

UDC 655: 681.6

DOI: 10.20535/2077-7264.1(79).2023.278136

© V. O. Kokhanovskiy, PhD, Associate professor,
O. V. Zorenko, PhD, Associate professor, R. A. Khokhlova,
PhD, Associate professor Igor Sikorsky KPI, Kyiv, Ukraine

**FACTORS THAT DETERMINE THE NEED
OF THE PRINTING ENTERPRISE
IN BASIC TECHNOLOGICAL EQUIPMENT**

**The article defines and substantiates the system of factors
that shape the printing company's need for production
equipment.**

**Keywords: polygraphy equipment; digital printing;
production efficiency; influencing factors; productivity;
technical re-equipment; need for equipment.**

Introduction

The question of the efficiency of the usage of printing equipment has become especially relevant in the conditions of competition and the general recession of the economy. In this regard, enterprises are interested in accelerating the process of replacing outdated and introducing new equipment and technologies in order to improve the use of fixed production assets and gain profit.

Based on the analysis of trends in the development of the printed production market, changes in its structure, reforming of the intra-industry structure [1–8] and the study of special literature on the problems of technical and technological forecasting [9–12], an attempt was made to substantiate the system of factors that shape the need of a printing enterprise for basic technological equipment.

Methods

The set of factors influencing the need of printing enterprises for basic technological equipment can be divided into two groups: external and internal (fig.).

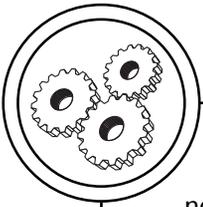
They must be taken into account when determining the need for both operating and new enterprises.

External factors include:

- economic policy of the state;
- scientific and technical progress;
- competition;
- demand for products produced by using the main technological equipment.

In turn, the demand for products also depends on many factors —

the population, the structure of consumption of certain types of products, the need for the corresponding types of products, individual demand for printed products. It, in turn, depends on the solvency of the population, the structure of consumption of goods.



When determining the needs of new enterprises for basic technological equipment, in addition to the listed factors (sub-factors), it is necessary to take into account the potential capacity of the market, the expected needs for the products produced at this enterprise.

A group of internal factors affecting the printing company's need for basic technological equipment includes the need to replace physically and morally outdated equipment with equipment designed for technical re-equipment of production, its expansion.

Expansion of production can be carried out at the expense of increasing the volumes of already developed products and at the expense of development of new types of them.

Technical re-equipment of production can be carried out on the basis of existing technology, by re-

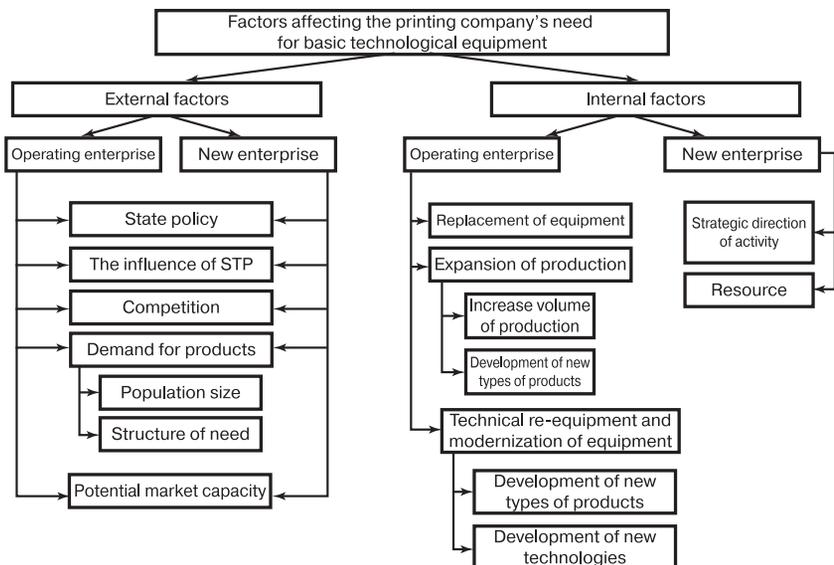
placing equipment, or mastering new technologies that require a suitable set of machines.

The influence of individual factors on the printing company's need for equipment is ambiguous. Some of them reduce the need for equipment. So, for example, if the equipment is purchased, the technical and operational characteristics of which significantly exceed the capabilities of the replaced one, then the company can increase its capacity without increasing the park of machines.

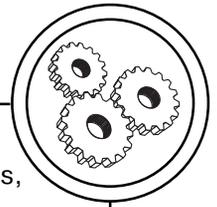
Among the factors that have a lowering effect on the growth of the need for equipment are:

- increase in productivity of machines;
- increasing their quality, strength and wear resistance.

As mentioned above, an important factor affecting the industry's need for basic technological equip-



Factors affecting the printing company's need for basic technological equipment



ment, is the state and trends in the development of the capacity of the global information market. It is characterized by a balance of information supply and demand. Determining and forecasting the dynamics of this market is a fundamental task both for manufacturers of media products and for manufacturers of the equipments of these products.

To increase the level of forecasting, it is necessary to take into account the expected state of the volumes of printed products and digital media.

The basis for forecasting the market of printing products is data on the dynamics of demographic and macroeconomic indicators.

Today is characterized by intensive development of communication technologies. This process, on the one hand, displaces traditional printing products in the market of information services, on the other hand, new information means transform the traditional printing technology into a qualitatively different technical base.

In the conditions of the recession of the economy, the need for a printing company to work for a specific customer is increasing, the main requirements of which include price, quality, and short order production times.

Such requirements can be met only by modern types of equipment, as a rule, with the use of digital technologies. Digital printing facilitates the communication process, allows to create direct contact between the customer and the manufacturer using the network, and entails the following trends:

- increase in volumes of digital publications;

- reduction of print runs, increase in product range;

- reduction of the production cycle;

- operational production (reduction of warehouse stocks, distribution through the network, local production);

- direct marketing.

The production of labels, packaging, advertising products is preserved according to traditional technologies.

Results

The following formula is recommended for calculating the need for equipment to replace worn out equipment:

$$D_3^{t_0+t} = P_i^{t_0+t-1} \cdot L_i^{t_0+t},$$

where $L_i^{t_0+t}$ is the annual rate of write-off of the i -th equipment in the period in % until $t_0 + t - 1$ period.

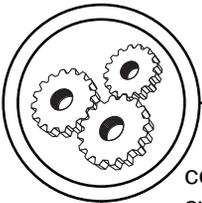
With quantitative constancy of the equipment park, the necessary disposal size can be characterized by the standard for renovation.

And in the conditions of expanded reproduction of the equipment park, the normative coefficient of its disposal can be calculated by the formula:

$$L_i^{t_0+t} = \frac{r}{(1+r)^{j-1}}.$$

Where r is the average annual growth of the park (in %); j is the term of useful use in years.

The calculation of the need for equipment for production expansion is carried out for newly built and reconstructed enterprises. For this purpose, a method of ac-



counting for the dynamics of the average productivity of the equipment is proposed.

The need for production expansion depends on the available equipment park of the i-th type and the average productivity of the equipment unit in the studied periods.

Let's introduce additional notations:

$P_i^{t_0}$, $P_i^{t_0+t}$ — available park of the i-th group of equipment in the base and $t_0 + t$ periods;

$X_i^{t_0+t}$ — output of products on the i-th equipment in the period $t_0 + t$;

$V_i^{t_0+t}$ — is the average productivity of the i-th equipment.

The calculation of the need for the i-th equipment for production expansion is carried out according to the formula:

$$D_{ri} = P_i^{t_0+t} - P_i^{t_0},$$

where $P_i^{t_0+t} = X_i^{t_0+t} / V_i^{t_0+t}$.

To calculate the forecast of the existing park of the i-th equipment in the $t_0 + t$ period, it is sufficient to have data on the growth rates of the productivity of the i-th equipment unit, as well as on the growth rates of production volumes.

$R_{iv}^{t_0+t} = V_i^{t_0+t} / V_i^{t_0}$, from where

$$V_i^{t_0+t} = V_i^{t_0} \cdot R_{iv}^{t_0+t} .$$

$R_{ix}^{t_0+t} = X_i^{t_0+t} / X_i^{t_0}$, from where

$$X_i^{t_0+t} = X_i^{t_0} \cdot R_{ix}^{t_0+t} .$$

The obtained ratios are substituted into the expression:

$$P_i^{t_0+t} = P_i^{t_0} \cdot (R_{ix}^{t_0+t} / R_{iv}^{t_0+t}).$$

And then in the expression:

$$D_{ri}^{t_0+t} = P_i^{t_0} \cdot (R_{ix}^{t_0+t} / R_{iv}^{t_0+t}) - P_i^{t_0} \cdot (R_{ix}^{t_0+t} / R_{iv}^{t_0+t} - 1).$$

Discussion

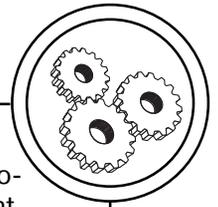
Thus, the need for equipment for the forecasted $t_0 + t$ period in order to expand production is determined on the basis of data on the available equipment in the base period and the rate of growth of the average productivity of the equipment unit and output.

The average productivity of the i-th type of equipment characterizes the average actual output per unit of a given type, subtype or type of equipment in the base year. However, due to the fact that this value is subject to changes over time, when determining its value in the prospective period, it is necessary to adjust the obtained basic data.

In addition to internal factors, external factors have a significant impact on the need of enterprises for equipment. Existing and newly created enterprises fall under their influence.

Conclusions

The availability of an equipment park that meets the modern needs of the market is an essential factor for an enterprise to optimize its production capacity, reorient production to new types of products and remain competitive. It is possible to predict technical re-equipment

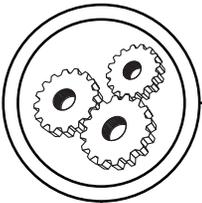


and improve such methods after a thorough analysis of the market, global trends in printing engineering, development of a program by the enterprise for re-equipment or modernization of existing equipment. When the enterprise develops a

program for re-equipment or modernization of existing equipment, a system of factors that determines the relationship between traditional and digital technologies of printing production should be taken into account.

References

1. *Three Print Industry Focus Points 2023*. Retrieved from <https://blog.drupa.com/en/three-print-industry-focus-points-2023/>.
2. *Market Trends in the European Label Industry*. Retrieved from <http://printfuture.com/archives/business/market-trends-in-the-european-label-industry/>.
3. *Digital Commercial Printing at Mid-Drupa Cycle: Where are we now?* Retrieved from <http://printfuture.com/print-tribe/digital-commercial-printing-at-mid-drupa-cycle-where-are-we-now/>.
4. *8th drupa Global Trends Report 2022 Executive Summary*. Retrieved from https://www.drupa.com/cgi-bin/md_drupa/lib/all/lob/return_download.cgi/8th_Global_Trends_Executive_Summary_EN.pdf?ticket=g_u_e_s_t&bid=7241&no_mime_type=0.
5. *7th drupa Global Trends Report 2020 Executive Summary*. Retrieved from https://www.drupa.com/cgi-bin/md_drupa/lib/all/lob/return_download.cgi/7th_drupa_Global_Trends_Executive_Summary_English.pdf?ticket=g_u_e_s_t&bid=5539&no_mime_type=0.
6. *6th drupa Global Trends Report 2019 Executive Summary*. Retrieved from https://www.drupa.com/cgi-bin/md_drupa/lib/all/lob/return_download.cgi/6th_drupa_Global_Trends_Executive_Summary_English.pdf?ticket=g_u_e_s_t&bid=4590&no_mime_type=0.
7. *5th drupa Global Trends Report 2018 Executive Summary*. Retrieved from https://www.drupa.com/cgi-bin/md_drupa/lib/all/lob/return_download.cgi/5th_Global_Trends_Executive_Summary_EN.pdf?ticket=g_u_e_s_t&bid=4582&no_mime_type=0.
8. *4th drupa Global Trends Report 2017 Executive Summary*. Retrieved from https://www.drupa.com/cgi-bin/md_drupa/lib/all/lob/return_download.cgi/4th_Global_Trends_Report_Executive_Summary_EN.pdf?ticket=g_u_e_s_t&bid=2606&no_mime_type=0.
9. Broudy, D., & Romano F. (2006). *Personalized and Database Printing. Micro Publishing Press*, 308 p.
10. Romano, F., Landolt, K., & Needham, M. (2007). *Marketing for Digital Set: A Guide to Print Markets. Printing Industries Press*, 104 p.
11. Thorp, J. (2016). *Printing for Business; a Manual of Printing Practice in Non-technical Idiom. Wentworth Press*, 2002 p.
12. Shtefan, Ye. V., Roik, T. A., Zorenko, O. V., & Shostachuk, O. P. (2021). *Metody tsyvrovoho upravlinnia polihrafichnyh protsesamy [Methods of Digital Control of Printing Processes]. Tekhnolohiia i tekhnika drukarstva, 2(72), 54–63. https://doi.org/10.20535/2077-7264.2(72).2021.242474 [in Ukrainian]*.



Список використаних джерел

1. Three Print Industry Focus Points 2023. [Електронний ресурс]. Режим доступу: <https://blog.drupa.com/en/three-print-industry-focus-points-2023/>.
2. Market Trends in the European Label Industry. [Електронний ресурс]. Режим доступу: <http://printfuture.com/archives/business/market-trends-in-the-european-label-industry/>.
3. Digital Commercial Printing at Mid-Drupa Cycle: Where are we now? [Електронний ресурс]. Режим доступу: <https://printfuture.com/print-tribe/digital-commercial-printing-at-mid-drupa-cycle-where-are-we-now/>.
4. 8th drupa Global Trends Report 2022 Executive Summary. [Електронний ресурс]. Режим доступу: https://www.drupa.com/cgibin/md_drupa/lib/all/lob/return_download.cgi/8th_Global_Trends_Executive_Summary_EN.pdf?ticket=g_u_e_s_t&bid=7241&no_mime_type=0.
5. 7th drupa Global Trends Report 2020 Executive Summary. [Електронний ресурс]. Режим доступу: https://www.drupa.com/cgibin/md_drupa/lib/all/lob/return_download.cgi/7th_drupa_Global_Trends_Executive_Summary_English.pdf?ticket=g_u_e_s_t&bid=5539&no_mime_type=0.
6. 6th drupa Global Trends Report 2019 Executive Summary. [Електронний ресурс]. Режим доступу: https://www.drupa.com/cgibin/md_drupa/lib/all/lob/return_download.cgi/6th_drupa_Global_Trends_Executive_Summary_English.pdf?ticket=g_u_e_s_t&bid=4590&no_mime_type=0.
7. 5th drupa Global Trends Report 2018 Executive Summary. [Електронний ресурс]. Режим доступу: https://www.drupa.com/cgibin/md_drupa/lib/all/lob/return_download.cgi/5th_Global_Trends_Executive_Summary_EN.pdf?ticket=g_u_e_s_t&bid=4582&no_mime_type=0.
8. 4th drupa Global Trends Report 2017 Executive Summary. [Електронний ресурс]. Режим доступу: https://www.drupa.com/cgibin/md_drupa/lib/all/lob/return_download.cgi/4th_Global_Trends_Report_Executive_Summary_EN.pdf?ticket=g_u_e_s_t&bid=2606&no_mime_type=0.
9. David Broudy. Personalized and Database Printing / David Broudy, Frank Romano // Micro Publishing Press. 2006. 308 p.
10. Frank Romano. Marketing for Digital Set: A Guide to Print Markets / Frank Romano, Kevin Landolt, Meredith Needham // Printing Industries Press. 2007. 104 p.
11. Joseph Thorp. Printing for Business; a Manual of Printing Practice in Non-technical Idiom / Joseph Thorp // Wentworth Press. 2016. 2002 p.
12. Штефан Є. В. Методи цифрового управління поліграфічними процесами / Є. В. Штефан, Т. А. Роїк, О. В. Зоренко, О. П. Шостачук // Технологія і техніка друкарства. 2021. № 2(72). С. 54–63. [https://doi.org/10.20535/2077-7264.2\(72\).2021.242474](https://doi.org/10.20535/2077-7264.2(72).2021.242474).

В статті визначено і обґрунтовано систему чинників, що формують потребу поліграфічного підприємства у виробничому обладнанні.

Ключові слова: поліграфічне обладнання; цифровий друк; ефективність виробництва; чинники впливу; продуктивність; технічне переоснащення; потреба в устаткуванні.

Надійшла до редакції 02.02.23