

«SIX SIGMA» AND PROGRAMMED PRINTING

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ABSTRACT

Nowdays, control and print leading systems were developed, its systems can be placed under name «programme printing». With them, we can link technological processes under graphic technology reproduction chain. Firstly, inside conditions were defined to get a quality achievement of graphic reproduction. On the contrary, in «six sigma» programme there is organization develop based on better, faster and cheaper. By the way, both programmes try to stop stagnation and damage, try to decrease product cycles as well as expence savings. Using known theoretical possibilities of every mentioned system in this paper, we try to achieve its symbioses on certain models aplicated in graphic practice.

Keywords: offset printing, graphic reproduction, six sigma, quality leading

1. INTRODUCTION

About 45% of all the printed materials today are made in conventional offset printing. The most expensive device in the technological process of the print production is the offset printing machine. In order to be profitable it is important that the printing house works with least possible work interruption, with the most possible acceptable speed and the satisfactory print quality. In order to achieve this aim there is continuous work on machine and technology improvements, on increasing the production quality and work organization.

A part of the offset machine which limits the printing speed is the feeder. By increasing the work of the feeder (e.g. stream feeding) the speed of the machine is increased. The introduction of inkers cooling is one of the stability factors of the print quality. In order to decrease the not working time of the machine the automatic washing of the machine and the automatic plate changing has been introduced. To monitor the quality of prints and to manage the production the systems of the "programmed printing" are introduced which use measuring stripes through the whole reproduction chain as well as the optical measuring instruments. The introduction of the computerized electronic devices for printing leading and special damping devices contributes to quicker machine preparation and to decrease of waste. All is controlled by optical devices which send the information to the machine by means of computers and in this way close the quality control circle.

2. AIMS AND THE USED METHODS

The aims of improvements can be: the shorter preparation time of the machine, the decrease of waste, the decrease of the number of operators, the increase of the print quality and the

increase of the printing speed of the machine. The achieving of these aims is the complex problem which has to be solved from the technical-technological aspect as well as from the organization aspect.

The mentioned aims can be achieved by using the quality management program "six sigma".

"six sigma" is one of the methods which helps companies (firms) to achieve higher quality and to remove defects, that is samples of the appeared defects whether in processes or on the products themselves. The method is based on the quality improvements so that it decreases the dissipation and ensures better productivity, quality of the product and the satisfaction of the buyer. The basic idea of the program is in continuous decrease of variations which appear in the process and on the product.

6σ is connected with the demands for the ability of the process with the supposition that the observed process is divided according to the normal division, while the standard aberration σ presents the dissipation measure. Statistical explanation of the programs "six sigma" is that the program means 99.9996% of successfulness. If this level of successfulness is presented by means of the defects on million opportunities (DPMO) it is equivalent to the appearance 3,4 defects on million opportunities. It originates from that, that "six sigma" gives almost a perfect result. While using the "six sigma program" the firm has to be articulated to the level of the process and analyzed each particular process. When the processes which are necessary to be improved are found they are acted at with the small group of experts. "Six sigma" uses two improving processes.

- The process DMAIC (define, measure, analyze, improve, control) for improving the existing processes;
- The process DAMDV (define, measure, analyze, design, verify) in developing the new products and processes or when no expecting results are achieved by the process DMAIC

Because the existing processes of the offset printing are presented in the example the process DMAIC was used. As it was already said it consists of five phases:

- 1) D - defining of aims improving: the appropriate objects for improving have been recognized and the characteristics which have the greatest influence on the quality from the viewpoint of the company as well as of the buyer are determined (CTQ = Critical to Quality);
- 2) M - measurement of the existing system which has to be improved: processes of data collecting have been planned, the temporary level "sigma" has been determined, and the measurements which enable the monitoring of the observed process and the determining if the introduced changes which can lead to improvements have been performed
- 3) A - analysis of the system: the collected and measured data have been analyzed in order to detect the potential causes of the process variations and the defined causes which have the greatest influence on the process variations have been defined. In this phase the difference between the temporary sigma and the aimed one has been determined.
- 4) I - improvement of the system: the key variables which influence the quality have been verified and the solutions which can be easily implemented into the process with the aim to work quicker, better and cheaper have been found out. The appeared

improvements have been controlled and monitored by continuous measurements and the usage of the statistic methods.

- 5) C – control of the new system: statistic and other tools have been introduced which must constantly monitor and control the key variables of the improving process in order to determine if the performed improvements have reached its goal.

3. EXPERIMENTAL PART

3.1. The used machines

The used method “six sigma” is presented in the offset printing process with the aim to determine the possible improvements. The conventional and contemporary automatic machines used in offset printing were observed.

Many printing houses use offset machines with the conventional ink duct (the blade in the ink duct is in one piece) without electronic support (4). Such a conventional machine Planeta 4 + 0 inks B1 size was used in this work. Heidelberg machines are among the modern automated and computerized offset machines with the modern ink duct (the blade is divided into particular ink zones). One of them is Speedmaster 4 + 0 inks, B1 size with the maximal equipment which is compared in this work.

3.2. Technological rationalized production

Printing with the visual control does not use any measuring instruments. The quality of the print obtained in these conditions depends exclusively on illumination, the quality of the operator and on his tiredness. The print measuring demands the setting of the measuring strip on the print, which has the consequence the waste increase (2). The automation of the machines rises the price of the machine but also achieves the determined savings and ensures the constant print quality. The observed Heidelberg Speedmaster had Computer Print Control device (CPC). CPC1 is the device for remote managing with the ink duct register and it prepares the connection with CPC2 and CPC3. CPC2 device is the Densitometric and Spectrophotometric control of the stripe on a print and CPC3 is ZONSKI CITAC of the printing form (3). CPC4 serves for automatic setting the register. CPtronic is the device for managing the dampening and the control the machine work. The machine was also equipped with the Baldwin chamber for the dampening solution and with the dampening unit alcolor. The washing of the machine was automatized.

3.3. Application of the project “six sigma” on the programmed printing

Based on the previously mentioned facts, the simplified application of the six sigma program in the offset printing on the conventional machine is presented.

Definition: to shorten the time necessary for preparation
to decrease the paper addition for printing

Measurement: the measurements are performed in order to determine the necessary preparation time on the conventional printing machine. The measurements were performed first on the conventional machine which was run by 1 printer and 1 helping worker and the second time the machine was run by 2 printers and 1 helping worker.

Analyzing: result analyzing determined by measurements with the aim of defining the time necessary for the preparation of the conventional printing machine depending on printers

Improvement: according to the performed analysis it was found out that the necessary time for the machine preparation can be decreased only by the introduction of technical and electronic improvements of the machine itself.

Control: the electronic machine was observed, which was once run by 1 printer and 1 helper, and the second time it was run by 2 printers and the third time CPC machine was observed which had automatic plate washing and which was run by 1 printer. The results of the necessary times for the machine preparation in dependence on the number of operators are presented in figure 1. The savings on paper addition in dependence on the run size was achieved in dependence on the technical equipment of the machine as presented in figure 2.

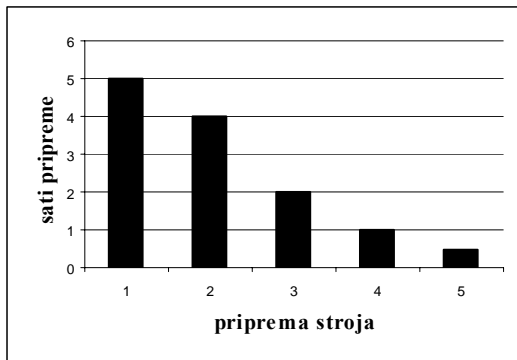


Figure 1. Histogram, the time for the machine preparation in dependence on organization and technical changes

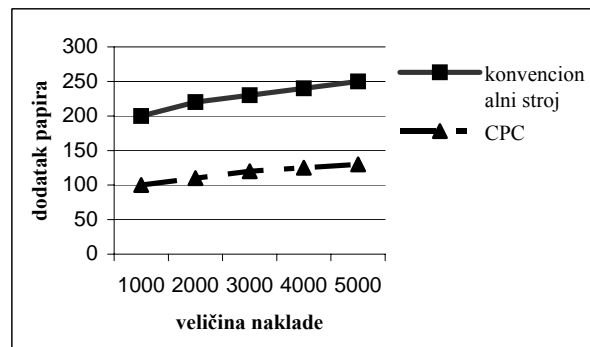


Figure 2. Savings on paper addition in dependence on the technical equipment of the machine

4. RESULT AND DISCUSSION

Organization process which recently appears more and more often in practice and which has tendency to achieve higher quality and to remove defects is “six sigma”. The possible application of the method DMAIC direct on the technological solutions in printing is presented on the simplified example

The measurements were performed first on the conventional printing machine. The results were submitted to the analysis and it showed that the determined improvements can be achieved by varying the quality and number of operators. However, the improvement of the technological possibilities of the machine is necessary for further improvements.

Following the suggestion obtained by using the process “six sigma” the measurements of the sophisticated modern offset machine were further performed. The determined results were analyzed and based on that analysis the new suggestion was created.

On the basis of the results, the histogram was made and it is presented in figure 1. It is visible from the histogram that the mechanical and computer improving of the machine can achieve shorter preparation time of the machine. However, it is visible that by the organization improvement (varying of the number and qualifications of workers) the preparation time for the machine can also be shortened. The effect of the combined usage of the mentioned parameters is visible.

Material savings is presented in figure 2. It is visible that the usage of the system alcolor, essentially changes the paper quality necessary for starting the machine. By using the Baldwin chamber, that is, by decreasing the surface tension of the dampening solution, and with the computer maintenance of the ink coating within the tolerances, the addition of paper during the run printing is decreased for 50%. In order to be able to use the CPC system the

measuring strips must be printed which means in our case (size B1) the waste of about 1,5% of paper. Comparing the savings and the increased usage of paper, the result is positive, that is, the savings is considerable, especially in short runs.

The estimate “six sigma” shows the directions of further seeking for material saving, that is, the impossibility of further considerable decrease of machine preparation time.

The possibility of the program 6 σ application in the production process of the printing house is presented in the mentioned example. For finding the real possibilities of improvements by the application of the program 6 σ , it is necessary to analyze the processes in details with the aim of finding the factor which mostly influences the quality of the process itself. In this case one of the processes of the improving program “six sigma” would be used with aim.

In order to comprise all the influential factors of some process the Ishikawa diagram can be used for detailed analysis. Ishikawa diagram is suitable for analyzing the causes and consequences of the appeared problem in the process in a simple way. Because of that the term diagram of cause and consequences is often used, because the essence of the method is to determine the cause and consequences of the problem in a way of “brainstorm” expert team.

5. CONCLUSION

This work has been tried to connect the methods of “six sigma” processes with the printing production process. The obtained results have shown that it is possible that the chosen method, in the concrete case DIAMC, gives results which lead to the decreasing time for the machine preparation and the decreasing the paper addition for run printing.

This method is particularly suitable for great printing houses in which it is supposed it is possible to control many other parts of the printing process by using this method. These preliminary researches have shown that, by using this method it is possible to recognize the part of the process in which the greatest need for improvements exists, that is, to recognize the processes where the possibilities of improvements with the existing ways of working i.e. technology are used up.

It is considered that the results should have direct financial effect.

6. REFERENCES

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