Model of the hierarchy of quality factor criteria layout processes*

Zoryana Selmenska[1,†], Zoreslava Plakhtyna[1,†], Myroslava Dubnevych[1,†] ,
Orest Khamula [1,*,†]

[1] *Lviv Polytechnic National University IPMT (Ukraine), Lviv, 19 Pid Holoskom str.*

Abstract

This article focuses on the study of layout — a key stage of prepress preparation that directly affects the quality of the final book product. The layout ensures the stylistic and technical unity of the design, as well as the artistic integrity of the publication, following technical rules, norms and standards.

The key aspects of preparing a book publication include creating a unique image, choosing the optimal artistic and graphic concept to reflect the idea and content, and creating a coherent composition of all elements of the work to ensure its expressive graphic appearance. A book is a complex system, where not only the content is important, but also the readability, expressiveness of fonts and aesthetics. The layout plays a key role in shaping the final appearance of the publication, requiring a comprehensive approach to achieve high quality book products.

This article describes the main factors influencing the layout process, including: thematic and production planning, reader demand, type of publication, volume of the publication, size parameters of the publication, font design, illustration design, layout complexity group, text composition rules, completion rules, and layout. As a result of the study of the selected criteria, it seems appropriate to represent the relationship between the factors in the form of a semantic network, which is an oriented graph, where each of the vertices corresponds to a concept, phenomenon or process, and the arcs represent the relationship between them. However, there is a need to create information tools that would not only identify a variety of factors related to the main stages of layout, but also determine their significance and impact on the overall quality of the process. The article considers the application of information technology to build a model of the hierarchy of quality factor criteria for the process of book layout. The paper describes a set of quality criteria for layout and possible relationships between them, which are presented in the form of an oriented graph with interdependence of factors.

Keywords

Hierarchy model, graph theory, semantic network, influence factors, reachability matrix, system analysis method, layout process, illustration design, font design, composition

1. Introduction

Since the subject of analysis and study is a book edition — the most common type of printed product, which is the main activity subject of publishing houses vast majority — the task of forecasting and assessing the quality of this extraordinary product is natural.

A book is a complex multi-level system, and the factors that make it up are not only the content of the main text, but also the readability, expressiveness and aesthetics of the font system. These aspects are closely related to the layout process, which plays a fundamental role in the creation of printed materials. The layout determines the final appearance of the publication and requires a comprehensive approach to ensure the high quality of book production [1].

Intelitsis'25: The 6th International Workshop on Intelligent Information Technologies & Systems of Information Security, April 04, 2025, Khmelnytskyi, Ukraine

* Corresponding author.

† These authors contributed equally.

zorselm@gmail.com (Z. Selmenska); zoreslava.plakhtyna91@gmail.com (Z. Plakhtyna); dubnevychmyroslava@gmail.com (M. Dubnevych); orest.h.khamula@lpnu.ua (O. Khamula)

0000-0002-9514-7923 (Z. Selmenska); 0009-0001-6868-8687 (Z. I. Plakhtyna), 0000-0001-7089-0190 (M. Dubnevych); 0000-0003-0926-9156 (O. Khamula)

When a text is reproduced in print, it should be easy to read and the prints obtained from the printing plate should be well perceived. For example, even minor violations in the font design of a publication can lead to a deterioration in children's health, in particular, to a decrease in vision due to non-compliance with the standards for the selected font size [2].

Illustrations are an integral part of a page's graphic appearance. An illustration is a visualisation that complements the textual material of a printed product. Illustrations are used to convey the emotional atmosphere of a work of art, visualise the images of the main characters, as well as demonstrate objects in publications; display step-by-step instructions in technical documentation [3].

There are several types of illustrations; they can occupy a missing strip of text in a book (stripes), half a strip (half-page), or an entire spread (full-page). Such images slow down the rhythm of the narrative, suggesting that the reader stops moving through the book to look at it. They reveal the content of the work and can depict individual episodes, character actions, descriptive fragments [4].

The book's layout is primarily determined by the format and arrangement of the columns on the page. These two factors largely determine the look of the book and the requirements for layout options.

The choice of paper format is a decision that determines the proportions and dimensions of the image plane - the book's page. The format of the publication is determined not only by the compositional criteria, but also by the content of the book, its intended purpose and readership. Sometimes it is necessary to change the format based on the size and nature of illustrations or tables, the length of formulas, and other elements. Finally, when choosing a format, it is necessary to maintain proportionate proportions between the format and the volume of the book [1].

The problem lies in the need to create such information tools that would not only make it possible to reasonably identify a set of factors related to the essence and functions of the main stages of the layout process, but also ensure the establishment of the weighting of factors and the priority of their impact on the integral quality indicator of this process. For this purpose, it is necessary to provide a system that covers a number of relevant tasks — from font selection to page layout organisation — that must be effectively solved before the publication of the publication. Identification, systematisation and optimisation of influence factors can improve the efficiency of the process and the quality of the finished product.

Creating an optimal algorithm that would simultaneously take into account all the constraints and requirements is a rather difficult task, given the multitude of all the indicators that characterise the quality of finished pages and the virtually unlimited range of page layouts and options for the relative placement of various elements in them [5].

2. Related works

The development of information technologies has a strong impact on production systems, and the availability of a computer allows to effectively combine various technologies necessary for production into an integrated computer-controlled production system, which has found application in the printing industry. Article [6] presents the results of the analysis of prepress, printing and post-press processes typical for printing enterprises in terms of integrated computer systems that allow interconnection at the enterprise level. At the same time, stages, technological operations, and procedures focused on the structure of production with the help of modern information and communication technologies were identified. Functional and information models were developed, especially for prepress. The study used such research methods as observation, descriptive and correlation analysis. The results of the study indicate their usefulness for achieving high productivity in the transformation of raw printing materials into finished products.

Automatic layout analysis has proven to be extremely important in the process of digitising large volumes of documents. The article [7] presents a mixed approach to layout analysis, which includes a process of layout segmentation using SVM and a classification process based on local and geometric features.

The article [8] analyses the process of evaluating the page format of complex document images. This process includes: analysing the structure and content of documents; automatic recognition of page components (text, images, tables); identifying relationships between elements to understand semantics; and a step-by-step analysis from low-level to high-level tasks. The result is improved document processing, optimised character recognition, and increased accessibility of documentation. This makes it easier to work with and categorise digital documents more efficiently.

Article [9] is dedicated to graphic design as an important component of visual communication. It discusses the use of typography, photography and illustration to create visual elements, as well as various applications of graphic design, such as branding, editorial design, advertising and web design.

In addition, the article analyses modern technologies that influence product design, such as algorithms for process optimisation and mobile edge computing, which bring data processing closer to the end user. It also highlights the role of machine learning in predicting changes in networks. Overall, the article demonstrates the integration of graphic design with technological innovations and their impact on our daily lives.

The research [10] highlights how visual elements attract attention, improve understanding of information and evoke emotions. Special attention is paid to optimising visual content for SEO and a list of useful tools and resources for creating visual materials is provided. The main conclusion is that visual content is a powerful tool for effective communication and marketing in the digital age.

Article [11] discusses the issue of ethics in design in the context of the crisis of modernity paradigms and the need to rethink values. The author emphasises the growing role of the designer in the post-industrial era, where creative labour is becoming a key factor in creating value. The article calls on designers to take social and moral responsibility, focusing on the needs of society and the environment, not just economic gain. The author proposes a shift from the concept of sustainable development to a broader ethical approach that takes into account social, economic and environmental aspects. Particular attention is paid to the impact of design on material culture and the need to consider the ethical implications of production and consumption.

This research [12] introduces factor analysis as a powerful tool for assessing layout design options. By employing correlation to group criteria into a smaller set of key factors, this dimension reduction technique simplifies the decision-making process. Factor analysis offers additional benefits, such as revealing relationships between criteria and accommodating both quantitative and qualitative data. The paper demonstrates the method's application through a case study from existing literature.

The significance of this approach lies in its ability to address the complex challenge faced by facilities planners when selecting an optimal layout design. This task typically involves evaluating numerous alternatives against multiple, often conflicting criteria. Factor analysis emerges as an effective solution to streamline this decision-making process.

A key advantage of this technique is its accessibility. It can be implemented using various software packages without requiring in-depth theoretical knowledge, making it highly practical for real-world applications.

In today's digital age, the automated extraction of pertinent data from unstructured and semi-structured sources has become increasingly valuable for both personal and professional applications. While comprehending word meanings is crucial, equally important is the process of document layout analysis. This involves identifying coherent geometric and logical sections within documents, such as blocks, cells, columns, tables, paragraphs, titles, and captions. This research [13] introduces innovative approaches to tackle this complex challenge by integrating both syntactic and semantic elements of document analysis. These advanced techniques form the foundation of KnowRex, a comprehensive system designed for ontology-driven Information Extraction, which aims to revolutionize how we process and understand document structures.

The article [14] argues that traditional design thinking needs to be updated for the digital age. It suggests "Digital Design Thinking" retains the customer and experience mindset of traditional design thinking but applies it within a digital environment to achieve speed and scale. The article outlines

several advantages of digital design thinking, including the use of real-time data, behavioral data at scale, lower costs, continuous experimentation, and the elimination of the Hawthorne effect because users are unaware they are being tested.

3. Proposed methodology/model/technique

In order to ensure high and stable quality of book editions preparation, it is necessary to provide a comprehensive system that covers a number of urgent tasks that must be effectively solved before the publication of the edition [15].

This task was formulated and solved using the tools of graph theory and methods of system analysis. The result is the development of a hierarchical graphical model of the priority influence of the layout process quality factors criteria.

In this research, we will focus on the criteria that have an obvious impact on the layout process [16].

Let the set of criteria be a certain set $S = \{s_1, s_2, ..., s_n\}$. For clarity, let us supplement the mathematical notation of the criterion with its mnemonic name, where s_1 — thematic and production planning (TPP), s_2— reader demand (RD), s_3—type of publication (TP), s_4 — volume of publication (VP), s_5 — size parameters of publication (SP), s_6 — font design (FD), s_7 — illustrative design (ID), s_8 — layout complexity group (LCG), s_9 — text composition rules (TCR), s_{10} — page completion rules (PCR), s_{11} — layout (L).

We formulate and solve such a problem using the tools of graph theory and methods of system analysis [17]. To begin with, the set of criteria for the process of making S_1 and the possible interactions between them are represented in the form of an oriented graph (figure 1).

Based on the above graph, we build a binary dependency matrix for a set of vertices using the following rule:

$$a_{ij} = \begin{cases} 1, \text{ if the criterion } i \text{ depends on the criterion } j \\ 0, \text{ if the criterion } i \text{ does not depend on the criteria } j \end{cases} \quad (1)$$

For convenience, let's place the matrix A of 11×11 elements in a table, adding an information row and a column with the mnemonic names of the factors.

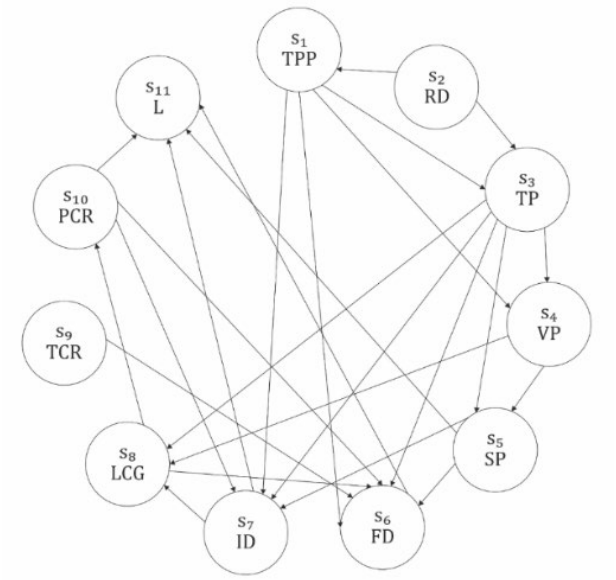

Figure 1: Graph of links between the criteria of layout processes quality factors.

Table 2
Binary dependency matrix

		1	2	3	4	5	6	7	8	9	10	11
		TPP	RD	TP	VP	SP	FD	ID	LCG	TCR	PCR	L
1	TPP	0	0	1	1	0	1	1	0	0	0	0
2	RD	1	0	1	0	0	0	0	0	0	0	0
3	TP	0	0	0	1	1	1	1	1	0	0	0
4	VP	0	0	0	0	1	0	0	1	0	0	0
5	SP	0	0	0	0	0	1	1	0	0	0	1
6	FD	0	0	0	0	0	0	0	0	0	0	1
7	ID	0	0	0	0	0	0	0	1	0	0	1
8	LCG	0	0	0	0	0	1	0	0	0	1	0
9	TCR	0	0	0	0	0	1	0	0	0	0	0
10	PCR	0	0	0	0	0	1	1	0	0	0	1
11	L	0	0	0	0	0	0	0	0	0	0	0

Next, we build the binary reachability matrix B, which uses the dependency matrix A obtained above and the unit matrix, denoted by I, according to the following rule: B = A + I.

The reachability matrix must satisfy the condition:

$$(I+A)^{k-1} \leq (I+A)^k = (I+A)^{k+1} \tag{2}$$

The construction of matrix B is reduced to filling in a table similar to the one above, with binary elements determined by a logical rule:

$$a_{ij} = \begin{cases} 1, \text{ if it is possible to get from vertex } i \text{ to vertex } j \\ 0 \text{ in other case} \end{cases} \tag{3}$$

The algorithm for creating matrix B includes the following steps:

1. Rewrite the first row of the dependency matrix A to replace the first row of the matrix B.
2. Mark the unit elements of the first row of matrix B, i.e. the elements for which the condition $b_{1k} = 1$ is satisfied. Select the *k-th* row of matrix A and supplement the first row of matrix B with the elements of this row. For matrix A, the first step of this algorithm involves the following actions:

$$\begin{array}{cc} & a_1 \quad a_2 \quad a_3 \quad a_4 \ \ldots \ a_8 \ \ldots \ a_{11} \\ a_1 & \|0 \quad 0 \quad 0 \quad 0 \ \ldots \ 1 \ \ldots \ 0\| \end{array} \quad \text{1st row of the matrix}$$

$$\begin{array}{cc} & b_1 \quad b_2 \quad b_3 \quad b_4 \ \ldots \ b_8 \ \ldots \ b_{11} \\ b_1 & \|0 \quad 0 \quad 0 \quad 0 \ \ldots \ 1 \ \ldots \ 0\| \end{array} \quad \text{1st row of the matrix}$$

$$\begin{array}{cc} & a_1 \quad a_2 \quad a_3 \quad a_4 \ \ldots \ a_8 \ \ldots \ a_{11} \\ a_8 & \|0 \quad 0 \quad 1 \quad 0 \ \ldots \ 0 \ \ldots \ 0\| \end{array} \quad \text{8th row of the matrix}$$

$$\begin{array}{cc} & b_1 \quad b_2 \quad b_3 \quad b_4 \ \ldots \ b_8 \ \ldots \ b_{11} \\ b_1 & \|0 \quad 0 \quad 1 \quad 0 \ \ldots \ 1 \ \ldots \ 0\| \end{array} \quad \text{1st row of the matrix}$$

3. Mark the unit elements of the first row of matrix B, i.e. the elements for which the condition b1k = 1 is satisfied. Select the k-th row of matrix A and supplement the first row of matrix B

with the elements of this row. For matrix A, the first step of this algorithm involves the following actions:

4. Select the next unit elements of the first row of matrix B and proceed to step 2.
   The search for units in the rows referenced by the analysed row is carried out up to the level of nesting until we get a repetition of the row number that has already been used. In this case, we take into account that the diagonal elements of matrix B are equal to one, since the matrix is square, inversely symmetric, and the reachability of an element by itself a priori gives one.
5. The process is repeated until there are no unmarked elements in the first row of matrix B, or until the entire row is filled with units.
6. Proceed to construct the next rows of matrix B.
7. The fonts should now be installed.

As a result of the steps described above, we get the following reachability matrix [17].

Table 2
Reachability matrix

		1	2	3	4	5	6	7	8	9	10	11
		TPP	RD	TP	VP	SP	FD	ID	LCG	TCR	PCR	L
1	TPP	1	0	1	1	1	1	1	1	0	1	1
2	RD	1	1	1	1	1	1	1	1	0	1	1
3	TP	0	0	1	1	1	1	1	1	0	1	1
4	VP	0	0	0	1	1	1	1	1	0	1	1
5	SP	0	0	0	0	1	1	1	1	0	1	1
6	FD	0	0	0	0	0	1	0	0	0	0	1
7	ID	0	0	0	0	0	0	1	1	0	1	1
8	LCG	0	0	0	0	0	1	1	1	0	1	1
9	TCR	0	0	0	0	0	1	0	0	1	0	1
10	PCR	0	0	0	0	0	1	1	1	0	1	1
11	L	0	0	0	0	0	0	0	0	0	0	1

Practically the vertex s_j (j = 1, 2, …, 11) of the original graph in Fig. 1 is considered to be reachable relative to the vertex s_i (j = 1, 2, …, 11), if it is possible to get from the latter to sj in any way, taking into account transitions through other vertices.

The result of the analysis of all vertices leads to a subset of reachable vertex $D(s_i)$.

The reverse statement is also logical: we consider the vertex s_i to be the predecessor of the vertex w_i if it is reached from it. The set of vertices of the predecessors will form some subset $P(s_i)$.

As a result, the intersection of subsets of reachable vertices and predecessor vertices, i.e., a subset:

$$Z(s_i) = D(s_i) \cap P(s_i) \tag{4}$$

whose vertices are not reached from any of the remaining vertices of the set W, determines a certain level of the hierarchy of factors attributed to these vertices. An additional condition is to ensure the equality of:

$$P(s_i) = Z(s_i) \tag{5}$$

The implementation of these dependencies using iterative tables leads to the formation of appropriate hierarchical levels, the initial one being the lowest in terms of priority of influence on the process under research.

To determine this level, we use the matrix of reachability and dependence of subsets, on the basis of which we build Table 1.

Table 3
First iteration

s_i	$D(s_i)$	$P(s_i)$	$D(s_i) \cap P(s_i)$
1	1, 2, 3, 4, 5, 6, 7, 8, 10,11	1, 2	1
2	1, 2, 3, 4, 5, 6, 7, 8, 10, 11	2	2
3	3, 4, 5, 6, 7, 8, 10, 11	1, 2, 3	3
4	4, 5, 6, 7, 8, 10, 11	1, 2, 3, 4	4
5	5, 6, 7, 8, 10, 11	1, 2, 3, 4, 5	5
6	6, 11	1, 2, 3, 4, 5, 6, 8, 9, 10	6
7	7, 8, 10, 11	1, 2, 3, 4, 5, 7, 8, 10	7, 8, 10
8	6, 7, 8, 10, 11	1, 2, 3 ,4, 5, 7, 8, 10	7, 8, 10
9	6, 9, 11	9	9
10	6, 7, 8, 10, 11	1, 2, 3, 4, 5, 7, 8, 10	7, 8, 10
11	11	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	11

As can be seen from the table, at the first iteration, the equality of $P(s_i)=D(s_i)\cap P(s_i)$ is applied to elements 2 and 9.

Therefore, they are elements of the first level of the hierarchy, which we will consider to be the criterion of the lowest priority level of influence on the quality of the layout process.

Remove the rows with numbers 2 and 9 from the table, and in the second column, delete the numbers 2 and 9.

Next table is the basis for calculating the second iteration, which results in the following level of the criteria hierarchy [18].

Table 4
Second iteration

s_i	$D(s_i)$	$P(s_i)$	$D(s_i) \cap P(s_i)$
1	1, 3, 4, 5, 6, 7, 8, 10,11	1	1
3	3, 4, 5, 6, 7, 8, 10, 11	1, 3	3
4	4, 5, 6, 7, 8, 10, 11	1, 3, 4	4
5	5, 6, 7, 8, 10, 11	1, 3, 4, 5	5
6	6, 11	1, 3, 4, 5, 6, 8, 10	6
7	7, 8, 10, 11	1, 3, 4, 5, 7, 8, 10	7, 8, 10
8	6, 7, 8, 10, 11	1, 3 ,4, 5, 7, 8, 10	7, 8, 10
10	6, 7, 8, 10, 11	1, 3, 4, 5, 7, 8, 10	7, 8, 10
11	11	1, 3, 4, 5, 6, 7, 8, 10, 11	11

We delete row 1 from table, and the same numbers in the second and third columns. As a result, we get the following table.

Table 5
Third iteration

s_i	$D(s_i)$	$P(s_i)$	$D(s_i) \cap P(s_i)$
3	3, 4, 5, 6, 7, 8, 10, 11	3	3
4	4, 5, 6, 7, 8, 10, 11	3, 4	4
5	5, 6, 7, 8, 10, 11	3, 4, 5	5
6	6, 11	3, 4, 5, 6, 8, 10	6
7	7, 8, 10, 11	3, 4, 5, 7, 8, 10	7, 8, 10
8	6, 7, 8, 10, 11	3 ,4, 5, 7, 8, 10	7, 8, 10
10	6, 7, 8, 10, 11	3, 4, 5, 7, 8, 10	7, 8, 10
11	11	3, 4, 5, 6, 7, 8, 10, 11	11

Performing the same steps as the previous ones, we will get the data for the next iteration.

Table 6
Fourth iteration

s_i	$D(s_i)$	$P(s_i)$	$D(s_i) \cap P(s_i)$
4	4, 5, 6, 7, 8, 10, 11	4	4
5	5, 6, 7, 8, 10, 11	4, 5	5
6	6, 11	4, 5, 6, 8, 10	6
7	7, 8, 10, 11	4, 5, 7, 8, 10	7, 8, 10
8	6, 7, 8, 10, 11	4, 5, 7, 8, 10	7, 8, 10
10	6, 7, 8, 10, 11	4, 5, 7, 8, 10	7, 8, 10
11	11	4, 5, 6, 7, 8, 10, 11	11

Generating further tables with repeating the relevant procedures will lead to the following result.

Table 7
Fifth iteration

s_i	$D(s_i)$	$P(s_i)$	$D(s_i) \cap P(s_i)$
5	5, 6, 7, 8, 10, 11	5	5
6	6, 11	5, 6, 8, 10	6
7	7, 8, 10, 11	5, 7, 8, 10	7, 8, 10
8	6, 7, 8, 10, 11	5, 7, 8, 10	7, 8, 10
10	6, 7, 8, 10, 11	5, 7, 8, 10	7, 8, 10
11	11	5, 6, 7, 8, 10, 11	11

Table 8
Sixth iteration

s_i	$D(s_i)$	$P(s_i)$	$D(s_i) \cap P(s_i)$
6	6, 11	6, 8, 10	6
7	7, 8, 10, 11	7, 8, 10	7, 8, 10
8	6, 7, 8, 10, 11	7, 8, 10	7, 8, 10
10	6, 7, 8, 10, 11	7, 8, 10	7, 8, 10
11	11	6, 7, 8, 10, 11	11

Table 9
Seventh iteration

s_i	$D(s_i)$	$P(s_i)$	$D(s_i) \cap P(s_i)$
6	6, 11	6, 8, 10	6
11	11	6, 7, 8, 10, 11	11

4. Results/discussions

Thus, as a result of performing actions on the elements of Fig. 1, a hierarchically structured model was obtained that simulates the priority of the influence of selected factors on the quality of the book layout process.

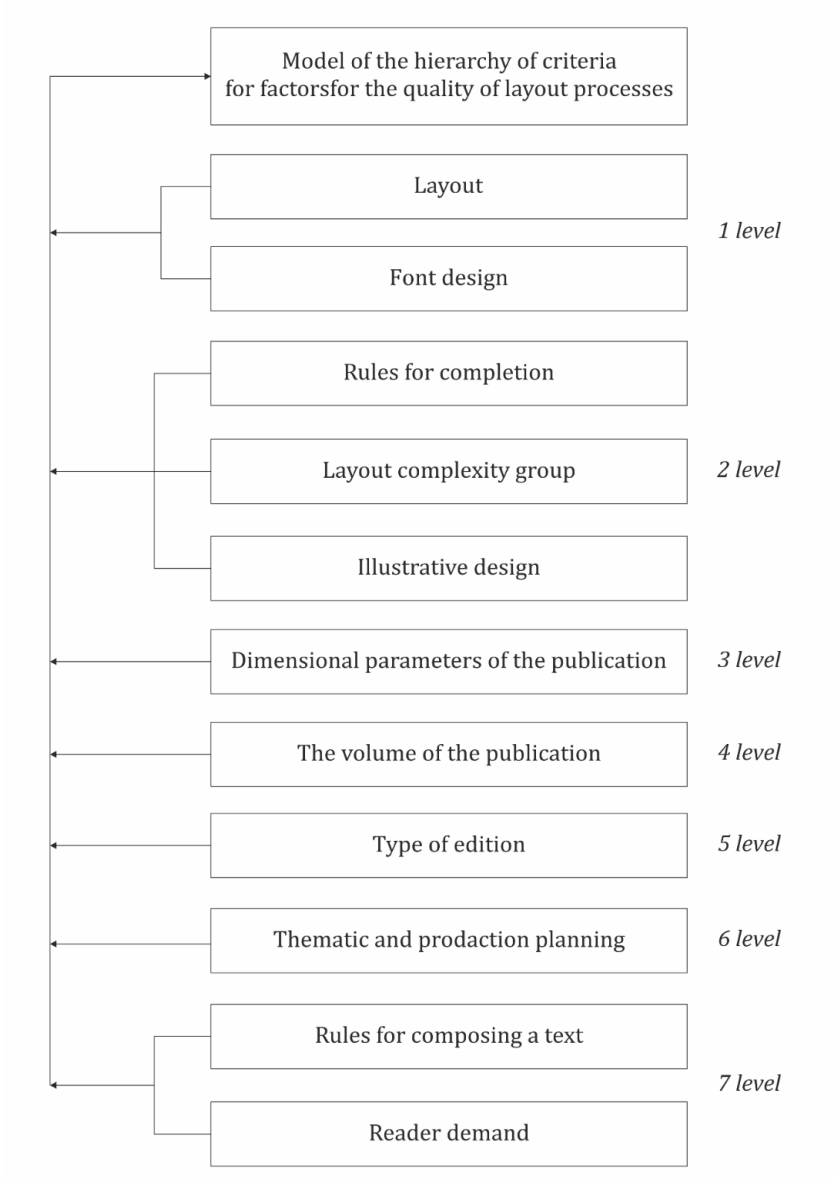

Figure 2: Hierarchy model of quality factor criteria for layout processes.

The last factor analysed is the first in terms of priority of influence on the layout process, i.e. the first factor in the hierarchical model is layout and font design, the next level is formed by the factors: completion rules, layout complexity group and illustration design, and then separate levels are formed by the factors: size parameters of the publication, volume of the publication, type of

publication and thematic and production planning. Reader demand and text composition rules determine the lowest level of the hierarchy. Using the data of the iterative analysis, we synthesise a hierarchically structured linguistic model in which the priority of the factor's action is determined by the level of its placement. The model reflects all the existing relationships between the factors, as set out in the original graphical model in (figure 1).

The synthesised model abstractly reflects the subjective assessments of experts regarding the factors that influence the main stages of book layout. As can be seen from (figure 2), the layout is of the greatest importance, depending on which a hierarchical 'pyramid' of action or statement factors is built. The main thing in solving the task is the selection of criteria related to the problem under research, and the establishment of the most complete set of relationships between them in expert way. These initial data are set using a graph and reflect a subjective vision of the ways to solve the problem. At the same time, the appearance of a particular criterion at a certain level depends on the established relationships between them, as specified in the initial graph. Their change in number and nature will lead to a modification of the original graph and a corresponding change in the resulting graphical model. If there is a software program for automating the process of building an achievability matrix and obtaining a model of the hierarchy of criteria, it is possible to optimise the choice of the best option. The reliability of assigning a particular criterion to the appropriate level of the hierarchy is ensured by the use of the known system analysis theory priciples, modelling theory, research and problem-solving methodology [19].

5. Conclusion

The research identified the key factors influencing the quality of the layout process: thematic and production planning, reader demand, type of publication, volume of the publication, size parameters of the publication, font design, illustration design, layout complexity group, text composition rules, completion rules, layout. The methodology for formalising the relationships between the factors using the construction of a semantic network is presented. A binary matrix of dependence and accessibility was built on the basis of the graph. To create a hierarchical graphical model, iterative tables were used, which led to the formation of the corresponding levels, the initial one being the lowest in terms of priority of influence on the process under study. Accordingly, the factor that was considered last takes on the highest priority of influence on the layout process. The proposed model reflects how the priority of criteria at the lower levels of the hierarchy affects the priority of criteria at the upper levels. It can also be seen that the most important criteria that affect the quality of the layout process are font design and layout. However, other criteria are equally important. The second level is formed by three factors: completion rules, layout complexity group and illustration design. Below that are individual levels that include such factors as the size of the publication, its scope, type, as well as thematic and production planning. The lowest level of the hierarchy is occupied by reader demand and text composition rules, which are recognised as the least influential. The proposed model can become an effective tool for preliminary control and management of the layout process at all its stages, ensuring the highest quality of the finished publication.

Declaration on Generative AI

The author(s) have not employed any Generative AI tools.

References

[1] An integrated approach to assessing the quality of design and production of school textbooks URL: https://www.researchgate.net/publication/351998671_A_comprehensive_approach_to_assessing_the_quality_of_design_and_production_of_school_textbooks.

[2] Burgin, M., Díaz-Nafría, J.M. Introduction to the Mathematical Theory of Knowledge Conceptualization: Conceptual Systems and Structures. October 2019 In book: Applied Informatics, Second International Conference, Madrid, Spain, November 7–9, 2019, pp.469-482.

[3] The use of illustration in the creation of children's publications [Electronic resource]. Access mode: https://openarchive.nure.ua/bitstream/document/17367/1/GluTaba1.pdf.
[4] Aspects regarding the organization of printing production in the context of Industry 4.0 Răzvan-George Răcheru, Lucia Adăscăliţa, Dorin-Vasile Piţigoi and Emilia Bălan MATEC Web Conf., 343 (2021) 02008 DOI: https://doi.org/10.1051/matecconf/202134302008
[5] A Corbelli, L Baraldi, F Balducci et al., "Layout analysis and content classification in digitized books", Italian Research Conference on Digital Libraries, pp. 153-165, 2016.
[6] L. Swarup, M. Shalini, A. Chaudhary, H. Adarsha, K. H. Wanjale and K. Yuvaraj, "Page Layout Analysis of Complex Document Images," 2024 15th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kamand, India, 2024, pp. 1-5.
[7] A. Punia, Graphic Design and Manufacturing of Enterprise Art Products Based on Machine Learning and 5G Network, 2023 9th International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, India, 2023, pp. 2438-2443.
[8] Heyzed The Power of Visual Content [Electronic resource]. Access mode: URL: https://medium.com/@tijaniheyzed
[9] Imbesi L. The Role of Design Research in a Postindustrial Society. Design Principles and Practices: An International Journal–Annual Review. (2019). Vol. 13. No. 1. 1–11.
[10] Helge T. Traditional vs. Digital Design Thinking. Digital design thinking portal. 2018. URL: https://www.digitaldesignthinking.io/
[11] L. Mayik., M Dubnevych, T. Holubnyk., Z. Selmenska, B. Kovalskyi. The information technology for the formation of high-quality visual content of newspaper publications, CEUR WS 3675 (2024) 52–71.
[12] Hrabovskyi, Y.; Minukhin, S.; Brynza, N. Development of an information support methodology for quality assessment of the prepress process. Eastern-European Journal of Enterprise Technologies, 6(2) (120), p. 30–40, 2022. DOI: 10.15587/1729-4061.2022.266907.
[13] C. Koliba, L. Gerrits, M. L. Rhodes, J. W. Meek, Complexity theory and systems analysis. In Handbook on theories of governance, Edward Elgar Publishing, (2022) 389–406.
[14] W. Qin, R. Elanwar and M. Betke, "LABA: Logical Layout Analysis of Book Page Images in Arabic Using Multiple Support Vector Machines," 2018 IEEE 2nd International Workshop on Arabic and Derived Script Analysis and Recognition (ASAR), London, UK, 2018, pp. 35-40, doi: 10.1109/ASAR.2018.8480095.
[15] W.T. Adrian, N. Leone, M. Manna and C Marte, "Document Layout Analysis for Semantic Information Extraction", Conference of the Italian Association for Artificial Intelligence, pp. 269-281, 2017.
[16] L. Swarup, M. Shalini, A. Chaudhary, H. Adarsha, K. H. Wanjale and K. Yuvaraj, Page Layout Analysis of Complex Document Images, 2024 15th International Conference on Computing Communication and Networking Technologies (ICCCNT), Kamand, India, 2024, pp. 1-5.
[17] J. Logeshwaran, et al Pravin, SVPA-the segmentation based visual processing algorithm (SVPA) for illustration enhancements in digital video processing (DVP), ICTACT Journal on Image and Video Processing, vol. 12, no. 3, pp. 2669-2673, 2022, February.
[18] R. Liu, S. Yu, F. Yang, Y. Pan and Y. Zeng, A Connected Components Based Layout Analysis Approach for Educational Documents, 2021 16th International Conference on Computer Science & Education (ICCSE), Lancaster, United Kingdom, 2021, pp. 875-880.
[19] K. Soleimani-Chamkhorami, F. Hosseinzadeh Lotfi, G. Jahanshahloo and M. Rostamy-Malkhalifeh, A ranking system based on inverse data envelopment analysis, in IMA Journal of Management Mathematics, vol. 31, no. 1, 367-385, (Dec. 2019). doi: 10.1093/imaman/dpz014.
[20] L. Karpenka, et al The Influence of a Brand's Visual Content on Consumer Trust in Social Media Community Groups. J. of Theoretical and Applied Electronic Commerce Research. 16 (2021) 18.
[21] A. Kudriashova, T. Oliyarnyk. Quality model of media systems with infographic data. Computer Systems and Information Technologies, (4) (2024) 22–27.