POSSIBILITIES OF EVALUATION OF THE EXPENDITURE OF THE CLOTHING INDUSTRY BY THE MONTE CARLO METHOD

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Abstract: *The analysis of the possibilities by which the expenses can be measured in the clothing industry in Romania, is the starting point of this research. We consider it useful to know the ways of measuring the expenses at the level of companies, in order to obtain a greater profit, by using as little resources as possible. The results of the empirical study are satisfactory, in the sense that through the safety interval of the average of the expenses, it is possible at any time to check the state of the company's performance. Therefore, according to the results of the proposed model, the company that is the subject of the case study should find solutions to reduce the operating and financial expenses existing in 2017.*

Key Words: *Monte Carlo method, expenses, probability distribution, random variable, clothing industry, scenario.*

JEL classification: *C63, D24, L67.*

1. Introduction

The clothing industry in Romania has a tradition of over 100 years, which has been forced with the passage of time to adapt to the various requirements coming from customers for lohn production as well as for mass production. In addition, the technologization of the activities carried out were necessary in order to help the efficiency of the production activities and the efficient management of the operating costs.

We believe that the garment industry, as an important branch of the national economy, contributes to ensuring sustainability in Romania, because sustainable development cooperates with economic development. In the years of communism Romania was internationally recognized for its garments and is still present but on a much smaller scale, as statistics show, where it is observed that at present - in 2019, there are 3,814 active companies that have as their object of activity - Manufacture of clothing (www.topfirme.com). In order for this industry to become what it used to be in the years of communism, we believe the need to use the existing resources towards some more advanced ones to attract external customers.

The challenges arising in the clothing industry in Romania and the European Union after 2000 are multiple, due to the impact of more and more existing companies as a result of two priority factors: the global economic crisis and the migration of lohn from the western European countries and even from Romania, towards the Eastern European or even the Asian countries where the labor force is vast and cheap. We consider that these two factors determined consequences that led the companies in the clothing industry to losses both from the perspective of the production made and the marketing of products, even more some of the companies reached the threshold of bankruptcy.

The expenses, according to Nicolae Todea (2002, p. 348) represent from a financial perspective any payment made to third parties for the purchase of the production factors, which can effectively become a component of the cost only when the production factors are consumed, the costs quantifying the relationship between the expenses and the results obtained, which can be materialized in products, works, services.

The two components of accounting - financial and management, highlight the expenses in their own way, taking into account the accounting records, which is the most important source of data for economic analysis. The total expenses found in the Company's Income Statement include both Financial expenses and Operational expenses that have the

following components: Expenditure on raw materials and consumables, expenses on works and services performed by third parties, personnel expenses, Other operational expenses (Camelia Burja, 2009, p. 91).

We believe that the need to reduce expenses in a company is a necessary measure in order to increase the profit to the same volume of activity. At the same time, it is necessary to take into account an important aspect in the analysis of the reduction of costs, that is, not to go up to the threshold of their sub-reduction, because in this way it will create a malfunction in the production process, which could have adverse consequences in the form of losses, which would be even more important than the economy that could be made by reducing expenses.

2. Literature Review

The Monte Carlo method is closely related to the problems of probability and value theory, as Paul Glasserman (2003, p. 1) points out. This method is distinguished by simplicity, the generality it proves and is based on the law of large numbers for independent random variables.

The idea of calculating by Monte Carlo method according to László Pokoradi (2016, p. 44) is older than the calculator, which has a history that has been noted since the last century, when numerical calculations were made using pencil and paper.

The name of the Monte Carlo method, however, is relatively recent since 1949 and was invented by Nicolas Metropolis. The Romanian researchers Ion Dobre and Floare Mustaţă-Horpos specify that the Monte Carlo method is known in the specialized literature and under the name of "the method of equivalent tests," the method of statistical experiments "," the method of indirect simulation "," the method of numerical simulation "," the method random numbers "," Monte Carlo simulation "," Monte Carlo sampling ", the name being taken after the name of Monte Carlo city of Monaco (Dirk P. Kroese, 2011; Robert L. Harrison, 2010; Alexander Shapiro, 2003), and in the States The United States of America is also referred to as the "Las Vegas method".

Ion Dobre and Flower Mustache-Horpos consider that the Monte Carlo method demonstrates its efficiency in analyzing phenomena and processes characterized by a large number of variables. It is shown that the method is used for the purpose of designating two techniques:

- The first technique involves evaluating the different integrals by using random variables;
- The second technique involves the replacement of a real phenomenon with a statistical one, which can be studied by modern calculation methods.

We are of the same opinion with Alexandru Manole, Constantin Anghelache, Mădălina Anghel, Andreea Marinescu (2016, p. 51), who considers that the Monte Carlo method presents a sensitivity analysis that returns the unilateral effects of the variables under various scenarios that can calculate the effects of a limited number. changes.

In another opinion, the Monte Carlo method (Samik Raychaudhuri, 2008, p. 91) relies on random values and statistical analyzes to calculate the results. This simulation method is closely related to random experiments, for which the result is not known in advance.

From the perspective of Frances Greselin, Fabio Piacenza and Ricardas Zitikis (2019, p. 2), the Monte Carlo method is a flexible one and widely used, but it requires intense calculations that slowly converge to the correct result.

In the Monte Carlo technique, as Victor Dragotă, Anamaria Ciobanu, Laura Obreja, Mihaela Dragotă (2003, p. 87) take into account, “the probability of the emergence of a certain economic status, but for purely rational reasons, which are directly related by the

preponderance of the objectivity of work and of the necessity of observing the law of normal distribution by the analyzed performance indicator. For each of these variables, the Monte Carlo method, a certain interval in which they can record values and a certain law of evolution. With the help of an electric calculator, it is possible to generate a series of values, at random, for each determined variable of the analyzed performance indicator ".

3. Research methodology

In order to perform a simulation based on the Monte Carlo model, the following steps are required (Georghe Barbu, Maria Miroiu, 2012, pp. 13-16; Daniel Manaţă, Pavel Fărcaş, 2010, pp. 60-62):

- Defining the problem, implies explaining the working variables. Also at this stage it is established: the set of admissible solutions, the standard error and the proposed effective method;
- Primary data collection, analysis, interpretation and processing. At this stage the statistical data are collected and characterized;
- The formulation of the simulation model, implies the determination of the measure of the statistical parameters of the random variables respective to the model;
- Estimating the input parameters of the model, in which the probability distributions of the variables are established;
- Evaluation of model performances and testing of parameters. In this stage, the results characterizing the variables are analyzed;
- Description of the simulation algorithm and writing the calculation program. The evolution cases of the model and the calculation error for each individual case are specified;
- Validation of the model, requires the certification of the performance of the model;
- Planning simulation experiments, estimating the statistical characteristics of the variables and estimating the results;
- The analysis of the simulated data, implies the interpretation of the model results.

The model proposed in this study is characterized by the following system described (Daniel Manaţe, Pavel Fărcaş, 2010, p. 60):

1. the entries include:

- *Input parameters* - p1, p2, ..., pn, which are known in the analysis;
- *Random variables* - X1, X2, ..., Xn, which depend on the evolution of the stochastic events;
- *The probability distribution to be achieved and cumulated* - f1, f2, ..., fn, which provides the association for each simulated size of the analysis;

2. transfers include:

- *The transfer function* called generic - g, depends on the system parameters and the random variables - $RK \rightarrow R$;

3. The outputs depend on:

- *Inputs* (input parameters, random variables, probability distribution);
- *Transfers* (transfer function).

Thus we can say that the model generates random vectors according to the laws of probability for each random variable. Therefore this model (Y) is of the form:

$$Y = g\ (p_1, p_2, ..., p_n, X_1, X_2, ..., X_n) \quad (1)$$

Taking into account the values of the outputs, a statistical analysis can be performed which involves the determination of the following statistical indicators:

1. Arithmetic Mean ($\bar{x}$)

$$\bar{x} = \frac{1}{n}\sum_i x_i \quad (2)$$

2. Standard Dispersion (s)

$$s = \sqrt{\frac{1}{N-1}\sum_i (x_i - \bar{x})^2} \quad (3)$$

3. Mean Square Deviation (s^2)

$$s^2 = \frac{1}{N-1}\sum_i (x_i - \bar{x})^2 \quad (4)$$

4. Coefficient of Variation (CV)

$$\mathrm{CV} = \frac{s}{\bar{x}} \quad (5)$$

5. Allowable Error (E)

$$\mathrm{E} = \frac{s}{\sqrt{n}} \quad (6)$$

where: N - number of values
n - years / months / days

Due to the academic complexity in the study of expenses, the limits of the present study focus on the importance of accounting information in making decisions at managerial level. From here started the customization of the Monte Carlo model at the CONF Ltd. through the scenario of the evaluation of the expenses, regardless of their nature. The name of CONF Ltd. it is a purely hypothetical one, with the purpose of maintaining the confidentiality of the data, although the company and the data on which the simulation was made are real and belong to the companies that own CAEN 1413 - Manufacture of other clothing (excluding underwear).

4. Results and Discussion

In order to highlight this simulation, CONF Ltd. it wants to reduce its expenses which vary from month to month depending on various factors such as: volume of work, investments made, consumption of electricity, gas, water, etc. For this simulation, we present below to CONF Ltd. the average expenditure range for 2017, spread over 12 months:

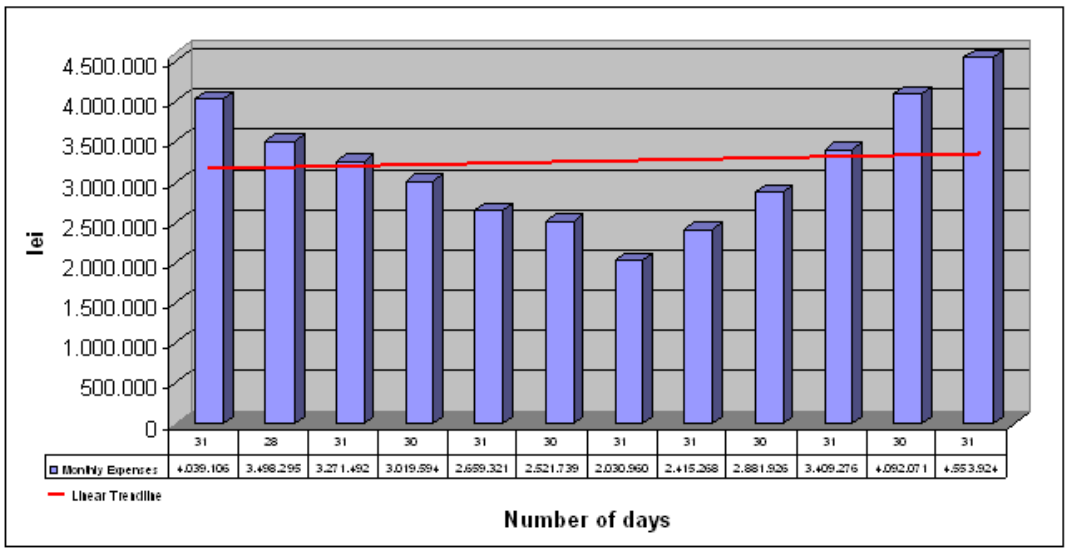

Chart 1. Expenses and trend in the months of 2017
Source: Own processing

We can say that these input parameters (expenses) at first glance present a relevant and slightly upward trend line. This fact is a warning of the increase in expenses, so it is necessary the need for a comprehensive analysis at managerial level to show what are the causes that led to the upward trend line. However, according to the discussions with the company representatives, we found that what led to this fluctuation of expenses in 2017 according to months is due to the production achieved, which in the summer period is much lower due to the holidays. granted to the execution personnel, and also to the reception of a much smaller number of clients from the clients. We note that the level of expenditure increases in the winter months, when the consumption with the suppliers increases, and production reaches the highest level of execution.

In order to determine an average spending range through the Monte Carlo model, we show in table no. 1 based on the 365 measurements expressed in days, the probability values of the 12 months analyzed.

Table 1. Probability distribution at CONF Ltd. in 2017

Probability	**Month**											
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Trust probability	0.950											
Achieved probability	0.085	0.077	0.085	0.082	0.085	0.082	0.085	0.085	0.082	0.085	0.082	0.085
Cumulative probability	0.085	0.162	0.247	0.329	0.414	0.496	0.581	0.666	0.748	0.833	0.915	1.000

Source: Own processing

The double sense of probability presents us the number of real possibilities of spending by frequencies, on the one hand and the degree of trust on the other (Petru Balogh, Pompiliu Golea, Valentin Inceu, 2013, pp. 33-40). For this study I considered it appropriate to establish the probability of confidence at 95%. We notice that the probability was realized during the whole period analyzed, and the sum of the calendar days for the year 2017, depends on each month separately. So we can say that between the

days of a month and the total of the days of a year there is dependency, although the two variables in the present study - the expenses and the number of days are independent.

Based on the results obtained in the calculation of the forecast achieved and cumulated from the table no. 1, we believe that the measure of the chances in the present model was reached, because in all the 12 months the probability registered values over 0, even more reaching in December 2017, in the case of the cumulative frequency of the number of days to a certainty, a necessary element by which we demonstrate the validation of the model.

To continue the study in establishing an average value of expenses, we consider a sample of 31 days for which we determine on the basis of random variables, the square of the deviation from the average of the expenditures in 2017 at CONF Ltd.

Table 2. The frequencies of the random variable for December 2017 according to days at CONF Ltd.

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Day	Random variable	Expenditures - xi	xi - $\bar{x}$	(xi - $\bar{x}$)^2
1	0.092	209,147	57,349.53	3,288,968,973.55
2	0.707	199,695	47,897.53	2,294,173,699.42
3	0.474	165,249	13,451.53	180,943,749.02
4	0.343	156,598	4,800.53	23,045,120.28
5	0.624	161,573	9,775.53	95,561,051.95
6	0.088	189,147	37,349.53	1,394,987,640.22
7	0.283	107,974	-43,823.47	1,920,496,230.68
8	0.790	156,764	4,966.53	24,666,453.35
9	0.179	143,491	-8306.47	68,997,388.48
10	0.452	135,249	-16,548.47	273,851,749.02
11	0.482	135,249	-16,548.47	273,851,749.02
12	0.233	143,491	-8,306.47	68,997,388.48
13	0.333	116,598	-35,199.47	1,239,002,453.62
14	0.321	107,974	-43,823.47	1,920,496,230.68
15	0.317	107,974	-43,823.47	1,920,496,230.68
16	0.136	189,147	37,349.53	1,394,987,640.22
17	0.088	196,477	44,679.53	1,996,260,698.88
18	0.125	159,241	7,443.53	55,406,188.48
19	0.931	153,924	2,126.53	4,522,144.02
20	0.774	156,764	4,966.53	24,666,453.35
21	0.285	117,974	-33,823.47	1,144,026,897.35
22	0.476	135,249	-16,548.47	273,851,749.02
23	0.655	161,573	9,775.53	95,561,051.95
24	0.978	153,924	2,126.53	4,522,144.02
25	0.356	116,598	-35,199.47	1,239,002,453.62
26	0.445	135,249	-16,548.47	273,851,749.02
27	0.613	161,573	9,775.53	95,561,051.95
28	0.645	133,478	-18,319.47	335,602,858.95
29	0.545	162,618	10,820.53	117,083,941.62

30	0.908	183,962	32,164.53	1,034,557,204.55
31	0.530	200,509	48,711.53	2,372,813,479.68
Total	-	4,553,924	-	23,078,000,335.47

Source: Own processing

For the representativeness of the chosen sample, 31 random values (numbers) from the range (0,1) were considered, corresponding to which was chosen the expenditure whose value of the cumulative probability is immediately higher than the random number. Considered as a whole, the sum of the deviations from the average of the expenses is equal to 0, thus the equality is verified methodologically. The statistical series presented by the sample can be interpreted by the size "xi", which appears most often in the sample. This value of the expenses is equal to 135,249 lei, appears in four days of the sample and is therefore the most representative.

Summary of the Monte Carlo model for the expenditure variable at CONF Ltd. depending on the number of days, it finally involves establishing the average of the statistical variable, of the dispersion and of all the specific indicators of the econometric modeling, which are presented systematically in the table no. 3.

Tabel 3. The script centralizer at CONF Ltd. according to the Monte Carlo model

-lei-

Indicator	Value
Arithmetic Mean - $\bar{x}$	**151,797.47**
Standard Dispersion - s	795,793,115.02
The Mean Square Deviation - s^2	**28,209.81**
Variation Coefficient - CV - %	**18.58**
Allowable Error - E	0.05
Distribution *t*. Values tα/2, no. degrees of freedom	2.04
Average range of expenses / day	**(141,461.53; 162,133.41)**

Source: Own processing

The Monte Carlo model presented under purely statistical influences for the sample of expenses during 2017 according to days, at the analyzed company, synthetically describes the model dashboard, where all the synthetic indicators of variation are presented.

Interpreted from a contextual aspect, the parameter of the overall position of the expenditures at CONF Ltd., Indicates the central tendency of the consumption of the described sample. Note that the arithmetic mean of the sample does not coincide with any of the monthly expenditure values, but falls between the minimum and the maximum specific consumption of the sample. By this we mean the representativeness of the sample arithmetic mean and implicitly the possibility of use in practice.

By determining the average of the squares of the deviations from the average, we determined the dispersion that is expressed without unit of measure. Its result presented in the table no. 3, shows us that the series of expenses analyzed for the sample revolves around the arithmetic mean. The average square deviation presented means that the number of days of the sample at a level of expenses equal to 4,553,924 lei, deviates on average by 28,209.81 lei from the estimated average. The value of the coefficient of variation expressed as a percentage presents the statistical sample analyzed as being below 35%, so that the sample of electricity consumption for the 31 days is a homogeneous one.

From this we deduce that the intensity of the variation is a reduced one, and the average is representative.

Due to the confidence probability established in table no. 2., the permissible error value in this case is 5% (Camelia Raţiu-Suciu, 2005, p. 458). A final impediment in establishing the average range for the value of expenses in 2017 in CONF Ltd. was the extraction of t distribution, in the case of the present model for ($t_{0.05/2}$; 30), taken from the annexes of the book entitled Modeling and simulation of economic processes (Camelia Raţiu-Suciu, 2005, p. 458). We consider the average of the expenses of the sample expressed in lei / days of a month, a homogeneous one from an economic perspective, and from a statistical point of view we can say that it is a representative one.

5. Conclusions

We conclude by stating that CONF Ltd. through the simulation model presented it is useful to the management of the company for making managerial decisions in analyzing the financial position and performance. Therefore, we consider useful the study undertaken in order to reduce the expenses at CONF SRL, by redesigning the sewing machines that could be of last generation and that could help in the process of making the garment in order to reduce the expenses with the service providers, especially electricity.

The diminution of the economic benefits appeared in CONF Ltd. imposes measures necessary to streamline production activity and increase revenues, which we believe could be possible through investments to modernize work equipment, which in the long run could lead the company to favorable economic results, attracting qualified personnel, as well as customers with requirements especially satisfied. Therefore, the Monte Carlo model through the analysis presented aims to establish the financial balance at CONF Ltd. which has the role of diagnosing and adjusting from an economic perspective the activity carried out.

Due to the fact that the proposed model is one created for a real commercial company, active in the Romanian clothing industry, we consider that the proposed simulation process is a true one, which presents all possible results, together with their probabilities.

In order to reduce the expenses, especially of the production ones, we consider that it would be necessary to use the value analysis that starts the analysis from the product design phase and continues until the final phase where the products reach the customers. We also believe that the Monte Carlo method can be introduced for the purpose of analyzing expenses, as this is generally realized and applied by consulting companies, having as an informative purpose for companies, which, following this analysis, the management can make optimal financial decisions.

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