

## RE-ENGINEERING APPROACH IN SMALL AND MEDIUM-SIZE COMPANIES' MODERNIZATION IN PRINTING AND PUBLISHING INDUSTRY

UDC 655.15.017.3:658.511.5

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**Abstract.** *This paper aims to introduce a new approach for preliminary machines-and-equipment determination in printing and publishing production sections. The approach enables application of re-engineering method in this type of production sections design. The method is probated in real conditions.*

### INTRODUCTION

The necessity of scientific and technological progress and the increasing competition between small and medium-size companies (SMC) of the printing and publishing industry (PPI) forces them to look for new opportunities of widening the variety of goods and services as well as increasing the quality and decreasing the prime cost. One of the ways of achieving these goals is the introduction of new equipment and implementation of the digital press technology.

The precise solution of the problem for finding the new equipment predetermines to a great extent its effectiveness. At the same time for the entrepreneurs in SMC it is of great importance to obtain a preliminary solution to the given problem, which should not differ from the final one. Regarding this the entrepreneurs should be able to receive an answer to the question for the necessary investments in buying new production equipment, the purchasing time and from there the possibility for implementing such modernization.

Because of its duration and prime cost, the conventional method for the selection of printing and publishing workshop equipment is not sufficient for the SMC conditions. So we need to get the principal answers to questions like: "What kind of equipment?", "What is the necessary investment?", "What is the returns rate?".

Generally, the selection of company equipment is a poly-criteria optimization problem, since the alternative versions are compared by total technical and economic characteristics.

The aim of the research is to offer a re-engineering approach for solving problems in a preliminary machines-and-equipment selection in printing and publishing SMC.

### 1. RE-ENGINEERING APPROACH

The re-engineering of business processes [1, pp. 121-127; 2, pp. 81-107; and 3] is a modern method for industrial engineering and management. Using information technologies, multidisciplinary groups of specialists and modern managers' approaches, aim to achieve: increasing in probability of successful market realization of newly developed products; decreasing in production prime cost; increasing in efficiency of materials usage; technical and human resources.

This approach offers an opportunity to apply the principles of re-engineering in printing and publishing production unit design.

### 2. PROBLEM SETTING

The following problem setting can be defined for preliminary determination of the necessary SMC equipment in PPI: In known technical solutions for the different stages of the technological process with limiting conditions as including maximum permitted area, quality product characteristics, maximum permitted production personnel, printing and publishing workshop production program, the aim is to determine such combination of technical means, where the technological process can be performed with minimum investments in fixed tangible assets and production prime cost.

### 3. CHARACTERISTICS

Definition of the following characteristics:

1. The problem is of "vector (poly-criteria) optimization problem" type. The choice is done on analysis basis of competing versions on the aggregate of preliminary given technical and economic characteristics. For the small and medium-size businesses the most significant in this preliminary determination stage of necessary machines and equipment, are "prime cost" and "necessary investment" characteristics. On this basis the entrepreneur can determine internal rate of fixed tangible assets.

2. The various number of technical solutions in the polygraph industry predetermines the various number of equipment variants. The power of the problem is of exponential type [1], which is the least favorable variant.

3. By determining the optimal variant, eliminated are these variants that are contradictory to the permitted area defined by the limiting conditions. The most important limits for the SMC are: existing production area, available production personnel, and production program.

4. When determining a variant, eliminated are these solutions for which two or more than two technical means cannot work together.

## 4. MATHEMATICAL MODEL

The Mathematical Model of problem defining has the following description:

To find out a variant

$$X = \{X_1^1; X_2^1; \dots; X_n^1; \dots; X_N^1\} \quad (1)$$

That is optimal by totality of criteria

$$\text{opt } F(X) = \{f_k(X); k, \dots, K\}$$

What are the satisfying restrictions?

$$\begin{aligned} f_m(X) &< b_m \\ g_m(X) &< b_m \end{aligned}$$

Which defines admissible area **S** wherever:

$N$  = number of particular functions that is expand the general function by design system;

$l_n$  = number of alternative machines or equipments for execution of  $n$  operation;

$F(X)$  = vector of aim functions – prime cost of production and necessary investments;

$f(k)$  = Technical-economic characteristic, to find for that the optimal value,  $k \dots K$ ;

$g(k)$  = Technical-economic characteristic, to find for that the optimal value,  $k \dots K$ ; and

$X$  = multitude of possible variants of different machines and equipments of production section.

Presume that the functions  $f(k)$  and  $g(k)$  are separable, additives or multiplicities are the dependences between technical-economic characteristics of possible variants for the different machines and equipments of the production section and respective homonymous characteristics of rudimentary unit, constructing them.

For solution of this sum, these methods and this program product are proposed for implementation [4, 5].

## 5. APPROACH APPLICABILITY IN REAL CONDITIONS

The proposed re-engineering approach is applied in PPH "Sara" – Bourgas by defining the necessary technical means of printing house.

PPH "Sara" – Bourgas is an enterprise of small-size type in the region of Bourgas. Object of the economic activity is printing of books and advertising materials (brochures, posters, folders, advertisement calendars, etc.). The necessity of improvement, increase in services quality and the strong competition in the region makes the necessity of finding new solutions for its production range and for production technique modernization.

As a result of the weak sides analysis in the company production, the operations that should be improved were defined (Figure 1). This determined the machinery type, which was necessary to change.

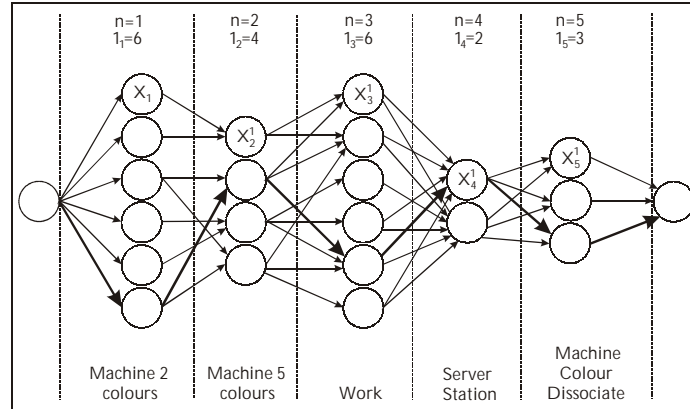


Fig. 1. Operations subject to modernization

By applying the re-engineering approach for preliminary choice the machinery shown in Table 1 were bought.

Table 1. New machinery and equipment

N	Machinery	Machinery r
1	Xerox DocuColor 2060 – 5 colors	1
2	Xerox DocuColor 2006 – 2 colors	2
3	Work Station	6
4	Server	1
5	Machine for colors dissociate	2

As a result of the changes in the equipment of the printing house the quality of the produced goods has been increased. At the same time its prime cost has been reduced (Figure 2).

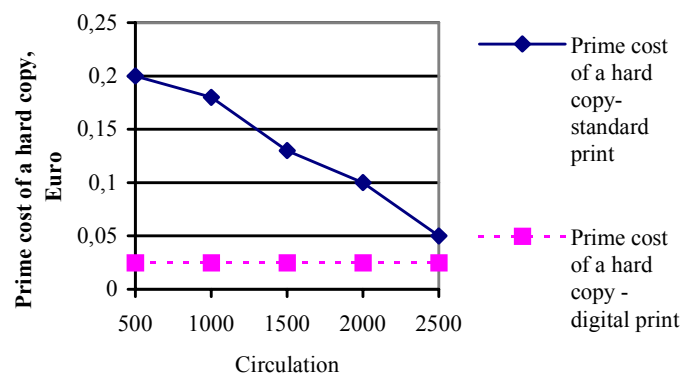


Fig. 2. Prime cost of a hard copy, depending on circulation

#### CONCLUSION

The developed re-engineering method supports the preliminary assessment for technical resources when contractors design a printed base. This approach enables us to answer a question (in its initial stage of the project) for the necessary investments and also provides an estimate of future production. The probation period of this approach in reality makes it possible to assess its applicability.

#### REFERENCES

1. Davenport T. H., and Stoddard D. B., Reengineering: Business Change of Mythic Proportions? *MIS Quarterly*, June 1994.
2. Stoddard D. B., and Jarvenpaa S. L., Business Process Redesign: Tactics for Managing Radical Change, *Journal of Management Information Systems*, 12/1, Summer 1995.
3. Hammer Michael and Champy James, Reengineering The Corporation, *Harper Business*, 2000.
4. Иванчев Д., Г. Неглер, Мрежово Оптимизиране, ISBN 954-438-028-0, ТУ-София, 1996.
5. Бояджиев, Ил., И. Малаков, Многокритериална Оптимизация на Структурата на Техническите Средства За Автоматизация На Монтажа, ISBN 0025-455X, *Машиностроене*, Vol. 7-8, 1997.

## **REINŽENJERING PRISTUP U MODERNIZACIJI MALIH I SREDNJIH ŠTAMPARSKO-IZDAVAČKIH KOMPANIJA**

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*U radu je prezentiran novi pristup u odredjivanju potrebnih mašina i opreme za štamparsko-izdavačke kompanije. Pristup omogućava aplikaciju reinženjering metode u projektovanju segmenata ovog tipa proizvodnje. Metod je potvrđen u realnim uslovima.*