SPSS AS A SUPPORT TOOL FOR MANAGERIAL DECISION-MAKING: AN APPLICATION OF THE STATISTICAL PROCESS CONTROL

Josef Černý

VŠB – Technical Unviersity of Ostrava, Faculty of Economics, Department of Mathematical Methods in Economics

Abstract: *Contemporary world can be characterized as a rapidly changing environment and it also brings not only opportunities, but difficulties too. It seems to be harder and harder to make right decisions in this complicated world. Intuitive way of decision making does not apply to be enough and it should be appropriately completed by exact quantitative methods for decision support. Managers could rely on methods and techniques such as marketing research, analyzing and using the data from marketing research, costs, revenues, profits, input, output modeling, simulation, quality control Fig.s, etc. This variety of methods and techniques is usually supported by software usage, with user-friendly graphical design. One of the appropriate software for decision-making support is SPSS. This paper deals with the SPSS usage for the case of statistical process control which can be a very useful tool for sustaining competitive advantage reached by quality delivered to the end customers.*

Keywords: *Decision-Making Support, SPSS Software, Process Quality, Statistical Process Control*

1. Introduction

This paper focuses on process, quality of outputs, how to analyze processes in order to find out if the process is or is not in the statistical control. These days can also be denoted as the time of information and communication technology (ICT), when computers plays a very significant role in any situations when business decision are necessary to be made quick and as exact as possible. Statistical process control is not the exception from using computer applications. In this paper, there will be described several approaches of how to use statistical process control techniques to analyze univariate (with one measured characteristic only) normally distributed processes. The brief background of the theory will be supplemented with the practical use of SPSS, the statistical software useful to be taken as a managerial decision-making support.

About the area of the statistical process control there has been written a lot of works. It contains various books dealing with quality management, so that is a direction from management to statistical tools. Other books are written about statistics, in general, but they also include the part of the process control applications. Besides books, there are many conference proceedings papers, or science magazines articles, where authors focus on particular problems, specialized situations, for example, non-normally distributed process outputs, non-manufacturing processes, processes about service distributions, etc. From the books there can be mentioned, f. e. Statistical Process control by Oackland, published in 1993, as a first edition and the last 6th edition in 2006. Other works are Statistical Process Control, the Deming Paradigm and Beyond by Thomson and Koronacki, published in 2002, Manufacturing Engineer's Reference Book by Koshal Dal, et al., published in 1993, Statistické metody pro zlepšování jakosti by Tošenovský and Noskievičová, published in 2000. From statistically oriented books Statistics for Business and Economics by Nebold, Carlson and Thorne, published in 2007, Statistics: Methods and Applications, by Hill and Lewicki, published in 2006, and other books. The scope of this field is very wide, so the article is aimed shortly on several classical Shewhart's control Fig.s of normally distributed outputs easily provided by SPSS, as the computer software utilization. This was the brief insight into the literature of the problems, being handled in this paper. There were many articles published about the area of statistical process control and various control Fig.s in Quality and Reliability Engineering International, where the whole volume 26 issue 2 was applied to this field of study.

2. Statistical Process Control

2.1 Process and its Attributes

2.1.1 What do Process, Quality and Other Core Definitions mean?

Process can be described in many ways. International Organisation for Standardization (ISO) defines process as 'set of interrelated or interacting activities which transforms inputs into outputs' [1]. Oakland [5] defines process as 'the transformation of a set of inputs, which can include materials, actions, methods and operations, into desired outputs, in the form of products, information, services or – generally – results. Oakland also mentions that 'each process may be analyzed by an examination of the inputs and outputs in order to determine the actions necessary to improve quality'. Other definition [8] says that: 'Processes are designed to add value to inputs by changing them in some positive way' into outputs.

All processes can be monitored and brought 'under control' by gathering and using data. This refers to measurements of the performance of the process and the feedback required for corrective action, where necessary.

Quality is according to ISO 9000 [1] 'degree to which a set of inherent characteristics fulfils requirements.' ISO also brings the definition of the words 'inherent', and 'requirements'.

'Inherent means existing in something, especially a permanent characteristic' [1], and requirement is a 'need or expectation that is stated, generally implied or obligatory.' [1]

These terms are also defined and described by quality gurus, Deming, Juran, Feigenbaum, Taguchi, Ishikawa, Crosby and others.

2.2 A Brief History of the Statistical Process Control

It was at the turn of the century of the 19th and the 20th, when from the first time there was mentioned a statistical process control. Vilfredo Pareto pointed, that many failures in a system are the results of a small number of causes [9]. Despite other thoughts about the process variation and process control, it was Dr. W. Edward Deming, who is considered as a father of the statistical process control (abbr. SPC). Most significant contributions to this area have been delivered by Shewhart (in 1924) and Hotelling.

Shewhart and Deming, main persons in SPC area, in their book, Statistical Methods from the Viewpoint of Quality Control, wrote the first time in 1939: ‘The long-range contribution of statistics depends not so much upon getting a lot of highly trained statisticians into industry as it does on creating a statistically minded generation of physicists, chemists, engineers and others who will in any way have a hand in developing and directing production processes of tomorrow.’ [7]

In the 1993, before his death, Deming claimed: ‘Management still does not understand process variation’ [5].

2.3 Statistical Process Control and Classical Shewhart Control Fig.s

This chapter deals with the theoretical background of statistical process control, as such and the deFig. of the Classical Shewhart Control Fig.s being used for various univariate processes with the output normal distribution, Fig.d with classical Gauss-Laplace ‘Bell Curve’. It can surely appear that there are also non-normally distributed outputs of processes, which follow distributions, for example, Weibull, Gamma, Beta distributions etc. As mentioned before, this paper deals with normally distributed, ‘Bell-curve shaped’, process outputs where is analyzed the only one measured parameter. The relationship between two parameters of the normal distribution - the mean and standard deviation - and the probability of the occurrence of outputs is depicted in Fig. 1 below.

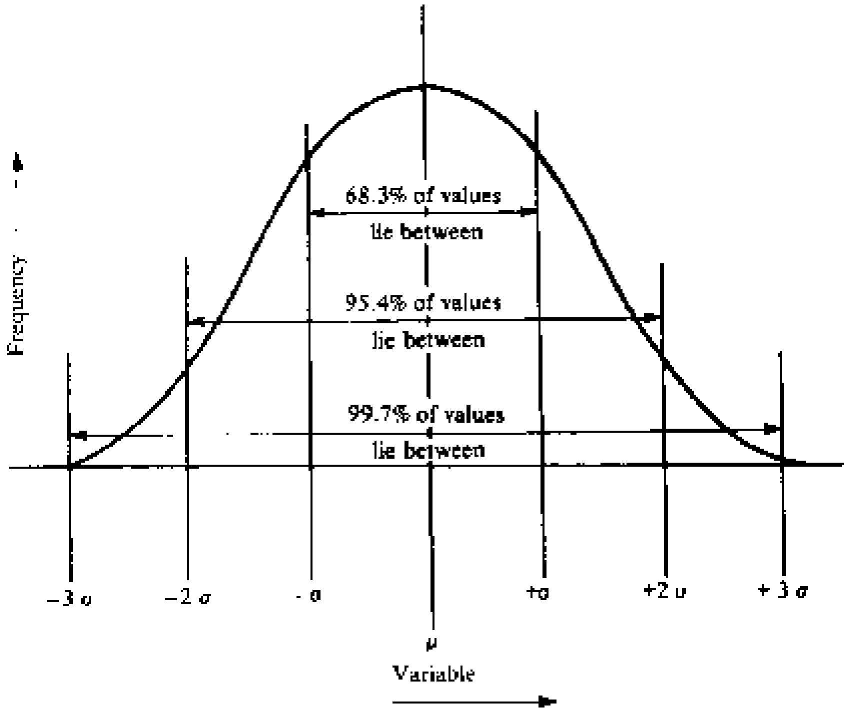

Fig. 1: Normal distribution and Gauss-Laplace Curve

Source: Oackland, 2003, p. [5]

2.3.1 Statistical Process Control

SPC can be defined as ‘the application of appropriate statistical tool to processes for continuous improvement in quality of products and services, and productivity in the workforce’. [5] Tošenovský a Noskievičová [10] define SPC as ‘a precautionary tool for quality management based on well-timed detection of the significant deviations from the predefined level inside a process, because it is possible to implement interventions into the process to reach the goal of keeping it on acceptable and stable level, eventually enable an improvement of the process’.

SPC is comparatively a wide area, where the statistical methods, tools and techniques meet with the management of the process. The main and common concept of most SPC techniques is demonstrated for example in [5] where the process in statistical control brings a predictable variability and no assignable causes exist. On the other hand for statistically uncontrolled process outputs it is not possible to predict variable and the quality of products is not likely to keep sustainable.

In SPC there can be used various Fig. techniques, such as control Fig.s, tally Fig.s, histograms, Pareto Fig.s, Ishikawa Fig.s. This paper considers control Fig.s to be the most significant in SPC.

2.3.2 Shewhart Control Fig.s in general

Reynolds and Stoumbos write in their article [6] that basically ‘control Fig.s are used to monitor process to detect special causes that can produce changes in the distribution of the process variable of interest. The traditional approach to monitoring μ and σ is to use two control Fig.s, one designed to monitor μ and the other designed to monitor σ. Traditional control Fig.s are based on the normality assumption.' Their definition [6] of control Fig.s can be pointed as: 'Let X denote the process variable being measured, and suppose that X has a continuous distribution with mean μ and standard deviation, σ. Let μ0 be the in-control or target value for μ, and let σ0 be in-control value for σ. In practice, σ0 (and sometimes μ0) would need to be estimated from process data during a preliminary Phase I in which process data are collected for this purpose. The objective of monitoring the process is to detect any special cause μ from μ0 and/or changes σ from σ0.'

Classical Shewhart control Fig.s were developed in 1924 and it was the groundwork of the complex SPC system [10]. The basic assumption of the use of classical Shewhart control Fig.s is the adequate number of process output samples (practically at least 20 samples). The usage of Shewhart's control Fig.s is dependent on three basic criteria. The first criterion is if the process produces measurable or immeasurable outputs. The other one looks on the sample size or what to summarize and the standard criterion is the in satisfaction of the normality assumption, as mentioned before. This division can be found clearly in Tošenovský and Noskievičová [10].

The principle of SPC [10] lies in setting the hypothesis H0 which claims that the process is under the statistical control and the alternative hypothesis H1 means that the process is out of the statistical control. In statistically controlled process the acceptance region of the null hypothesis lies between the upper (UCL) and lower control lines (LCL) and the regions out of this area present the field of rejection of the null hypothesis and turning to the acceptance of the alternative one. The values UCL and LCL are called the critical values and their values depend on the significance level α, i. e. the probability of the I. type error. In SPC this level is called the risks of the false alarm and it Fig.s the probability of useless searching for the assignable cause although the process remains in statistically controlled state. The probability of β, the II. type error, so-called neglected alarm, shows the probability that the control Fig. will not detect the assignable causes (all points lies inside the UCL and LCL area but they do not shape any random cluster).

2.4 Construction of the Classical Shewhart Control Fig.s

Let us say that we have measurable quality characteristics, at first. We can use three control Fig.s as they were mentioned above, however, the one case samples are not usual so the main focus will be given on $\bar{x}, R$ Fig.s and $\bar{x}, s$ Fig.s. There will be also given a smaller scope to other types, i. e. control Fig.s for immeasurable process outputs, where is about to summarize the number of non-conformities.

2.4.1 $\bar{x}, R$ Control Fig. for smaller samples

Classical $\bar{x}, R$ Fig.s are used for smaller samples, practically in the range from 2 to 10 units in a sample. The whole process of the testing process outputs starts with the setting the test criteria to be the sample means $\bar{x}_j$, where the sample size of all samples stays constant to n. The process of the control Fig. $\bar{x}, R$ construction is described in more details in [10] and id also uses the help of standard ISO 8258 for specified constants describing in formulas. From the basic formula computing the sample mean [10]

$$\bar{x}_j = \frac{1}{n}\sum_{i=1}^{n} x_{ij} ; \quad (2.\ 1)$$

where x_{ij} is the i-th measured value of the analyzing variable in the j-th sample, and not know the target values μ_0 and σ_0 and the false alarm risk at the level $\alpha = 0{,}0027$, we can set the control central line (CL), as follows [10]:

$$CL = \hat{m}_0 = \bar{\bar{x}} = \frac{1}{k}\sum_{j=1}^{k} \bar{x}_j ; \quad (2.\ 2)$$

where k represents the umber of samples used for CL computation, at least 20. Then we can set the upper and lower control limits (UCL and LCL) and according to [10] we arrive with the final formulas for UCL and LCL, as follows [10]:

$$UCL = D_4 \cdot \bar{R}, \quad (2.\ 3)$$

$$LCL = D_3 \cdot \bar{R}. \quad (2.\ 4)$$

Values of D_4 and D_3 are also contained in the standard ISO 8258 for the sample sizes from 2 to 25 units. They depend on the sample size [10].

2.4.2 $\bar{x}, s$ Control Fig. for samples greater than 10 cases

The key-stone of the assumptions is similar to $\bar{x}, R$ Fig.s, so that the samples come from normally distributed process outputs and the false alarm risk level is set to be α equal to 0,0027. CL is derived in the same way as in the $\bar{x}, R$ Fig.s, according to the formula (2. 2). For control limits we do need to have a estimate of the standard deviation of the process, $\hat{s}_0$. It can be found from the sample standard deviation, s, then:

$$\hat{s}_0 = \frac{\bar{s}}{C_4}, \quad (2.\ 5)$$

where $\bar{s}$ means the mean of standard deviations of all samples and C_4 is a constant dependent on the sample size and the assumption of the normal distribution of the controlled variable, and it is included in the standard ISO 8258 [10]. The mean of all standard deviations is computed according to:

$$\bar{s} = \frac{\sum_{j=1}^{k} s_j}{k}, \quad (2.\ 6)$$

where k presents the number of samples (at least 20), s_j is the sample standard deviation in j-th sample and is computed according to the formula:

$$s_j = \sqrt{\frac{\sum_{i=1}^{n}(x_{ij} - \bar{x}_j)^2}{n-1}}, \quad (2.7)$$

After several steps of deriving, described in for example in [10], we can reach the final formulas for UCL and LCL:

$$UCL = B_4 \cdot \bar{s}, \quad (2.8)$$

$$LCL = B_3 \cdot \bar{s}. \quad (2.9)$$

where B_3 and B_4 are contained in ISO 8258 [10].

There are many other control Fig.s. For immeasurable characteristics there are control Fig.s for counting the number non-conformity outputs of the process or control Fig.s for number of nonconformities per unit used in situations where n is constant for all samples, but there is only one type of product to be analyzed, or non the same n for all samples. Several outputs are distributed according to Poisson distribution, but there can be found an approximation to the normal distribution. As mentioned before, the aims of this paper focus primarily on $\bar{x}, R$ and $\bar{x}, s$ Fig.s, and the usage of SPSS for SPC.

Classical Shewhart Control Fig.s have all several basic evaluation rules. For the simple description of possible causes if the particular rule, which is violated, see the literature, for example already mentioned [10].

SPSS Statistics 17 (also version 18) uses following control rules:

- any point above or below 3 sigmas,
- 2 consecutive out of last 3 points lie above or below 2 sigmas,
- 4 consecutive out of last 5 points lie above or below 1 sigma,
- 8 consecutive points above or below the central line,
- 6 points in a row are trending up or trending down
- 14 points in a row are alternating.

3. Case Study

3.1 SPSS and Control Fig.s

SPSS Statistics (originally meant Statistical Package for the Social Sciences) represents the software with the use in many practical applications, for example we can use SPSS for questionnaire data analysis, correlation, regression analysis, hypothesis testing, model creating and estimating, time series, cross-sectional, panel data analysis, Pareto or control Fig.s and other tools. SPSS Statistics is coming through the development. This fact is proved by the existence of the latest version 18. This statistical analytical software brings one of the biggest advantages for IT non-specialist because the user interface is user-friendly. In the following part of this paper, there will be demonstrated the usage of the specific data set of the ring diameters. Samples reached from the process simulation must be tested for the satisfaction of the normality assumption. For testing it was used the exploration Kolmogorov – Smirnov normality test of samples in SPSS (see in the menu analyze, descriptive statistics and explore and nonparametric tests, more precisely 1-sample K-S test).

3.1.1 Process Output Data Set

At first, we must define the data sets for quality control, before we use SPSS for the practical survey of the process control. Let us assume that we have two data sets. First data set is a process output of the ring diameters with the normal distribution parameters, for mean with the value 15,00 mm and for standard deviation with the value 0,10. First data set contains 30 samples with 8 units in each sample. The second data set is based on bigger ring diameters, with the parameters, for mean with the value 17,00 and for standard deviation with the value 0,10. The second data set contains 30 samples with 12 units in each sample. It implies that the first data set is developed for $\bar{x}, R$ control Fig. and the second data set for $\bar{x}, s$ type of control Fig.. Data sets are displayed in tables in Appendix part. Both data sets were tested for the normality by Smirnov-Kolmogorov test of normality. All samples embody the values of test criterion to accept the hypothesis claiming their normality.

3.1.2 Control Charts Analysis

Before the analysis, let us mention that the process outputs specification limits were set to be equal to the central line and control limits (UCL and LCL). At first, let us analyze the control Fig. for the mean of the diameters of the smaller rings, i. e. with 15,00 mm specified mean. In the mean Fig. we can see no subgroup mean out of the control lines, but there was found one pattern violating the control rules. Eight consecutive points follow below the central line, to be exact points from the sample 6 to the sample 14. It could show the problem of existence of some non-random causes. One of more possible causes could be in personal changes of people working on the machine. The exact cause depends on the particular company and could be found out by using team based creative thinking techniques, for example Ishikawa Fig.. Attention should be paid to the means of subgroups 22 and 24. Although they do not violate control limits, they appear to be close to them. Control Fig. for the range does not display any significant problems of strongly changing variability. The range does not also reflect the significant trend in variation. Ranges of samples fluctuate in the neighbourhood of the total average range 0,305. However, there are four points of the mean range of samples 6, 14, 21, and 26, where the difference from all 30 samples range mean is clearly more significant than others. More clearly it can be seen in the Fig. 2

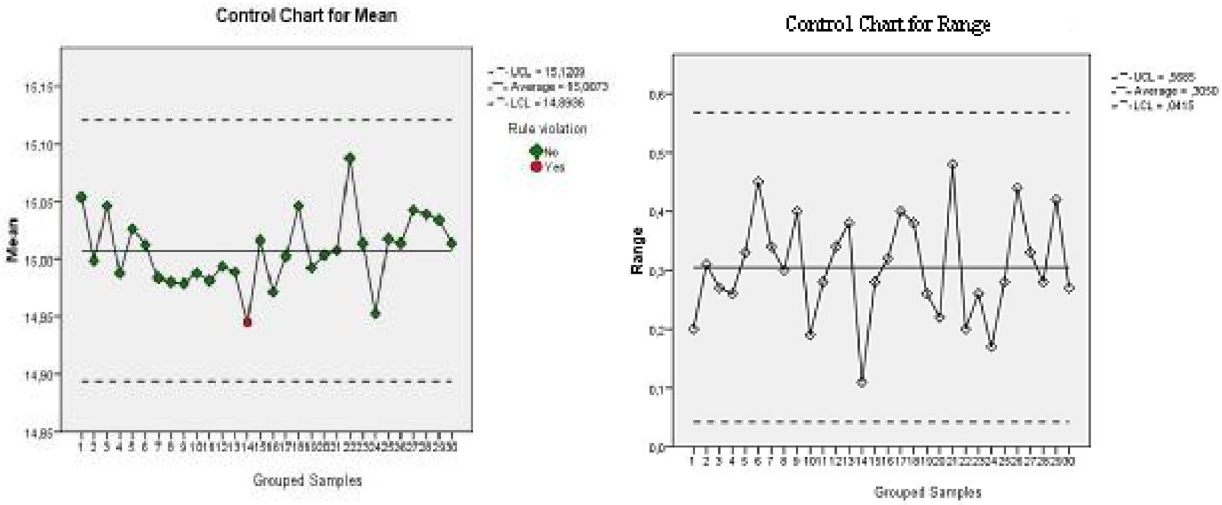

Fig. 2: Ring diameters 15,00mm analysis of the mean and range; Source: SPSS output of the case study experiment

Now let us analyze the process outputs of ring diameter with prescript mean 17,00mm. It was used $\bar{x}, s$ control Fig. except for $\bar{x}, R$ with regard to having more than 10 units of sample size. Again, SPSS Statistics showed that there is one violation of the control Fig.s rules. We cannot see any violating the control lines, but there can be seen several possible patterns of potential non-randomness in the Fig.. Although the rule is violated in the raw of outputs of samples 7 to 11, we can see the small trend from the sample 7 to the sample 22 and then the run of point is without any problem. Let us express the possible cause of strong decreasing from the sample 6 to the sample 7 and then trending up to the sample 22. From the 7 sample, the machine was operated by a new employee. The run of points in control Fig. for a mean is shown in Fig. 3.

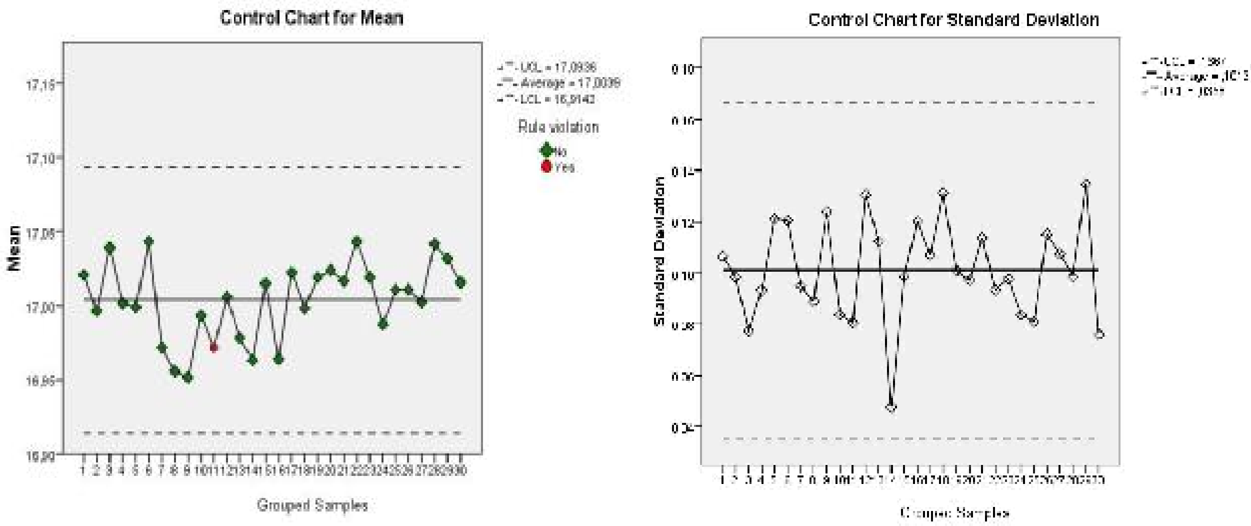

Fig. 3: Ring diameters 17,00mm analysis of the mean and standard deviation; Source: SPSS output of the case study experiment

The variation, displayed in the control Fig. for the standard deviation (see Fig. 3), seems to be scattered around the prescript value 0,10mm and does not show any significant non-randomness during data collecting. Awareness could be required in the value of the sample 14, which has the standard deviation near the lower control limit line. The attention needs to be paid to the next continuing of the process, because the variability could point to the little rising trend.

The both data sets for different ring diameters have a lot in common. During process assessment period there was no significant violating the outputs parameters according to control limit lines but the problem areas appeared anyway. There can be assignable causes that changes process outputs in a way that they do not reflect in products deflects but some patterns can show statistically uncontrolled process which can lead to needless costs in a future.

4. Conclusions

Process managing is the wide, but important area for reaching the continual sustainable growing of the value of the company. Shewhart control Fig.s are the helpful tool for process control analysis and they still have their importance in decision making. In our post-modern turbulent age we should take adequate care of any kind of competitiveness, especially the capability of customer satisfaction with sustaining or improving the expected quality of products. These days when there are a lot of activities to be managed in every minute, computers play a huge role. There are many software tools which provide the quicker analytical outputs for decision making. This paper brought an insight into the possibility of the use of SPSS Statistics (version 17) as a helping tool for analyzing statistical control of the process. This software was also used for testing the assumptions. Control Fig.s presents the useful tool for the both operating management of manufacturing business units, and for the top managers to control how the performance of the company is changing during a time period and it can set the standards for benchmarking.

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Contact address:

Ing. Josef Černý
Dělnická 1592/2, Bruntál, 792 01
email: mr.j.cerny@seznam.cz, josef.cerny.st2@vsb.cz
Phone: (+420) 737 242 589, (+420) 777 592 623

Appendix 1

Tab. 2: Process output of ring diameters , 30 samples with 8 units, generated by the generator of pseudorandom numbers with MS-Excel

Sample	Unit Cases							
	1	2	3	4	5	6	7	8
1	14,97	15,17	15,07	15,04	15,10	15,04	15,03	15,01
2	14,87	14,84	15,03	15,06	15,01	14,94	15,15	15,09
3	15,02	15,05	14,91	15,02	15,11	15,07	15,01	15,18
4	15,13	15,09	14,98	14,90	14,99	15,05	14,89	14,87
5	15,12	15,19	15,01	15,12	14,92	15,11	14,86	14,88
6	15,17	14,99	15,06	14,97	15,11	14,72	15,02	15,06
7	14,78	14,95	15,01	14,92	14,94	15,05	15,10	15,12
8	14,98	15,07	14,91	14,92	15,05	15,15	14,85	14,91
9	15,11	14,96	15,19	14,96	15,05	14,83	14,94	14,79
10	14,89	15,08	15,05	14,95	14,97	15,00	15,05	14,91
11	14,93	14,86	15,01	14,95	14,96	15,14	14,98	15,02
12	14,83	14,92	15,08	15,08	14,86	15,17	14,97	15,04
13	14,82	14,85	15,09	15,05	15,20	15,02	14,98	14,90
14	14,90	14,96	14,94	14,94	14,94	15,01	14,96	14,91
15	14,92	15,00	14,91	15,13	15,01	15,19	14,92	15,05
16	14,79	15,00	15,11	14,82	14,98	15,00	15,06	15,01
17	14,94	14,97	14,88	15,06	15,28	14,93	15,01	14,95
18	14,96	15,22	14,84	14,99	15,13	15,09	15,13	15,01
19	15,01	14,83	15,07	15,00	15,09	15,00	15,03	14,91
20	14,96	14,93	15,06	14,93	15,13	15,10	15,01	14,91
21	14,97	14,74	15,22	14,95	15,02	15,04	15,02	15,10
22	14,96	15,14	15,14	15,08	15,05	15,15	15,02	15,16
23	15,13	14,87	15,13	15,08	14,98	14,99	15,00	14,93
24	14,99	14,93	15,01	15,05	14,88	14,90	14,88	14,98
25	14,98	15,08	15,00	15,07	15,13	14,85	15,02	15,01
26	14,95	15,05	15,05	15,16	14,97	14,74	15,01	15,18
27	15,20	15,09	15,00	15,03	14,87	15,01	15,08	15,06
28	15,09	15,06	14,89	15,06	15,08	15,03	14,93	15,17
29	15,24	14,86	14,82	15,19	15,08	15,00	15,06	15,02
30	14,93	14,89	15,08	14,97	15,04	15,02	15,02	15,16

Appendix 2

Tab. 3: Process output of ring diameters, 30 samples with 12 units, generated by the generator of pseudorandom numbers with MS-Excel

Sample	Unit cases											
	1	2	3	4	5	6	7	8	9	10	11	12
1	16,97	17,17	17,07	17,04	17,10	17,04	17,03	17,01	16,94	16,78	16,94	17,16
2	16,87	16,84	17,03	17,06	17,01	16,94	17,15	17,09	16,90	17,05	17,09	16,93
3	17,02	17,05	16,91	17,02	17,11	17,07	17,01	17,18	17,12	17,05	16,92	17,01
4	17,13	17,09	16,98	16,90	16,99	17,05	16,89	16,87	17,09	17,12	16,99	16,92
5	17,12	17,19	17,01	17,12	16,92	17,11	16,86	16,88	16,83	16,90	16,98	17,07
6	17,17	16,99	17,06	16,97	17,11	16,72	17,02	17,06	17,13	17,12	17,15	17,02
7	16,78	16,95	17,01	16,92	16,94	17,05	17,10	17,12	16,98	16,94	16,87	17,00
8	16,98	17,07	16,91	16,92	17,05	17,15	16,85	16,91	16,89	16,93	16,91	16,90
9	17,11	16,96	17,19	16,96	17,05	16,83	16,94	16,79	16,81	16,83	16,98	16,97
10	16,89	17,08	17,05	16,95	16,97	17,00	17,05	16,91	16,92	17,14	16,89	17,07
11	16,93	16,86	17,01	16,95	16,96	17,14	16,98	17,02	17,05	16,90	16,86	17,00
12	16,83	16,92	17,08	17,08	16,86	17,17	16,97	17,04	17,09	17,15	16,78	17,10
13	16,82	16,85	17,09	17,05	17,20	17,02	16,98	16,90	16,99	16,88	17,06	16,90
14	16,90	16,96	16,94	16,94	16,94	17,01	16,96	16,91	16,99	16,96	16,97	17,08
15	16,92	17,00	16,91	17,13	17,01	17,19	16,92	17,05	17,02	16,87	17,04	17,12
16	16,79	17,00	17,11	16,82	16,98	17,00	17,06	17,01	16,96	17,16	16,80	16,88
17	16,94	16,97	16,88	17,06	17,28	16,93	17,01	16,95	17,09	17,00	17,12	17,04
18	16,96	17,22	16,84	16,99	17,13	17,09	17,13	17,01	16,95	17,03	16,81	16,82
19	17,01	16,83	17,07	17,00	17,09	17,00	17,03	16,91	17,23	17,10	16,95	17,01
20	16,96	16,93	17,06	16,93	17,13	17,10	17,01	16,91	17,07	17,19	16,90	17,10
21	16,97	16,74	17,22	16,95	17,02	17,04	17,02	17,10	17,06	16,99	16,99	17,10
22	16,96	17,14	17,14	17,08	17,05	17,15	17,02	17,16	16,90	16,90	17,01	17,01
23	17,13	16,87	17,13	17,08	16,98	16,99	17,00	16,93	17,09	16,94	17,17	16,92
24	16,99	16,93	17,01	17,05	16,88	16,90	16,88	16,98	17,14	17,08	16,95	17,06
25	16,98	17,08	17,00	17,07	17,13	16,85	17,02	17,01	16,93	17,09	16,92	17,05
26	16,95	17,05	17,05	17,16	16,97	16,74	17,01	17,18	16,97	17,05	16,93	17,07
27	17,20	17,09	17,00	17,03	16,87	17,01	17,08	17,06	16,87	16,85	17,06	16,91
28	17,09	17,06	16,89	17,06	17,08	17,03	16,93	17,17	17,14	16,86	17,13	17,06
29	17,24	16,86	16,82	17,19	17,08	17,00	17,06	17,02	17,10	16,99	16,86	17,16
30	16,93	16,89	17,08	16,97	17,04	17,02	17,02	17,16	17,02	16,94	17,10	17,02