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## MODEL OF PRIORITY FACTOR INFLUENCE ON THE PROCESS OF BOOK PUBLICATION FORMATION

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*The process of creating a book publication involves a series of interrelated stages, which are determined by many creative, organisational and technological factors. The final result of book production — its quality, content richness and aesthetic appeal — directly depends on the harmonious interaction of all components of the publishing process. Since this process involves numerous interrelated decisions that determine both the content and visual structure of the book, it is important to identify the factors that have a decisive influence on achieving high performance.*

*The article establishes that the formation of a publication depends on the interaction of factors such as reader demand, subject matter, type and format of the publication, age audience, volume and features of the artistic design. It also substantiates the need to create a model of the priority influence of factors, which makes it possible to systematise the identified interrelationships, quantitatively assess their significance and establish a hierarchy of influences. Such a model is designed to ensure a scientifically sound approach to analysing the process of book publication, making it possible to identify the most decisive factors on which its quality and structural integrity depend.*

*Based on the ranking method, which consists in ordering factors according to their importance, a hierarchical model of factor interaction has been constructed, taking into account both direct and indirect links between them. A quantitative assessment of the weight coefficients of each factor was carried out, which made it possible to determine their priority levels and form a generalised semantic network of the publication formation process. The results obtained reflect the logic of interaction between the elements of the publishing system and allow not only a deeper understanding of its structure, but also predict the effectiveness of its functioning at individual stages. The developed model is the basis for designing and justifying alternative and optimal ways of implementing the process of forming a publication, which creates the prerequisites for improving the efficiency and quality of the book layout process.*

**Keywords:** *priority influence model, influencing factors, publishing process, publication formation, ranking.*

**Problem statement.** In the current conditions of the publishing and printing industry, the process of book production is characterised by a complex structure that combines creative, editorial, technological and production stages. Each of these stages is influenced

by a combination of internal and external factors that determine the quality of the final product. The lack of a systematic approach to assessing the degree of influence of these factors leads to an irrational distribution of resources, a decrease in the efficiency of publishing processes and a deterioration in the quality of publications. Therefore, there is a need to develop a model that would reflect the priority of the influence of individual factors on the process of book production and allow for a quantitative assessment of their interrelationships.

**Analysis of recent studies and publications.** The issue of researching the processes of book production and assessing the impact of factors on their quality has been repeatedly addressed in the works of V. M. Senkivsky, I. V. Pikh, and O. V. Melnikov, who developed a method for ranking factors influencing the quality of technological processes in printing production. A. V. Kudryashova proposed an information technology for the predictive assessment of the quality of the editorial and publishing process, while S. F. Gavenko and O. V. Melnikov studied standards in the publishing and printing industry as factors stabilising the quality of printed products.

At the same time, most works focus on technological or organisational aspects, while the issue of quantitatively determining the priority of factors influencing the publication formation process remains insufficiently researched. This necessitates the development of a model that will allow the integration of qualitative and quantitative characteristics of factors into a single assessment system.

**Purpose of the article.** The purpose of the article is to develop a model of priority influence of factors on the process of book publishing, which involves the identification, classification and ranking of the main factors that affect the quality of the publishing process.

**Presentation of the main research material.** The process of creating a book publication is a complex and multifaceted system that combines creative, technical, and organisational stages. The final result depends on the coordinated interaction of all elements of this process — a high-quality, aesthetically pleasing and substantively complete publication that can satisfy the needs of its readership. The creation of a book publication involves a set of interrelated decisions concerning both content and form, which is why it is particularly important to identify the priority factors that directly influence the effectiveness of this process [1].

Assume that  $S = \{S_1, S_2, S_3, S_4, S_5, S_6\}$  is the general set of factors, where  $S_1$  — thematic and production planning,  $S_2$  — reader demand,  $S_3$  — type of publication,  $S_4$  — age category of the reader,  $S_5$  — volume of the publication,  $S_6$  — design option.

Taking into account the above set of factors, we will design a semantic network — an informational static model of the relationships between the factors of the book publishing process (Fig. 1). [2].

The semantic network presented outlines the main factors influencing the formation of a publication [3].

Using predicate constructions, we present the functional relationships between the factors involved in the typesetting process of a book publication in the following form:

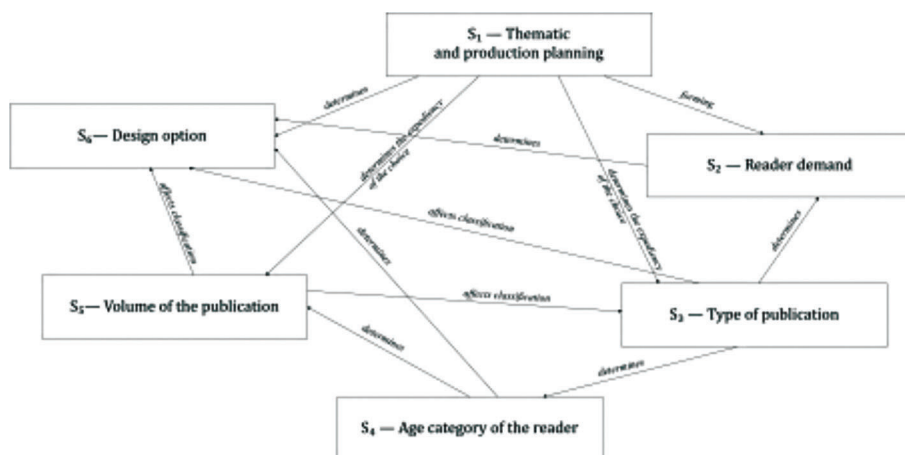


Fig. 1. Semantic network of factors influencing publication formation

$(\forall S_i) [\exists (S_1, \text{Thematic and production planning}) \leftarrow \text{forming } (S_1, S_2) \wedge \text{determines the expediency of the choice } (S_1, S_3) \wedge \text{determines the expediency of the choice } (S_1, S_5) \wedge \text{determines } (S_1, S_6)];$

$(\forall S_i) [\exists (S_2, \text{Reader demand}) \leftarrow \text{determines } (S_2, S_6)];$

$(\forall S_i) [\exists (S_3, \text{Type of publication}) \leftarrow \text{determines } (S_3, S_2) \wedge \text{determines } (S_3, S_4) \wedge \text{affects qualification } (S_3, S_6)];$

$(\forall S_i) [\exists (S_4, \text{Age category of the reader}) \leftarrow \text{determines } (S_4, S_3) \wedge \text{determines } (S_4, S_6)];$

$(\forall S_i) [\exists (S_5, \text{Volume of the publication}) \leftarrow \wedge \text{affects qualification } (S_5, S_3) \wedge \wedge \text{affects qualification } (S_5, S_6)];$

To establish the ranks of factors in the process of book publishing, we will use the factor ranking method, which has been improved by introducing hierarchical models of dependencies between factors.

In further research, it is advisable to take into account the following definitions and statements [4].

**Definition 1.** Any technological process in printing production involves a number of factors that have a decisive influence on the quality of its implementation and, accordingly, on the quality of printed products.

Let  $R = \{r_1, r_2, \dots, r_m\}$  — arbitrary set of technological processes;  $S = \{S_{1m}, S_{2m}, \dots, S_{nm}\}$  — multiple factors affecting the quality of the m-th process, де  $n_m$  — number of factors in the m-th process. We will also assume that

$$A(S_k) = \bigcup_{j=1}^n \omega(S_{jk}) (k=1, 2, \dots, m),$$

where:  $A(S_k)$  — numerical indicator of the quality function of the m-th process;  $\omega(S_{jk})$  — numerical weight indicator of additional quality brought by factor j to technological process k. Then the definition can be presented as follows:

$$(\exists p)(\forall s) A(s_k); r \in R; s \in S.$$

**Definition 2.** The rank and priority of a factor is determined by a weighting coefficient. Among any set of factors, at least one priority factor can be identified.

Thus, for the set  $W = \{w_{1m}, w_{2m}, \dots, w_{nm}\}$  the weight of factors in the technological process, provided that  $B(w) = \max \{w_{1m}, w_{2m}, \dots, w_{nm}\}$ , we will have:

$$(\exists p)(\forall w)B(w); r \in R; w \in W.$$

Statement 1. The existence of relationships between factors is a prerequisite for their formalised representation in the form of a graph.

Statement 2. Accounting for and analysing the influences and dependencies between factors in the initial graphical model, built on the basis of expert judgements, allows the initial ranks of factors to be determined.

Statement 3. When comparing factors within the initial graph, the synthesised multi-level model shows only the advantages between them.

Statement 4. The final weight values that determine the rank and degree of influence of factors on the m-th technological process of printing production can be identified by creating and processing a matrix of pairwise comparisons and calculating the normalised components of the main eigenvector of the matrix.

Definition 3. A set of factors ordered by descending normalised weight values does not contain factors that are absolutely identical in terms of their impact on the technological process [5].

On the condition that  $C(w) = w_j > w_{j+1}$  для  $(j = 1, 2, \dots, n-1)$  the following entry would be fair:

$$(\forall w)C(w); w \in W.$$

According to statements 1–4, the synthesis of a model of the priority influence of factors on the m-th technological process of printing production is carried out by identifying the factors characteristic of the analysed process, creating, analysing and processing the initial graphical model, in which the relationships between the factors are established on the basis of expert judgements.

The ranking method is based on numerical indicators relating to the number of influences and dependencies between factors and their corresponding weighting coefficients. In this case, we distinguish between direct actions, calling them 1st order influences, and indirect actions, calling them 2nd order influences. We will also distinguish between dependencies, establishing 1st and 2nd orders of importance for them in a similar way.

To calculate the total weight values of the direct and indirect effects of factors and their integral dependence on other factors, let us introduce the corresponding symbols. Let  $q_{ij}$  — number of influences or dependencies for the j-th factor ( $j = 1, \dots, n$ );  $w_i$  — weight of the i-th type. We will distinguish between certain types of relationships between factors, which we will depend on the type of relationship identified by the digital value of the index, namely:  $i = 1$  — впливи 1-го порядку;  $i = 2$  — впливи 2-го порядку;  $i = 3$  — залежності 1-го порядку;  $i = 4$  — залежності 2-го порядку.

For calculations, we set some arbitrary numerical values for weight coefficients in relation to the types of relationships. We will assume that for both types of influences, the weights will be positive, i.e.  $w_1 > 0$ ,  $w_2 = w_1/2$ , accordingly for dependencies — negative, namely:  $w_3 > 0$ ,  $w_4 = w_3/2$ . Let us denote the integral weight values of factors by the sums of weights of all types of connections as  $S_{ij}$  [6].

Finally, we obtain the following formula for calculations:

$$S_{ij} = \sum_{i=1}^4 \sum_{j=1}^n q_{ij} w_i,$$

where  $n$  — conditional number of the technological process factor or its stage.

Since, according to the given initial conditions  $w_3 > 0$  and  $w_4 < 0$ , that, accordingly  $S_{3j} < 0$  and  $S_{4j} < 0$ . To bring the weight values of the factors ‘to the origin’, i.e. to obtain additional values, it is necessary to move the histogram of the integral graphical representation of all types of connections upwards based on the ratio:

$$\Delta_j = \max |S_{3j}| + \max |S_{4j}|, \quad (j = 1, 2, \dots, n).$$

Taking into account (5) and (6), the final formula for obtaining the total weight values of the factors will be as follows:

$$S_{Fj} = \sum_{i=1}^4 \sum_{j=1}^9 (q_{ij} w_i + \Delta_j).$$

Quantities  $S_{Fj}$  serve as the basis for weighting, i.e., establishing the levels of quality factors in the implementation of the technological process. Based on the results of the weighting, we synthesise a graphical model using the obtained weight values, which reflect the priority of the factors’ influence on the process. [7].

Based on the graph (Fig. 2), for each factor we construct hierarchical trees of their connections with other factors, taking into account both types of influence — direct and mediated, i.e. indirect, which pass through another factor [8].

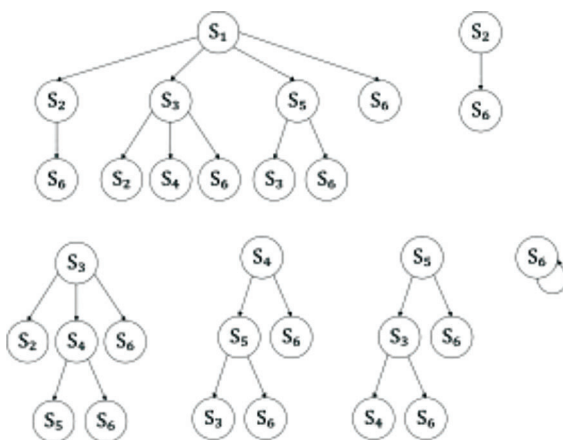


Fig. 2 Graphs of hierarchical direct and indirect influences between factors shaping publication

Let us introduce the following symbols to show the relationships between the factors under consideration:  $\rightarrow$  — directly influences,  $\rightarrow(\dots)$  — indirectly influences,  $\leftarrow$  — directly depends on,  $\leftarrow(\dots)$  — indirectly depends on,  $\wedge$  — logical “and”,  $\leftrightarrow$  — no influence or dependence.

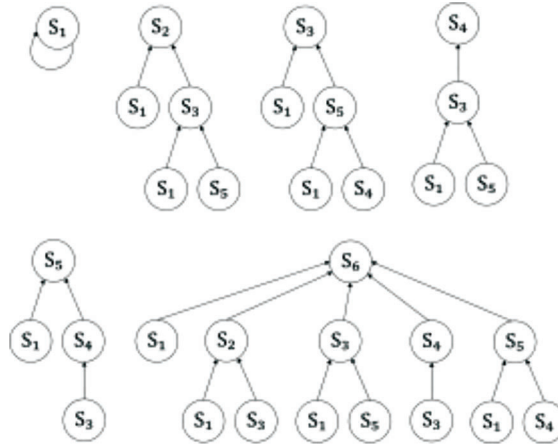


Fig. 3. Graphs of hierarchical direct and indirect dependencies between factors influencing publication formation

Direct and indirect influences of factors:

$$S_1 \rightarrow S_2 \wedge S_1 \rightarrow (S_6) \wedge S_1 \rightarrow S_3 \wedge S_1 \rightarrow (S_2, S_4, S_6) \wedge S_1 \rightarrow S_6 \wedge S_1;$$

$$S_2 \rightarrow S_6 \wedge S_2;$$

$$S_3 \rightarrow S_2 \wedge S_3 \rightarrow S_4 \wedge S_3 \rightarrow (S_5, S_6) \wedge S_3 \rightarrow S_6 \wedge S_3;$$

$$S_4 \rightarrow S_5 \wedge S_4 \rightarrow (S_3, S_6) \wedge S_4 \rightarrow S_6 \wedge S_4;$$

$$S_5 \rightarrow S_3 \wedge S_5 \rightarrow (S_4, S_6) \wedge S_5 \rightarrow S_6 \wedge S_5;$$

$$S_6 \leftrightarrow S_6.$$

Direct and indirect dependencies of factors:

$$S_1 \leftrightarrow S_1;$$

$$S_2 \leftarrow S_1 \wedge S_2 \leftarrow S_3 \wedge S_2 \leftarrow (S_1, S_5);$$

$$S_3 \leftarrow S_1 \wedge S_3 \leftarrow S_5 \wedge S_3 \leftarrow (S_1, S_4);$$

$$S_4 \leftarrow S_3 \wedge S_4 \leftarrow (S_1, S_5);$$

$$S_5 \leftarrow S_1 \wedge S_5 \leftarrow S_4 \wedge S_5 \leftarrow (S_3);$$

$$S_6 \leftarrow S_1 \wedge S_6 \leftarrow S_2 \wedge S_6 \leftarrow (S_1, S_3) \wedge S_6 \leftarrow S_3 \wedge S_6 \leftarrow (S_1, S_5) \wedge S_6 \leftarrow S_4 \wedge S_6 \leftarrow (S_3) \wedge S_6 \leftarrow S_5 \wedge S_6 \leftarrow (S_1, S_4);$$

Based on the above statements and the introduced indicators, we will calculate the total weight coefficients of direct and indirect influences of factors, as well as the level of their integral dependence on other factors.

For calculations, we will use the following conditional values of weight coefficients in conditional units:  $w_1 = 10$ ,  $w_2 = 5$ ,  $w_3 = -10$ ,  $w_4 = -5$ .

As a result, we obtain an expression for calculating the intermediate total values of the weights of the factors determining the publication [9]:

$$S_{ij} = \sum_{i=1}^4 \sum_{j=1}^7 q_{ij} w_i.$$

Table 1

**Calculation data and ranking of factors in the formation of the publication**

| Number of factor $j$ | $q_{1j}$ | $q_{2j}$ | $q_{3j}$ | $q_{4j}$ | $S_{1j}$ | $S_{2j}$ | $S_{3j}$ | $S_{4j}$ | $S_{Fj}$ | Rank Factor $r_j$ | Level of priority |
|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------------------|-------------------|
| 1                    | 4        | 6        | 0        | 0        | 40       | 30       | 0        | 0        | 155      | 5                 | 1                 |
| 2                    | 1        | 0        | 2        | 2        | 10       | 0        | -20      | -10      | 95       | 2                 | 4                 |
| 3                    | 3        | 2        | 2        | 2        | 30       | 10       | -20      | -10      | 125      | 4                 | 2                 |
| 4                    | 2        | 2        | 1        | 2        | 20       | 10       | -10      | -10      | 115      | 3                 | 3                 |
| 5                    | 2        | 2        | 2        | 1        | 20       | 10       | -20      | -5       | 115      | 3                 | 3                 |
| 6                    | 0        | 0        | 5        | 7        | 0        | 0        | -50      | -35      | 0        | 1                 | 5                 |

Based on the established priority levels, we form a model of the priority influence of factors on the quality of the book publishing process. [10].

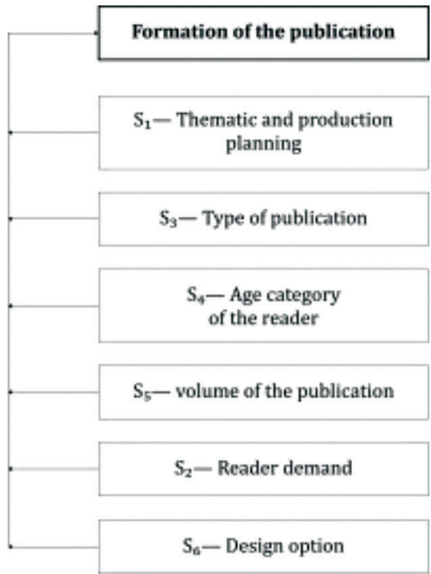


Fig. 4 Model of the priority influence of factors on the process of publication formation

**Conclusions.** The study found that the process of creating a book publication is a multifactorial system in which creative, organisational and technological components interact. The proposed model of priority influence of factors made it possible to determine the degree of significance of each of them and to identify the main interrelationships between the elements of the publishing process.

The proposed model serves as a basis for designing and calculating alternative and optimal options for implementing the publication formation process, which will serve as a prerequisite for improving the efficiency of the book layout process.

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## МОДЕЛЬ ПРІОРИТЕТНОГО ВПЛИВУ ФАКТОРІВ НА ПРОЦЕС ФОРМУВАННЯ ВИДАННЯ

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*Процес формування книжкового видання охоплює низку взаємопов'язаних етапів, які визначаються впливом багатьох факторів творчого, організаційного та технологічного характеру. Кінцевий результат формування книжкового видання — його якість, змістова насиченість та естетична привабливість —*

безпосередньо залежить від гармонійної взаємодії всіх складових видавничого процесу. Оскільки цей процес включає численні взаємопов'язані рішення, що визначають як змістову, так і візуальну структуру книги, важливо встановити, які саме фактори мають визначальний вплив на досягнення високої результативності.

У статті встановлено, що формування видання залежить від взаємодії таких чинників, як читацький попит, тематика, вид і формат видання, вікова аудиторія, обсяг та особливості художнього оформлення. Також обґрунтовано необхідність створення моделі пріоритетного впливу факторів, що дає змогу систематизувати виявлені взаємозв'язки, кількісно оцінити ступінь їхньої вагомості та встановити ієрархію впливів. Така модель покликана забезпечити науково обґрунтований підхід до аналізу процесу формування книжкового видання, уможливаючи виявлення найбільш визначальних чинників, від яких залежить його якість і структурна цілісність.

На основі методу ранжування, який полягає в упорядкуванні факторів за ступенем їхньої важливості, побудовано ієрархічну модель взаємодії факторів, у якій враховано як прямі, так і опосередковані зв'язки між ними. Проведено кількісну оцінку вагових коефіцієнтів кожного фактора, що дало змогу визначити рівні їх пріоритетності та сформувати узагальнену семантичну мережу процесу формування видання. Отримані результати відображають логіку взаємодії елементів видавничої системи та дозволяють не лише глибше зрозуміти її структуру, а й прогнозувати ефективність функціонування на окремих етапах. Розроблена модель є основою для проектування та обґрунтування альтернативних і оптимальних способів реалізації процесу формування видання, що створює передумови для підвищення ефективності та якості процесу верстання книжкових видань.

**Ключові слова:** модель пріоритетного впливу, фактори впливу, видавничий процес, формування видання, ранжування.

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