connection between the two variables. If we want to assess the intensity of this connection by the coefficient *c*, as in the case of the classical solution, we shall have:

$$c = \sqrt{\frac{\chi^2}{\chi^2+N}} = \sqrt{\frac{4,426}{804,426}} = 0,0740$$

The intensity of the connection between the aforementioned variables can be also estimated based on table 7 generated in SPSS, in which we have the value of the phi correlation coefficient, respectively the value of the Cramer coefficient.

The correlation coefficient is calculated according to the formula:

$$phi = \sqrt{\frac{\chi^2}{N}} = \sqrt{\frac{4,426}{800}} = 0,0743\,.$$

Table 7. Phi and Cramer correlation coefficients for the variables "environment of origin" and "buyer / non-buyer status", calculated using SPSS (Symmetric Measures)

		Value	Approx. Sig
Nominal by Nominal	Phi	.074	.035
	Cramer's V	.074	.035
N of Valid Cases		800	
a. Not assuming the null Hypothesis b. Using the asymptotic standard error assuming the null hypothesis			

Source: author's calculations, using SPSS software

In the literature, the following thresholds are indicated for *phi* values:

Table 8. The intensity of the connection between two variables based on the values of the correlation coefficient phi

phi	Relation
Less than 0.10	Weak
0.10-0.30	Low
0.30-0.50	Moderate
0.50-0.70	Strong
Greater than 0.7	Very strong

Source: Labăr, Adrian Vicențiu, SPSS pentru științele educației. Metodologia analizei datelor în cercetarea pedagogică, Editura Polirom, Iași, 2008

In order to determine if the second criterion taken into consideration - the level of education of potential buyers - influences the decision to purchase at least one book, we will proceed in the same way, using the SPSS software. This software generates the following output, which reflects the interdependencies between the variable "visitor's education level", respectively "buyer / non-buyer status" – table 9.

Table 9. Crosstab between the level of education and the buyer / non-buyer client's status

			Level of education			Total
			Elementary	Middle	Superior	
Client's status	Buyer	Count	100	135	190	425
		Expected Count	127.5	138.1	159.4	425.0
		%within client's status	23.5%	31.8%	44.7%	100.0%
		%within the level of education	41.7%	51.9%	63.3%	53.1%
		Adjusted residual	-4.3	-.5	4.5	
	Non-Buyer	Count	140	125	110	375
		Expected Count	112.5	121.9	140.6	375.0
		%within client's status	37.3%	33.3%	29.3%	100.0%
		%within the level of education	58.3%	48.1%	36.7%	46.9%
		Adjusted residual	4.3	.5	-4.5	
Total		Count	240	260	300	800
		Expected Count	240.0	260.0	300.0	800,0
		%within client's status	30.0%	32.5%	37.5%	100.0%
		%within the level of education	100.0%	100.0%	100.0%	100.0%

Source: author's calculations, using SPSS software

Again, it can be seen that of the 425 visitors who bought books (and which reflects 53.1% of the total number of people present at the exhibition), 23.5% have an elementary education level, 31.8% have a middle level education and 44.7% are university graduates. Similarly, for the 375 people who did not purchase books after visiting the exhibition (which represents 46.9% of the analysed sample), the distribution is as follows: 37.3% have an elementary level of education; 33.3% have secondary education and 29.3% have higher education.

In this case, the chi-square test value in SPSS is: $\chi^2(2) = 25{,}359$ and Sig (p) <0.01. This value is significant, so we reject the null hypothesis and reject the conclusion that the purchase of the book is different for clients with different training levels. In order to analyse the intensity of the association between the variables considered in this case, we generated the table no. 10.

The table highlights the value of Cramer's V, respectively phi coefficient, determined with the help of SPSS software. A correlation coefficient value equal to 0.178 implies a connection of moderate intensity, according to those mentioned in table 8.

Table 10. Phi and Cramer correlation coefficients for the variables "level of education" and "buyer / non-buyer status", calculated using SPSS (Symmetric Measures)

		Value	Approx. Sig
Nominal by Nominal	Phi	.178	.000
	Cramer's V	.178	.000
N of Valid Cases		800	
a. Not assuming the null Hypothesis b. Using the asymptotic standard error assuming the null hypothesis			

Source: author's calculations, using SPSS software

Therefore, based on the research conducted on the sample of 800 visitors of the book exhibition, it can be stated that between the purchase decision and the education level of the potential buyer, there is a connection of modest intensity.

5. CONCLUSIONS

The chi-square test allows the marketing researcher to collate variances of population with the aim of determining if the submitted sample has been extracted form a population which had a normal distribution and a certain variance. The paper showed some numerical examples for the application of chi-square test in marketing, *as a goodness of fit*, in order to estimate if a theoretical distribution matches the empirical data.

The chi-square test is largely used by researchers in various areas due to its unquestionable advantages:

- it is a free statistical test for distribution, which can easily be applied for any kind of population distribution;
- the chi-square test is appropriate for using not strictly in the field of social sciences, but in management and marketing analysis, as well;
- as the paper testifies, the values of chi-square test can be determined without difficulty, in a classic manner or with the help of the SPSS soft; besides, it is very easy for the researcher to draw an objective conclusion regarding the rejecting or accepting the null hypothesis, based on calculation performed in this context;
- the chi-square – test yields the additive property which enables the researcher to add the outputs obtained from independent but correlated samples;
- the test does not employ measurements like mean, mode, median or standard deviation, being based on observed frequencies extracted form an empirical research.

Despite this benefits that undoubtedly accompany the application of chi-square test in marketing research area, we must also stress three drawbacks:

- the test can be carry out under certain requirements that must be met;
- the application of chi square test is valuable in testing statistical hypothesis, but it cannot be used for estimation purposes;
- Cramer's V coefficient presents a certain propensity to indicate low correlation magnitudes, even for the cases when notable results are obtained.

REFERENCES:

[1]. Balaure, V. (coord.) (2003), *Marketing*, Uranus Publishing House, Bucharest
[2]. Bucea-Manea-Țoniș, R.; Epure, M. (2010) *SPSS și Excel în analiza datelor statistice în domeniile economic, social, tehnic (SPSS and Excel in Statistical Analyses for Economic, Social and Techical Fileds)*, AGIR Publishing House, Bucharest
[3]. Alexa, E.; Stoica, C.M. (2010) *Cercetări de marketing. Teorie și aplicații (Marketing Research. Theory and Applications)*, CH Beck Publishing House, Bucharest
[4]. Cătoiu, I. (coord.) (2009) *Cercetări de marketing. Tratat (Marketing Research. Treatise)*, Uranus Publishing House, Bucharest
[5]. Constantin, C. (2012) *Analiza datelor de marketing. Aplicații în SPSS (Marketing Data Analysis. SPSS Applications)*, CH Beck Publishing House, Bucharest
[6]. Drăguț, B.M. (2013) *Cercetări de marketing (Marketing Research)*, Pro Universitaria Publishing House, Bucharest
[7]. Isaic-Maniu, A.; Vodă, V.G. (2006) *Prelucrarea statistică a experimentelor (Statistical Treatment of Experiments)*, Economica Publishing House, Bucharest
[8]. Jaba, E., Grama, A. (2004) *Analiza statistică cu SPSS sub Windows (Statistical Analysis with the Help of SPSS-Windows)*, Polirom Publishing House, Iași
[9]. Jaba, E.; Pintilescu, C. (2007), *Statistică. Teste grilă și probleme (Statistics. Multiple Choice Tests and Applications)*, Sedcom Libris Publishing House, Second Edition, Iași
[10]. Jaba, E. (2002), *Statistică (Statistics)*, Economica publishing House, Bucharest
[11]. Kumar, R.; Sharma, S. (2016) *Chi-Square Test in Business Research*, International Journal of Commerce and Management Research, 2(5), pp. 24-26
[12]. Lădaru, G.R.; Sima, V. (2017) *Introducere în cercetări de marketing (Introduction to Marketing Research)*, ASE Publishing House, Bucharest
[13]. Labăr, A.V. (2008) *SPSS pentru științele educației. Metodologia analizei datelor în cercetarea pedagogică (SPSS for Education Sciences. The Methodology of Data Analysis within Pedagogical Research)*, Poirom Publishing House, Iași
[14]. Meghișan, G.; Stancu, I.; Meghișan, G.M. (2008) *Cercetări de marketing (Marketing Research)*, Sitech Publishing House, Craiova
[15]. Meghișan, G.M. (2008) *Marketing – definiții, studii de caz, aplicații (Marketing – Definitions, Case studies, Applications)*, Sitech Publishing House, Craiova
[16]. Nedelea, M.A. (2017) *Cercetarea de marketing (Marketing Research)*, Economica Publishing House, Bucharest
[17]. Papuc, M.; Kacso, S.; Zbuchea, A. (2004) *Cercetări de marketing. Aplicaţii (Marketing Research. Application)*, Lumina Lex Publishing House, Bucharest
[18]. Smedescu, I. (2008) *Marketing – aspecte teoretice, studii de caz, aplicații, teste (Marketing – Theory, Case studies, Applications, Tests)*, Universitara Publishing House, Bucharest