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Improvement of the System of Quantitative Risk Assessment Indicators for Financial Companies Performance

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Abstract. The article studies the existing methodological recommendations for risk assessment of the performance of financial institutions, participants of non-bank financial services market. In particular, attention is focused on the performance of financial companies, which are the largest in number of subjects of the non-banking market. The aim of the study is to develop an approach to risk assessment of financial companies' performance. The methodological basis for achieving the aim is a systematic analysis of the existing provisions of the Regulator regarding the criteria for assessing the risk of the performance of financial institutions. The article studies in detail the state of the modern risk assessment system in accordance with the criteria developed by the Regulator, identifies the key shortcomings of the recommendations and suggests supplementing the existing list with performance assessment indicators, taking into account the experience of the previous Regulator. An analysis of the legislation was carried out regarding the presence in it of quantitative indicators of risk assessment of the performance of participants in the non-banking financial services market, which made it possible to propose an expanded list of criteria for achieving the aim of the study. The feasibility of the proposed system of quantitative indicators for assessing the risks of performance is confirmed by the existing actions of the Regulator, which partially coincide with the proposed provisions. The developed recommendations provide an opportunity to improve the risk assessment system both for inspections by supervisory authorities and for financial institutions seeking to strengthen preventive measures in their management

Keywords: risk assessment system, risk criteria, regulator, indicator system, financial companies and individual risks, non-bank financial services market

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INTRODUCTION

In the current conditions of the economic crisis, the corona crisis and the escalation of the conflict in the East of the country, the functioning of financial institutions in terms of their risk assessment is an urgent issue. In addition, the market of non-banking financial services is experiencing a change of the Regulator, which significantly affects state regulation and supervision. The National Bank of Ukraine outlined its intentions regarding the performance of these financial institutions [1] as a simplified inspection procedure, motivating it by the absence of significant risk for the financial system through the mechanisms of attracting funds that do not include the savings of the population. However, the existing recommendations [2] presented by the National Bank of Ukraine for assessing the risk of financial institutions performance through the system of criteria do not take into account the minimum needs of market participants to implement a risk-oriented approach in their own management system and only superficially analyze the risk of their performance.

Thus, there is a real need to systematize and improve the system of risk assessment of the performance of non-bank financial services market participants, which is aimed at a comprehensive analysis of the features of the specific performance of each subject. Methodological recommendations, that take into account a wide range of indicators, study in-depth the defined process, will allow us, in the further development of the industry, to simplify the risk assessment mechanism for both financial institutions and the Regulator. Also, the possibilities of implementing such an approach will contribute to the development of preventive measures for all users in the market of non-bank financial services in general and financial companies in particular.

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LITERATURE REVIEW

The problems of risk assessment of performance were delt with by such scientists as I. Blank [3], I. Balabanov [4], V. Vitlinskyi [5] and others who considered risk management only from the standpoint of minimizing losses, providing recommendations on quantitative risk assessment using economic and statistical methods, assessment of the financial condition of various participants in the financial services market. N. Vnukova, V. Smolyak [6] and M. Dyadyuk [7], in turn, revealed the problem of quantitative assessment of risk in real conditions, giving preference to combined methods, using the analysis of financial coefficients and, accordingly, statistical methods. Thus, risk as a negative condition that contributes to slowing down the development of the institution's performance is a sufficiently researched process, and methods of its assessment are economically substantiated and diverse. This is evidenced by the modern scientific works of such foreign scientists as C. Verbano, K. Venturini [8], F. Turra [9], who summarized knowledge about risk as a category through the taxonomy of existing literary sources and grouped methods for its determination and minimization. However, the risk of the performance of individual financial institutions, for example, financial companies, has a different nature of quantitative assessment, which is not fully reflected in the research of modern scientists, both domestic and foreign ones. Problems of risk assessment of non-bank financial institutions are equally relevant for Ukraine and other countries of the world. Thus, modern publications by foreign authors [10; 11] emphasize the process of risk management through its comprehensive expert assessment, drawing attention to the impossibility of access to financial company reports, which remains a controversial issue for the Ukrainian market of financial services. The available works of scientists, which are aimed at the performance of other subjects of the financial services market, emphasize this problematic aspect.

Thus, theoretical aspects of risk assessment of the performance of such an entity as a bank were studied by H. Azarenkova [12], L. Bondarenko [13], A. Hradil [14], H.M. Markowitz [15], O. Pernarivsky [16], O. Khrystoforova [17] and others. And risk management processes in the bank performance were noted in the works by T. Vasylieva [18], O. Haidarzhyiska [19], A. Yepifanov [20], S. Kozmenko [21], L. Matlaha [22] and others. Therefore, the majority of researchers are engaged in risk assessment exclusively within the banking sphere, which affects the state of development of the performance of other participants in the market of non-banking financial services. And although risk has recently become an urgent problem of the functioning of any financial institution, all the listed works do not directly relate to the performance of non-bank financial services market participants. This cluster remains under-researched due to the unprocessed reporting of these institutions and the lack of experience in applying the relevant regulatory and legal support of the Regulator. Thus, under modern economic conditions, there is an urgent problem of assessing the risk of market participants, especially those that, due to the heterogeneity and diversity of licenses, do not have a clear system of assessing the risk of performance (financial companies). Solving these problematic aspects is possible if there are methodological recommendations that take into account the comprehensiveness of the performance of financial companies and their individual risks.

The aim of the study is to improve methodological recommendations for assessing the risk of financial companies performance through a system of quantitative indicators.

MATERIALS AND METHODS

The theoretical basis of the research is the works of modern scientists and the legislation of Ukraine in the field of regulation of financial services markets, especially in the aspects of risk assessment of the performance of financial institutions that provide non-banking financial services. To achieve the defined goal of the research, a system of general scientific and special research methods was used: theoretical generalization (for clarification of indicators of risk assessment of financial companies performance); comparison (for correlation of different systems of quantitative risk assessment indicators); system analysis, formalization (for identification of the gaps in the modern approach to risk assessment of financial companies performance); synthesis (for the formation of methodological recommendations regarding the risk assessment system of financial companies performance).

RESULTS AND DISCUSSION

In accordance with the Law of Ukraine "On Amendments to Some Legislative Acts of Ukraine to Improve the Functions of State Regulation of Financial Services Markets" dated September 12, 2019, No. 79-IX [23], the powers of the National Commission, which carries out state regulation in the field of financial services markets, have been terminated. Instead, the function of market regulation of non-banking financial services is entrusted to the National Bank of Ukraine (hereinafter referred to as the NBU, the Regulator). In order to determine the periodicity of scheduled inspections, the new Regulator in December 2020 developed and approved the Regulation on establishing criteria for assessing the degree of risk from the performance of non-banking financial services market participants, their social importance, based on which the periodicity of scheduled inspections is determined, and the order of their application (further – Regulation) [2]. This Regulation is a source of modern legislation, which presents methodological recommendations for risk assessment of the performance of participants in the non-banking financial services market. When studying the structure and information content of the Regulation, it was determined that the proposed assessment system includes three criteria, namely: "state of corporate management, risk management and internal control; performance indicators; compliance with mandatory criteria and standards of capital adequacy and solvency, liquidity, profitability, asset quality and riskiness of operations, other indicators and requirements limiting risks in transactions with financial assets" [2].

In addition, the assessment is carried out by three subjects of the market of non-banking financial services – the insurer; credit union; financial company, lessor and pawnshop. That is, the third composite group in the Regulation is represented by financial institutions or persons that have the same license status, but essentially are engaged in various

exclusive types of activities. Probably, the combination of these participants took place since the classification of the activities of these financial institutions corresponds to the concept of "financial company", but the mechanisms of providing various financial services by their nature, although sometimes similar to crediting, have significant differences. Thus, in the activity of pawnshops, there is the definition of collateral, storage of things, and in the activity of lessors – intermediary services, financial lease, etc. In addition, operating factoring companies manage financial assets in the interests of third parties. From the point of view of the essence of the performance of these financial institutions, the absolute difference in the risks assumed by these participants of the market of non-banking financial services remains an important aspect, and therefore the process of their assessment should be of a special nature. Therefore, further research is aimed at improving the main issues in the Regulation and definition of the risk assessment indicators of the third group of financial institutions. Moreover, special attention is paid to financial companies as the quantitatively largest participants in the market of non-banking financial services.

The Provisions presented by the Regulator contains, as it was already mentioned, three criteria, the first of which includes a formal assessment of reporting measures, compliance with the requirements of legislation on the protection of the rights of service recipients, the results of external audits, etc. Assessment according to this criterion is carried out qualitatively in order to comply with existing items that are important for the NBU within the scope of tasks corresponding to the control function of the body, but for the process of assessing the risk of performance these aspects are of a derivative nature, therefore, in the future, attention is focused on improving the other two criteria of risk assessment of the performance of financial companies, which are defined as quantitative indicators of performance, their compliance with standards.

Regarding the list of indicators that characterize the specified criteria, there are only two of them in the Provisions, one indicator for each criterion – issued guarantees (by term) for the assessment period, compliance with the standard of the size of equity capital and/or other standards [2]. In the opinion of the author, such an assessment is not comprehensive and cannot fully outline the degree of risk of the financial company performance, therefore, for a more comprehensive analysis, it is suggested to use a certain list of coefficients. In addition, the list specified by the Regulator allows us to include standards at the auditor's discretion, which introduces a subjective aspect of control and limits financial companies due to the lack of clear methodological recommendations for assessing their risks.

Indeed, modern scientists, although paying attention to the process of risk assessment of financial institutions, bypass the analysis of the performance of financial companies, due to which, as it was noted, the number of publications on the topic is small and has the character of recommendations. Therefore, in order to build a comprehensive system of indicators for assessing the risk of non-banking financial services market participants, it is proposed to use indicators from regulatory acts introduced by the previous Regulator or from the orders that have lost their validity not due to inoperativeness, but a change of the Regulator, namely – the Orders of the National Commission , which carries out state regulation in the field of financial services markets "On Approval of the Regulations on Mandatory Financial Standards and Requirements Limiting Risks on Transactions with Financial Assets of Financial Institutions that have Received a License to Conduct Business Activities for the Provision of Guarantees and Sureties" dated 30.05. 2019 No. 980 [24] (hereinafter – Order-1) and the Order of the State Commission for Regulation of Financial Services Markets of Ukraine "On Approval of the Procedure for Reporting by Financial Companies, Financial Institutions – Legal Entities under Public Law, Trust Companies, as well as Legal Entities – Business Entities, which by their Legal Status are Not Financial Institutions, but have Defined by Laws and Regulations Derzhfinposlug or Natskomfinposlug Opportunity to Provide Financial Leasing Services" dated January 27, 2004, No. 27 [25] (hereinafter – Order-2). For the sake of clarity, the indicators are summarized, systematized and correlated to the existing Provisions on the risk assessment of the performance of financial institutions in the market of non-banking financial services (Table 1).

Table 1. Consolidated indicators of risk assessment of financial companies performance

Consolidated indicators of the risk assessment of the performance of financial companies	Comparison with the existing assessment system defined by the provisions
Performance indicators according to Order-1	
Amount of provided financial services	None
The value of assets of financial companies, including by the term of validity of contracts	None
The number of contracts concluded (existing requirement, future requirement)	Coincides
Leasing payments (for lessors)	None
Sources of funding	None
Compliance with standards according to Order-2	
Standard of capital adequacy	Coincides
The standard of the maximum risk per person or related persons	Calculation is possible
Liquidity reserve standard	Calculation is possible
Requirements for limiting the guarantor's risks with financial assets	Calculation is possible

Source: developed by the author based on [24; 25]

As we can see in Table 1, the regulatory acts proposed for consideration [24; 25] reveal more deeply the process of assessing the performance of financial companies, providing an opportunity for persons conducting inspections to familiarize themselves with the state of the institution in more detail. The list of presented indicators differs from the criteria of the effective Provisions of the National Bank of Ukraine, which does not contain standards for liquidity reserves, maximum risk, the volume of financial services provided, the value of assets and the size of leasing payments. Some standards may be determined by the NBU, but these particular standards are not specified in the relevant regulatory document. Thus, the existing list of indicators for assessing the performance of financial companies and their compliance with regulations, which is presented to the NBU for inspections, can be expanded by taking into account the experience of the National Financial Services Commission, which is presented in Orders 1 and 2.

All the proposed indicators of risk assessment of the financial company performance require the information, provided in the financial statements, for the calculation, which, at present, such financial institutions make public untimely. That is, non-compliance with the obligation of all participants of the non-banking financial services market to publish reports remains an urgent problem, which does not make it possible to conduct calculations according to the proposed indicators. Thus, in the register of financial institutions, as of July 1, 2021, there are 33 operating financial companies for which the main licensed activity, among others, is financial leasing. One of the financial companies that publishes official financial statements in a timely manner and in compliance with the requirements is "Interregional investment and leasing company" LLC [26], on the example of which, it is proposed to carry out an assessment of the risk of performance in accordance with the indicators given in Table 1. The calculation results are given in Table 2.

Table 2. Results of the risk assessment of the performance of "Interregional Investment and Leasing Company" LLC

Consolidated indicators of the risk assessment of the performance of financial companies	Standard	Value of the indicator in 2020 (thousand hryvnias)	Compliance with the standard
Performance indicators according to Order-1			
Amount of provided financial services		1135	In progress
The value of assets of financial companies, including by the term of validity of contracts		11396	In progress
The number of contracts concluded (existing requirement, future requirement)		Not determined in the absence of the amount published by the lessor	
Leasing payments (for lessors)	Do not exceed the book value of the leased item. As a rule, 8-10%	Not determined in the absence of the amount published by the lessor	
Sources of funding	Own capital or borrowed capital	Own capital	In progress
Compliance with standards according to Order-2			
Standard of capital adequacy, %	⩾ 7	66	In progress
Maximum risk standard for one person or related persons, % < 20 73	< 20	73	Not in progress
Normative liquidity reserve, thousands of UAH	> 0	11011,5	In progress
Requirements for limiting the guarantor's risks with financial assets		In progress	

Source: developed by the author based on [24-26]

As it can be seen in Table 2, two indicators relating to the essence of leasing contracts and the number of contracts concluded during the reporting period cannot be determined due to the lack of such information in the official financial documentation. First, the data are of an individual contractual nature for each individual client of the company, and second, they are confidential. Regarding the amount of financial services provided, it is proposed to determine them through income from the sale of products (leasing services), the presence of which indicates the degree of activity of a participant in the market of non-banking financial services, and, in turn, own sources of financing are a positive indicator in the management processes of such a financial institution. The normative standards that are defined in the presented calculation are fulfilled according to the size of the capital and the liquidity reserve, which characterizes the timeliness of the financial institution's fulfillment of its obligations under the provided leasing services. As for the maximum risk per one related person, the standard is not complied with. This indicator is defined as the ratio of the sum of the claims of the financial company and the financial obligations provided by it to the regulatory capital of the financial institution. Non-compliance with this standard indicates that certain obligations of partners of a financial institution have not been fulfilled. The requirements for limiting risks, as evidenced by the reporting of "Interregional Investment and Leasing Company" LLC, are fulfilled in full due to the presence of the internal risk management system, compliance with legislation in the process of carrying out its activities

and carrying out any calculations of standards based on the book value. Thus, the risk assessment of the performance of "Interregional Investment and Leasing Company" LLC indicates that it fulfills its obligations to its clients in a timely and unconditional manner, but despite the perspective of the financial institution in terms of risk prevention, there is a certain threat of losing its own resources due to ill-considered work with partners. The obtained result is not an in-depth analysis of the situation regarding risk assessment, does not take into account its varieties and features of impact, which is why it needs clarifications and additions.

The application of the methodology in practice certainly provides an opportunity to get acquainted with the performance of financial institutions, but it is worth noting that the presented indicators analyze the performance of financial companies rather superficially, almost without taking into account their specifics. That is, they are not enough to develop a system of quantitative risk assessment indicators of the performance of financial companies. The above standards can serve as transitional provisions when assessing the risk of performance, but in order to improve the quality of the process, it is worth supplementing the system of indicators not with universal, but with special indicators that are inherent in the assessment of the performance of a specific participant in the market of non-banking financial institutions. Undoubtedly, in order to implement these changes, the Regulator needs time to coordinate its activity and strengthen the risk assessment process. Also, it can be noted that a large number of licenses of financial companies suspends the process of implementing such changes or postpones them, but certain confirmations of the aspects proposed in the article are reflected in the regulatory provisions of the NBU for the present time, which characterizes the direction of the Regulator on this issue and emphasizes the opportunities for development of areas of regulation of non-banking financial services markets.

Thus, the Regulator confirmed the existing problems of risk assessment of the performance of financial lessor companies and started the procedure of discussing proposals for strengthening the mechanism by publishing the White Paper "Future Regulation of Non-Bank Leasing" in May 2020 [1]. This document provides coverage of the current state of development of the financial leasing market, its problems and ways to overcome them. As a problem, the Regulator sees the nonconformity of financial lessor companies' reporting with IFRS, the absence of a risk management system and an internal control system. Indeed, we can agree that the problems of forming a system of indicators for assessing the performance of financial companies can be solved by bringing their financial statements in line with international standards, which will allow for the integration of data on the results of work in the scientific space, which will be reflected in the creation of various methodological recommendations, strengthen the internal control procedure and , probably actualize the problems of risk analysis of their performance, but such measures are not comprehensive and require the initiative of the Regulator. In addition, the White Book states that the future regulation of financial leasing provides for considering such criteria as the book value of assets, the share of the leasing company in the market, the number and significance of violations of the law. Also, as a list of performance indicators of financial lessor companies, maintenance of equity at the appropriate level, approval, updating and implementation of the business plan, introduction of proper corporate management and internal control system, introduction of a proper system of risk management and financial monitoring, provision of regular information to the NBU, disclosure of information on the network are proposed. As you can see, the list contains only one quantitative indicator that meets the valid criteria for assessing the risk of the performance of financial companies. The information presented in the White Book is partially taken into account in the Provisions and the model of regulation of the NBU, for the time being, remains not fully implemented.

CONCLUSIONS

Thus, in order to carry out a qualitative risk assessment of financial companies performance it is necessary to strengthen the system of quantitative indicators, which is suggested to be implemented by taking into account the experience of the previous Regulator (National Financial Services Committee), improving the list with individual (specific) coefficients that distinguish participants from each other. Also, the universal approach to the risk assessment of the performance of financial companies, presented in the valid Provisions, is not sufficient for implementation due to the absolutely different nature of risks assumed by a pawnshop, a lessor or a financial factoring company, therefore it is suggested to carry out the division of the risk assessment process in terms of various subjects – financial institutions providing non-banking financial services.

The considered normative legal acts in the sphere of regulation of non-banking financial services markets are ambiguous, need additions and improvement on the implementation of a risk-oriented approach to the assessment of performance indicators of financial companies. The proposed list of quantitative indicators for assessing the risk of performance is one of the possible ways, at the moment, to expand the depth of research on this issue, due to the lack of available financial reporting, a clear policy of the Regulator regarding assessment criteria, differentiation by financial services provided by financial institutions. The presented approach is not comprehensive according to the available indicators but corresponds to the real possibility of carrying out an assessment in modern conditions.

Further research should be directed to the comprehensive expansion of the system of quantitative risk assessment indicators of financial companies performance and its practical approbation by determining the importance of each indicator according to expert judgment. The formed system of quantitative indicators, which takes into account all the above components, is able to speed up the Regulator's response to any negative changes in the performance of financial companies, on the one hand, and to develop preventive measures for the timely internal management of identified risks by financial companies, on the other.

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Удосконалення системи кількісних показників оцінки ризику діяльності фінансових компаній

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Анотація. У статті досліджено існуючі методичні рекомендації щодо здійснення оцінки ризику діяльності фінансових установ учасників ринку небанківських фінансових послуг. Зокрема, зосереджено увагу на діяльності фінансових компаній, які є найбільшими за кількістю суб'єктами небанківського ринку. Метою дослідження є розробка підходу до оцінки ризику діяльності фінансових компаній. Методичним підґрунтям досягнення мети є системний аналіз існуючих положень регулятора щодо критеріїв оцінки ризику діяльності фінансових установ. У статті детально досліджено стан сучасної системи оцінки ризику відповідно до розроблених регулятором критеріїв, визначено ключові недоліки рекомендацій та запропоновано доповнити існуючий перелік показниками з оцінки діяльності, враховуючи досвід попереднього регулятора. Проведено аналіз законодавства щодо наявності в ньому кількісних показників оцінки ризику діяльності учасників ринку небанківських фінансових послуг, що дозволив запропонувати розширений перелік критеріїв для досягнення мети дослідження. Доцільність запропонованої системи кількісних показників оцінки ризиків діяльності підтверджена наявними діями регулятора, що частково співпадають з висунутими положеннями. Розроблені рекомендації дають можливість удосконалити систему оцінки ризиків як для перевірок органами нагляду, так і для фінансових установ, що прагнуть посилити превентивні заходи з їх управління

Ключові слова: ризик, критерії ризику, регулятор, система показників, фінансові компанії та індивідуальні ризики, ринок небанківських фінансових послуг

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Peculiarities of Financial Resources Management System of Industrial Enterprises

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Abstract. Financial resources are the basis of any enterprise functioning. Their formation and use should be based on an effective management system that takes into account the general principles of building management systems as well as the specifics of managing financial resources. The analysis of scientific literature has shown that there is a constant search for approaches to the formation of such systems and their constituent elements. The purpose of the article is to build a system for managing financial resources of industrial enterprises according to the peculiarities of their activities and sources of financing. With the help of scientific generalization, the essence and main constituent elements of the enterprise's financial resources management system, their differences from the general management system have been determined. Based on the use of the systems approach, a comprehensive assessment of the current state of financial resources of industrial enterprises of Ukraine has been carried out. The use of correlation-regression analysis made it possible to define how the sources of financial resources of industrial enterprises affect the level of their net profit. The study has shown that the financial resources of Ukraine's industrial enterprises are mainly formed at the expense of current liabilities, namely at the expense of accounts payable. The state of settlements with the enterprise's debtors directly affects the timeliness of accounts payable repayment. The main characteristics of the accounts payable management process are provided, and it is proposed to separate accounts payable and accounts receivable as important components of the management object in the managed subsystem of the financial resources management system of industrial enterprises. As subjects of management, it is proposed to single out all subdivisions related to the formation and distribution of financial resources of industrial enterprises, and the main tasks are set for each of them to perform. The obtained results can be the basis for practical use by managers of enterprises, will increase the efficiency of management, and can also be the basis for conducting further research on the formation of financial resource management systems of enterprises in other industries

Keywords: enterprise management, financing, net profit, capital structure, accounts payable, management objects and subjects

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INTRODUCTION

Financial resources are the basis of the existence and functioning of any enterprise. The success of the enterprise's activity depends on the sufficiency, timeliness of receipt, cost and terms of engagement of financial resources. Therefore, it is important to build such a financial resource management system at the enterprise which would take into account the peculiarities of its activity – industry affiliation, size, number of owners, available sources of fund raising, etc.

Many works of both foreign [1-3] and Ukrainian economists [4-6] are dedicated to issues related to the management of financial resources. However, a large number of issues that include those related to the construction of the enterprise's financial resources management system and take into account its branch affiliation and the current state of economic development are still unresolved.

Building a high-quality management system of financial resources should consider the peculiarities of their formation and distribution. Therefore, first of all, it is necessary to establish the essence of this economic category. Monetary funds formed in the state and at enterprises as a result of the distribution and redistribution of the gross domestic product are often equated with financial resources [5]. Such an interpretation takes into consideration all financial resources of both enterprises and the state and does not satisfy the essence of this research.

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If to look directly at the enterprise's financial resources, it can be noted that in the process of their circulation, they ensure the functioning of the enterprise according to its main types of activity, namely operational, investment and financial. Thus, the enterprise's financial resources are "funds at its disposal, which are divided according to two characteristics: by their types and composition; according to the sources of their formation. They are intended to be spent on extended reproduction, fulfilling financial obligations to individuals and legal entities, economic stimulation" [4].

Normal functioning of the enterprise is impossible without a sufficient amount of financial resources. This fact is confirmed in the study [7], whose authors note that financial capital is the most important resource that enables industrial enterprises to implement their innovative strategies. They also discovered that financial resources have a significant and positive effect on the performance and innovative behavior of industrial enterprises.

The purpose of the study is to build a system for managing the financial resources of industrial enterprises taking into account the peculiarities of their activities and the sources of their financial resources formation. For this, a number of tasks have been set and solved, namely:

– study of peculiarities and main sources of financial resources formation of Ukraine's industrial enterprises;

– defining the degree of influence of the volumes of various sources of financial resources on the volumes of net profit of Ukraine's industrial enterprises;

– provision of methodical recommendations regarding the construction of financial resources management system of an industrial enterprise taking into account the peculiarities of their formation.

LITERATURE REVIEW

In order to define the peculiarities of the system of managing financial resources of industrial enterprises, first of all, it is necessary to decide what is meant by the system in general and by the enterprise management system in particular. In the study [8], it is proposed to understand the system as a set of interconnected and interacting elements that ensure the effective functioning of the entire system.

The management system is a collection of elements (subsystems) that interact through informational connections to achieve certain goals. It implies that this system has been created to achieve the goal of solving the problem [9].

In her research, O. Lozhachevska conducted a semantic analysis of the concept of an enterprise management system. As a result, the author does not single out any of the definitions as the most complete and does not give her definition to this concept but only notes that each of them reveals the peculiarities of various aspects of systems functioning and can be used depending on the purpose of scientific research.

The author also formed the structure of the modern enterprise management system which consists of various functional subsystems of the enterprise. As the main one, she singles out the subsystem of managing the enterprise's financial activities, namely automated accounting, cost management, financial planning, etc. According to the author, an effective management system can be built using different approaches – systems approach, functional approach, process approach, integration approach, dynamic approach, situational approach [5].

Research on the essence of the "enterprise management system" concept conducted by H. Seleznova and I. Ippolitova allowed them to define that the majority of scientists consider it as "a totality of the managing system (the subject of management) and the managed system (the object of management), as well as the connections between them. Another view of the management system consists in defining it as a set of elements (components) that allow achieving the organization's goals" [10]. Such elements include technical, technological, organizational, economic and social elements.

It should be noted that the listed elements form the internal environment of the enterprise. In its turn, the enterprise, as an open social system, is necessarily exposed to the influence of the external environment and interacts with the elements that are outside the system (for example, competitors, sources of equipment and technology, government regulation, social factors, etc.).

An effective enterprise management system should provide the ability to quickly react and adapt the internal environment to constant and rapid changes in the external environment. This process reflects the dynamic capabilities of the management system as a key opportunity for the enterprise to face uncertainty and produce competitive advantages in existing conditions. The article by I. Shevchenko, Y. Razvadovskaya, E. Kaplyuk and K. Rudneva is dedicated to the study of this issue and proposes indicators for evaluating the dynamic capabilities of industrial enterprises. The defining attribute of dynamic capabilities is the ability of an enterprise to analyze environmental changes, predict the dynamics of market changes, and make appropriate management decisions [11].

In addition to the elements of the internal and external environment, an effective enterprise management system must have a feedback formed between its subsystems. This allows getting information about the actual state of the system, as well as comparing the results obtained from its operation with the planned ones. In its turn, this will make it possible to timely detect deviations in the system's operation, to develop and implement appropriate measures in order to bring the actual results closer to the desired ones.

In addition to the construction of the enterprise management system, the issues arise as to assessing the state and degree of effectiveness of the entire management system and its individual elements. So, T. Bogdanova and L. Zhukova dedicated their research to assessing the state of the management object on the basis of a universal complex indicator. The idea behind their research lies in the fact that all management decisions are made on the basis of information. The more accurate and high-quality this information is, the more accurate management decisions will be. Both structured data from open sources of information and unstructured data from open sources of information (texts, news, comments, photos) can be used to evaluate the management object. According to the authors [12], when evaluating management objects, the unstructured data accounting will increase the effectiveness of management and will take into account its qualitative characteristics (reputation, reviews, trends). These data can be obtained by a non-contact method from open sources.

MATERIALS AND METHODS

The theoretical basis of the study is the works of Ukrainian and foreign researchers on the problems of management systems and management of the enterprise's financial resources.

A systems approach was used as a methodological basis for conducting this study. This made it possible to carry out a comprehensive assessment of the current state of financial resources of Ukraine's industrial enterprises. The general scientific methods such as deductive, analysis and synthesis, abstraction, generalization, comparison, analogies were used when laying the foundations of building the enterprise management system, which made it possible to comprehensively consider the object of research.

With the help of scientific generalization, the essence and main constituent elements of the enterprise's financial resources management system have been determined. The graphic method provided a visual representation of the results of scientific research, namely the dynamics and structure of financial resources sources of Ukrainian industrial enterprises.

With the help of the Excel table editor, a correlation-regression analysis has been carried out, which made it possible to establish which of the sources of financial resources of industrial enterprises affect the level of their net profit, and to assess the degree of this influence.

The main source of information for the study was the publications and data of the State Statistics Service of Ukraine [13].

RESULTS AND DISCUSSION

The general enterprise management system consists of various functional subsystems, one of which is the financial resource management system. It is built on the same principles that are used for the general management system. Therefore, the enterprise's financial resources management system consists of two main elements:

1) the object of management (managed subsystem), which includes the financial resources of the enterprise, their volume and structure, as well as the structure of financial resources and the ways in which they are used;

2) the subject of management (managing subsystem), i.e., individual managers or departments that ensure the functioning of the management object in accordance with the established goals and use various methods and forms of management influence for this purpose.

In their research, A. Karminsky and A. Rybalka note that management subjects are people who make decisions, those who stand behind specific numbers and performance indicators of the enterprise. These people form a corporate management system which can become either a guarantee of the effective work and development of the enterprise or the cause of its stagnation.

Managers can use both internal and external mechanisms of control over the enterprise's activities. Taking into account the specifics of their research, the authors attribute the stock market, which reflects the publicity and openness of the enterprise's activities, to the external control mechanisms, and the complete combination of executive functions (CEO) by big owners – to the internal ones. At the same time, in accordance with the theory of motivation, theory X is the more common management style. According to this theory, managers are sure that they must constantly motivate employees to act and organize supervision, because employees do not want to take the initiative and fully fulfill their duties for the benefit of the enterprise. Also, according to the authors, in the economic literature, the impact of industry expectations formed by the enterprise's management on its financial stability is not sufficiently well researched [14].

In order to be effective, financial resources management should be carried out with the help of a financial mechanism. O. Varaksina, A. Perebyinis note that usually the financial mechanism consists of several elements that are related to each other, namely [15]: financial methods, financial levers, legal, regulatory and information support.

N. Kondratenko, M. Novikova, N. Spasiv believe that the integration and globalization processes, which influence the work of Ukrainian enterprises, require an update of the financial resources management system [16]. They dedicated their research to the development of a system of adaptive management of the enterprise's financial resources, which, on the basis of management decisions, the adoption of which should be based on the use of appropriate information technologies and software products, will ensure the stability of financial income, balance sheet liquidity and profitability of the company. They associate the management of financial resources of a modern enterprise with the effective organization of the work of its financial services, which provides an opportunity to attract the necessary financial resources and invest them in profitable projects. The construction of an adaptive financial resources management system allows the enterprise not only to survive, but also to achieve strategic stability and to function effectively in the conditions of a changing external environment. In the study [16], the authors present a graphic image of the general system of managing the enterprise's financial resources and emphasize the need to take into account the tasks of the adaptive management system, such as adaptation to the external environment, ensuring financial stability, maintaining the structural liquidity of the balance sheet, etc.

From the point of view of systems management theory, the financial resources management system is a complex, dynamic and open system. It should be built taking into account the specifics of the enterprise's activity and the specifics of the formation of its financial resources, namely, considering the field of its activity, the size and form of ownership of the enterprise, the organizational structure of management, the peculiarities of the sources of formation and spending of its financial resources. The analysis of the approaches of various authors to the construction of enterprise management systems showed that it is expedient to conduct further research to define the peculiarities of the formation and distribution of financial resources of Ukraine's industrial enterprises that will allow proposing an effective system of their management.

During the research, authors of this study considered large and medium-sized industrial enterprises as the most complex in terms of sources of financial resources, organizational structure, and the construction of their management system.

Let it be considered the main sources of financial resources of Ukraine's industrial enterprises (Fig. 1). According to the principle of building liabilities of the balance

sheet (or according to the sources of assets coverage), they are divided into: equity capital; long-term and current liabilities and guarantees. There are also liabilities associated with non-current assets and disposal groups in the balance sheet, but their absolute size and specific weight are insignificant and do not affect the results of the study.

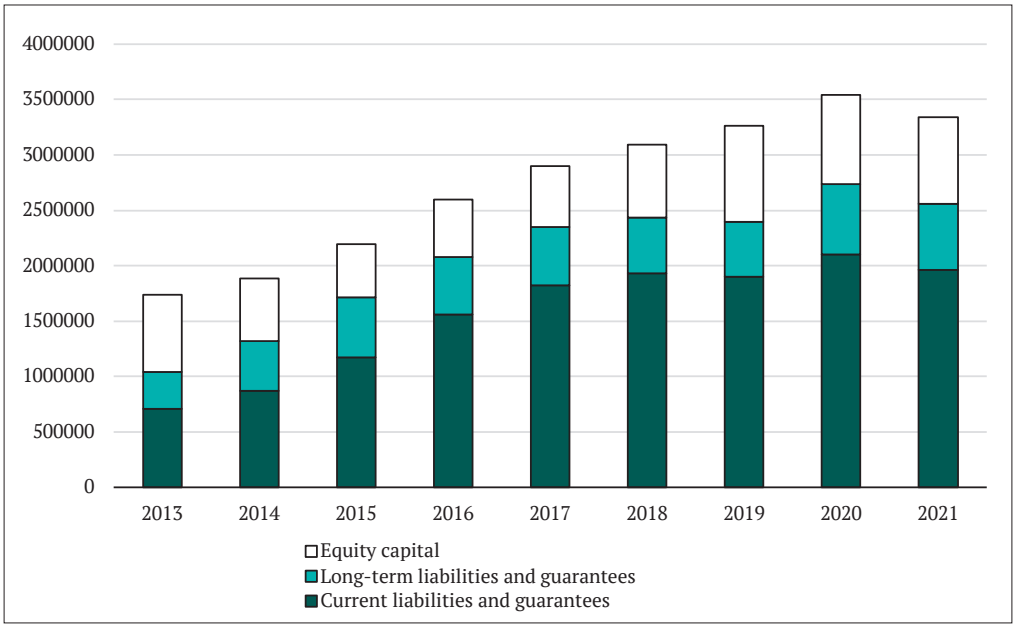

Figure 1. Sources of financial resources of Ukraine's industrial enterprises, UAH million

Source: developed by the author based on data [13]

It can be seen that the volume of financial resources of industrial enterprises was increasing almost from year to year. Thus, in 2013, their volume amounted to 1,738,633 million hryvnias, in 2020 it increased twice and reached a maximum of 3,541,158 million hryvnias. In 2021, there was a slight drop in the amount of financial resources of industrial enterprises (to UAH 3,343,107 million), which may be related to their operation in the pandemic.

If to consider the structure of financial resources of industrial enterprises, can be seen that the current liabilities and guarantees account for the highest share. In 2013, it was 40.6%, and in 2021 it reached 58.7% of the total amount of financial resources. The share of long-term liabilities and guarantees from year to year was at the level of 19.3%, and equity capital – at the level of 24.9% of the total volume of financial resources. Thus, the structure of sources of financial resources of industrial enterprises is dominated by current liabilities and guarantees, i.e., funds raised for a period of up to 1 year.

The main goal of the creation and operation of any enterprise, regardless of the characteristics of its products, size, form of ownership, number of founders, etc., is to obtain and increase net profit as the main financial result of its activity. Let's consider whether the size and sources of financial resources of industrial enterprises affect the amount of their net profit. For this, it was used correlation-regression analysis. Calculations are carried out using the Excel spreadsheet editor. If the influence is considered of different sources of financial resources on the amount of net profit (Table 1), then the most influential are the amounts of equity capital (0.628) and current liabilities (0.624). The volume of long-term liabilities has a minor influence (0.232). There is also a close relationship between the volumes of long-term and current liabilities (0.782).

Table 1. The degree of correlation between the studied indicators

Indicator	Net profit	Equity capital	Long-term liabilities	Current liabilities
Net profit	1			
Equity capital	0.628	1		
Long-term liabilities	0.232	0.163	1	
Current liabilities	0.624	0.480	0.782	1

Source: developed by the authors based on their own research

Thus, such sources of financial resources as equity capital and current liabilities were included in the model. In general, the regression model of the influence of various sources of financial resources on the net profit of the enterprise looks as follows:

$$Y = c + b_1 \cdot x_1 + b_2 \cdot x_2, \quad (1)$$

where Y is the amount of net profit of industrial enterprises; c – the constant; b_1, b_2 – regression coefficients; x_1 – the amount of equity capital; x_2 – the amount of current liabilities and guarantees.

With the help of the Regression tool in the Data Analyzes analysis package of the Excel table editor, the following function was obtained, which reflects the influence

of the amount of financial resources of industrial enterprises on the amount of their net profit:

$$Y = -485\ 266 + 0{,}476 \cdot x_1 + 0{,}126 \cdot x_2, \quad (2)$$

where Y is the amount of net profit of industrial enterprises, UAH million; x_1 – amount of equity capital, UAH million; x_2 – amount of current liabilities and guarantees, UAH million.

Large negative values of the "constant" indicator show that with small amounts of financial resources, enterprises will receive net losses. It should also be noted that the obtained value of the coefficient of determination R^2, which characterizes the quality of the obtained function, is 0.53071 (Fig. 2).

Regression Statistics	
Multiple R	0.728498
R Square	0.53071
Adjusted R Square	0.374279
Standard Error	122408,5
Observations	9

Figure 2. Results of regression statistics calculations

The higher the value of R^2 (its maximum value is 1), the higher the dependence between the independent factors of the model (x_1, x_2) and the dependent factor Y. In this case, changes in the amount of equity capital (x_1) and current liabilities and guarantees (x_2) lead to changes in net profit (Y) only in 53.071% of cases. That is, the amount of net profit is significantly influenced by other factors, in addition to the determined amount of financial resources. However, these factors were not considered in the model.

Thus, an effective system of managing financial resources of industrial enterprises should ensure their sufficient level and pay special attention to the management of current liabilities and guarantees as the main source of the formation of financial resources.

Let it be considered, which sources form the current liabilities and guarantees of Ukraine's industrial enterprises. Analysis of statistical reporting data [13] showed that they are formed at the expense of short-term bank loans, current accounts payable for goods, current guarantees and other short-term sources (Fig. 3).

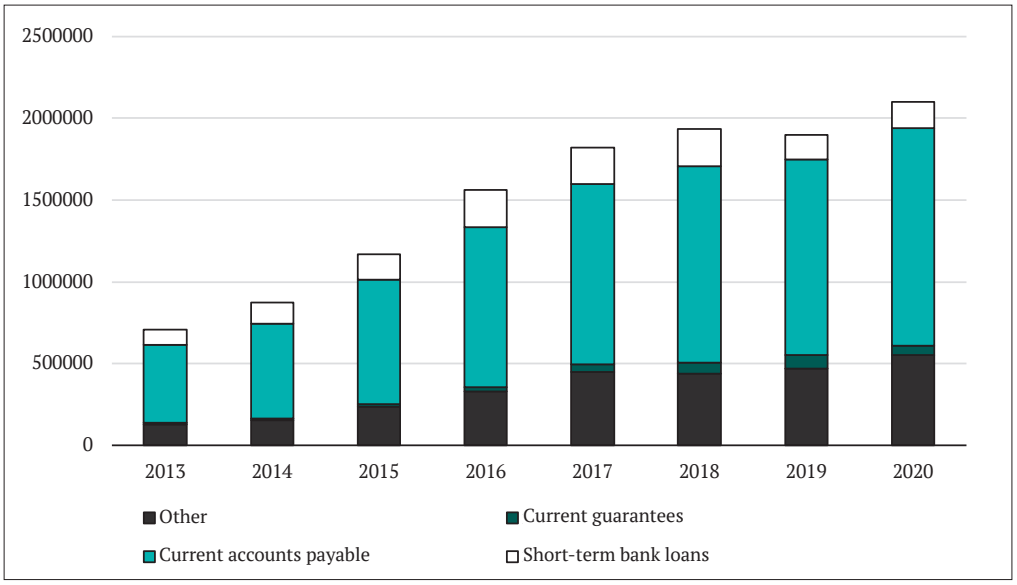

Figure 3. Sources of current liabilities and guarantees of industrial enterprises, UAH million

Source: developed by the authors according to [13]

In 2013, the volume of current liabilities amounted to UAH 705,980 million, of which current accounts payable account for 67.6%. In 2020, the volume of current liabilities increased almost 3 times to UAH 2,098,733 million. Their structure is also dominated by accounts payable which account for 63.3%. This makes it necessary to take into consideration such a peculiarity of industrial enterprises as to build their financial resources management system predominantly at the expense of current accounts payable.

The authors [17] note that the process of managing the enterprise's accounts payable has a number of peculiarities in relation to their object, subject, purpose, tools, etc.

According to the authors' opinion, the characteristics given by the authors refer not only to the management of accounts payable, but also to the management of accounts receivable. This is due to the fact that the timely repayment of debts to the enterprise's creditors primarily depends on the enterprise's timely receipt of funds from buyers. If the debtors comply with their obligations, the enterprise not only has enough funds to make timely and complete settlements with creditors, but also has free working capital.

The authors suggest that the process of managing the enterprise's accounts payable should be considered taking into account the following peculiarities (Table 2). In modern conditions, accounts receivable is an integral attribute of sales and the organization of settlements at an industrial enterprise. The saturation of commodity markets, the growth and strengthening of competition for the customer lead to the active use of commodity credit as one of the effective tools of the sales policy of any modern enterprise. Inefficient management of accounts receivable, on the one hand, is expressed in their unjustified and uncontrollable increase which leads to significant amounts of overdue debt. This, in turn, leads to the deterioration of the financial condition of the enterprise and even to its bankruptcy due to the lack of funds to carry out current activities and repay debts to creditors. On the other hand, the refusal to provide customers with product credit leads to the loss of a part of customers, revenue, profit and, as a result, to the loss in competition. Management of accounts receivable, as an object of management at the enterprise, involves the following stages: accounting, monitoring, analysis, control, collection, refinancing [18].

Table 2. Peculiarities of the enterprise's accounts payable management process

Characteristic	Content
Object	Economic relations with suppliers regarding receiving payment deferrals for raw materials, materials, components and other goods
Subject	Financial managers, accounting, planning and economic department
Main goals	Maximum satisfaction of the need to finance current activities and minimize the cost of attracting borrowed financial resources
Implementation tools	Cash flow management policy, repayment schedule, payment calendar
Principles	Systematicity, complexity, dynamism, balance, responsibility, transparency
Stages	Analysis, fund raising (formation of fund raising principles, usage period optimization, optimization of fund raising conditions, minimization of cost), accounting, use efficiency ensuring, organization of timely calculations; control
Methods	Analytical, planning, budgeting, synchronization, restructuring, mutual settlements

Source: developed by the authors based on [17] and their own research

Unlike management of accounts payable, many works of scientists are dedicated to the management of the enterprise's accounts receivable and the acceleration of their turnover [17; 18]. This can be explained by the fact that the credit and price policy in relation to its customers directly depends on the decisions made by the management of the enterprise. Management of accounts payable is largely related to the conditions dictated by suppliers. However, the enterprise's executives have always at their disposal the means to influence and control the state of accounts payable. The process of managing accounts payable and accounts receivable should begin at the stage of concluding contracts with suppliers and buyers of products. These contracts must take into account possible discounts for early repayment of funds, establish fines for late and improper fulfillment of the terms of the contract, they must be based on credit and price policies approved by the enterprise. Therefore, it is expedient to expand the circle of subjects that take part in the financial resources management and add employees of the commercial, planning and economic and accounting departments to financial managers. Thus, the system of managing financial resources of an industrial enterprise should look as follows (Fig. 4).

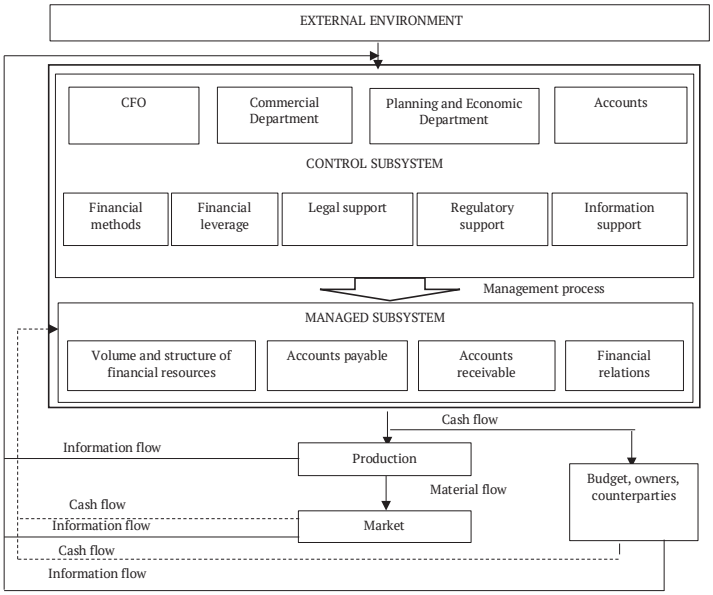

Figure 4. System of financial resources management of an industrial enterprise

Source: developed by the authors

The main tasks of the financial director, planning and economic department and accounting department in relation to the management of accounts payable include:

– formation of basic economic and financial conditions for concluding contracts with buyers and suppliers of products;

– accounting of operations for the purchase of raw materials and components and the sale of products;

– calculation of bonuses for workers for improving the terms of contracts with buyers and suppliers;

– drafting and execution of payment calendars for accounts payable and accounts receivable;

– planning of the cost of production and profit of the enterprise taking into account the discounts given to buyers and those received from suppliers.

The tasks of the commercial department are to find and conclude contracts with buyers of the enterprise's products. The commercial department, together with the planning and economic department, should develop a price and credit policy in relation to different groups of product buyers. Some conditions should be for large customers with whom the enterprise has been cooperating for a long time, others – for new and small customers. It is also necessary to rank the conditions for currency and hryvnia contracts, for buyers who make advance payment for goods and for those who receive products on the terms of deferred payment. As it has been mentioned, a competent credit and price policy towards buyers will allow the enterprise to directly influence its ability to settle with the creditors timely and in full.

The legal department can also act as the subject of the enterprise's financial resources management. At the same time, its main tasks will include the coordination of the main legal terms of contracts concluded by the enterprise with its suppliers and buyers. Such conditions should ensure the enterprise minimizes losses from untimely or incomplete fulfillment of contracts by buyers and the possibility of lawsuits in case of violation of contract terms. The object of management (managed subsystem) in the financial resources management system of an industrial enterprise is cash receipts and payments which make up the cash turnover and affect the formation and use of the financial resources of the enterprise, as well as the relationships formed in this process. As it has been defined while analyzing the peculiarities of the formation of financial resources of industrial enterprises, the management of such a source of financial resources as accounts payable requires primary attention. In its turn, accounts payable management is closely connected with accounts receivable management. Therefore, in the financial resources management system of the industrial enterprise, these types of accounts have been singled out as separate important objects of financial resources management.

The factors of the external environment affecting the state of the financial resources management of an industrial enterprise, i.e. its managed and managing subsystems, can include the interests of the owners of the enterprise; crisis phenomena in the external environment; legislation that regulates financial relations (first of all, tax legislation), the ease of attraction and the cost of various sources of financial resources, the exchange rate, the inflation rate, etc.

CONCLUSIONS

The system of managing financial resources of an enterprise is a part of the general system of enterprise management. The principles, subsystems and elements of the financial resource management system are based on approaches to the construction of management systems. Accordingly, a distinction is made between managing (management subject) and managed (management object) subsystems.

The peculiarity of the managing subsystem of financial resources management is that management is carried out within the framework of the financial mechanism, which includes a number of interrelated elements.

Large and medium-sized industrial enterprises considered in this research usually have an extensive management system as well as systems for managing their financial resources. Therefore, to the subjects of industrial enterprises financial resources management, the authors propose to include not only the financial manager, but also the commercial, planning and economic department and the accounting department, whose activities are also connected with the formation and use of the enterprise's financial resources.

The conducted study of the main sources of financial resources of Ukraine's industrial enterprises made it possible to define that current liabilities and guarantees are the basis of financial resources formation. Analysis of the impact of various sources of financial resources on the level of net profit of industrial enterprises showed that the volume of current liabilities has the greatest impact. And the insufficient total level of financial resources of enterprises will generally lead to net losses.

The study of the structure of current liabilities and guarantees of industrial enterprises showed that accounts payable are the main source of their formation. Timely settlements with creditors, in their turn, are not possible without timely settlements of debtors with the enterprise. Therefore, the peculiarity of the managed subsystem of managing financial resources of industrial enterprises is the need to pay great attention to the management of accounts payable and accounts receivable.

Also, the system of managing financial resources of industrial enterprises is an open system and is influenced by factors of the external environment.

The obtained results and the methodology used in the study can serve as a basis for further research on the formation of effective financial resource management systems of enterprises in other industries.

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Особливості системи управління фінансовими ресурсами промислових підприємств

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Анотація. Фінансові ресурси є основою функціонування будь-якого підприємства. Їх формування та використання має ґрунтуватися на ефективній системи управління, яка враховує як загальні принципи побудови систем управління, так й особливості управління фінансовими ресурсами. Аналіз наукової літератури показав, що йдуть постійні пошуки підходів щодо формування таких систем та їх складових елементів. Метою статті є побудова системи управління фінансовими ресурсами промислових підприємств з врахуванням особливостей їх діяльності та джерел фінансування. За допомогою наукового узагальнення було визначено сутність й основні складові елементи системи управління фінансовими ресурсами підприємства, їх відмінності від загальної системи управління. На основі використання системного підходу було здійснено комплексне оцінювання поточного стану фінансових ресурсів промислових підприємств України. Використання кореляційно-регресійного аналізу дозволило встановити, як джерела фінансових ресурсів промислових підприємств впливають на рівень їх чистого прибутку. Дослідження показало, що фінансові ресурси промислових підприємств України формуються переважно за рахунок поточних зобов'язань, а саме за рахунок кредиторської заборгованості. На своєчасність погашення кредиторської заборгованості безпосередньо впливає стан розрахунків з дебіторами підприємства. Надано основні характеристики процесу управління кредиторською заборгованістю, запропоновано у керованій підсистемі системи управління фінансовими ресурсами промислових підприємств відокремлювати кредиторську та дебіторську заборгованість, як важливі складові об'єкту управління.У якості суб'єктів управління запропоновано виділяти усі підрозділи, які пов'язані з формуванням й розподілом фінансових ресурсів промислових підприємств, та встановлено основні завдання, які має виконувати кожний з них при цьому.Отримані результати можуть бути основою для практичного використання керівниками підприємств, що дозволить підвищити ефективність управління, а також можуть бути підґрунтям для проведення подальших досліджень з формування систем управління фінансовими ресурсами підприємств інших галузей

Ключові слова: управління підприємством, фінансування, чистий прибуток, структура капіталу, кредиторська заборгованість, об'єкти та суб'єкти управління

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Authorized Economic Operator's Program within the Framework of Improvement of the Customs Policy of Ukraine

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Abstract. The introduction of the authorized economic operator program means for businesses simplification of declaration, efficiency of customs procedures and reduction of risks. This allows entrepreneurs to save time and money on customs terminal services and creates transparent and clear customs clearance procedures. However, so far only one company has received such a status, and the State Customs Service is considering another application for authorization. The purpose of the work is to assess the conditions and benefits of the program of an authorized economic operator in the framework of improving customs policy. The object of the study is the program of an authorized economic operator in Ukraine. The risks of international supply chains were highlighted in the paper. Entities that can obtain the status of an automated economic operator and the conditions for granting authorization to an automated economic operator are presented in detail. The simplifications and advantages of the status of the automated economic operator received by the subjects are systematized. In the course of research such methods were used as: analysis and synthesis, induction and deduction, comparison, system approach. The analysis helped to identify the shortcomings of the status of an automated economic operator, which can be further used by researchers to make recommendations for improving the regulatory framework

Keywords: authorized economic operator, customs policy, supply chain risks, customs security, simplification of declaration, customs formalities

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INTRODUCTION

The Authorized Economic Operator program is a key driver of customs and economic partnerships between countries. It creates a safe, transparent and predictable environment for trade. Ukraine's customs legislation should gradually converge with EU customs legislation, and one of the stages of adaptation is the introduction of the institution of an authorized economic operator in Ukraine. The status of AEO confirms the highest degree of customs confidence in the enterprise and, as a result, allows to apply the largest list of special simplifications and to take advantage of customs formalities for the goods moved by such enterprises. The future recognition of the status of national AEOs by the customs authorities of the EU countries will ensure the participation of Ukrainian operators in the formation of so-called safe supply chains and increase their competitiveness in foreign and domestic markets. As a result of the implementation of the program, a certain increase in economic growth is expected, which is currently happening.

State regulation of the functioning of authorized economic operators in Ukraine is based on the Customs Code of Ukraine (Chapter 2 "Authorized Economic Operator") [1], resolutions of the Cabinet of Ministers of Ukraine "On some issues of functioning of authorized economic operators" [2], "On approval of the Unified State Register of Authorized Economic Operators" [3], "On approval of the form, description and rules of use of the national logo of the authorized economic operator and the form of the certificate of the authorized economic operator" [4], "On approval of the application forms of the enterprise for granting permission for special simplification and permission for special simplification" [5], etc.

The issue of customs policy was considered in the scientific works of P. Dzjubenko [6], A. Lisov [7], O. Grebelnyk [8], I. Gutsul [9], S. Shevchuk [10]. The authors define customs policy as a relationship, associated with the exchange of goods. At the same time, these relations together form a certain system of international exchange relations established

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between states in order to provide markets for sales or raw materials, stimulate the development of certain industries, establish mutually beneficial trade cooperation with other states, protection from external competition. However, the authors' position on the interpretation of customs policy does not take into account modern integration processes, which translate customs policy from the national level to the supranational level of integration.

Authors I. Prykhodko and Y. Prykhodko [11] characterizing the features of Ukraine's customs policy in the context of European integration, justify the need to adapt, harmonize and unify customs legislation to EU requirements. But the authors do not consider the program of an authorized economic operator under the Association Agreement with the EU.

The research of aspects of the implementation of the program of an authorized economic operator is devoted to the works of such scientists as V. Turzhansky [12], I. Berezhnyuk [13], I. Nestoryshen [13; 14], A. Brendak [13]. Scholars emphasize that the transformations in the world political and economic space necessitate the development of new approaches to ensuring the security of the state in the face of the constant growth of threats, both internal and external. I. Mesecha [15], L. Prus [16] also studied the theoretical foundations and organizational and economic prerequisites for the emergence of the institution of authorized economic operator. However, the issue of using the program in AEO still remains insufficiently worked out.

Foreign scholars recognize the importance of using the program of an authorized economic operator. In particular, A. Torello [17] argues that customs clearance operations can be facilitated if importers, freight forwarders or logistics operators have been granted the status of authorized economic operator. Simplification of customs formalities, as well as fewer documentary customs controls and physical inspections, speed up international trade flows and reduce delivery times. A. Erceg [18] argues that AEO status means that a company can prove its reliability and safety. In addition, it means that the company has access to simplified customs procedures. A. Ariadna [19] and D. Widdowson [20] state that when the parties meet certain standards, including compliance with trade requirements and demonstrate a commitment to security of supply chains, they may be granted AEO status with some trade facilitation benefits, including mutual recognition of their AEO status in foreign countries with which the country has concluded a mutual recognition Agreement or "MRA"

However, the introduction of the institution of an authorized economic operator and the procedure for acquiring the status of such an authorized operator by enterprises has a somewhat slow pace and is characterized by low interest from entrepreneurs. Requires further study of the risks of international supply chains, the conditions for granting AEO status to entities and the benefits that AEOs can enjoy.

The purpose of the work is to assess the conditions and benefits of the program of an authorized economic operator in the framework of improving customs policy.

MATERIALS AND METHODS

The study used a systematic approach to generalize the legal support for the use of the program of an authorized economic operator in Ukraine.

RESULTS

Changes in the global market and growing dependence on supply chain participants are the reasons for the high level of risk. The introduction of an authorized economic operator also means reducing risks for business. Currently, among the global risks of international supply chains can be identified such risks (Table 1).

Table 1. Risks of international supply chains

Risk		Risk description
Internal risks		
Risks of the main elements of supply links	Logistics of procurement	Arise due to non-rhythmic work of suppliers or due to the inability of the enterprise to effectively plan the order of raw materials, materials, etc. The reasons for such risks may be: – dependence of the enterprise on a small number of suppliers with disabilities; – impossibility to fulfill the terms of the supply contract (product quality, delivery time, supply volumes, etc.); – financial supply problems; – violation of the conditions of transportation and storage by third parties involved in the performance of the supply contract
	Logistics of production	Are directly related to changes in the operational work of the enterprise and may occur for the following reasons: – changes in requirements for product quality and conformity; – violation of production technology; – failures in production processes
	Logistics of sales	Related to the violation of demand for products and services, information between the central enterprise and the market, as well as the quality of customer requirements, i.e. the speed of order fulfillment, the availability of the necessary stock to fulfill customer orders, timely delivery and more. The reasons for this risk may be: – change of financial capacity of the customer; – changing fashion trends; – change of product range; – season change; – change in the economic situation in the country; – incorrect forecasting of demand for products by the enterprise itself

Table 1, Continued

Risk		Risk description
Internal risks		
Risks of the main elements of supply links	Return management	Arise both in cases of need to provide the return of the received party to the supplier (manufacturer), and at the received addresses from clients (buyers). Financial losses and losses of appearance at returns are a significant risk for many companies that provide supplies to the retail network
Risks of logistics management	Structural risks	Related to the personnel policy of the enterprise and the positioning of logistics and supply chain management in the structure of enterprise management
Risks of logistics management	Structural risks	Related to the personnel policy of the enterprise and the positioning of logistics and supply chain management in the structure of enterprise management
	Financial risks	Elated to the management of the operating budget: direct logistics costs and hidden logistics costs, as well as the management of working capital, "frozen" in raw materials and goods and the efficient use of fixed assets for logistics (warehouses, transport, etc.)
	IT risks	Related to the completeness of logistics parameters and data, as well as their synchronization with all relevant enterprise systems
	Operational risks	Related to the implementation of operational procedures, which in turn can be divided into: – transport risks; – customs risks; – warehouse risks
External risks		
Risks that do not depend on the organization of the supply chain and the company itself. External risks include: natural disasters; military action; terrorist attacks; criminal risks; political change; changes in the economic situation		

Source: systematized on [21]

Security issues in the supply chain are becoming particularly important in the context of the escalation of local conflicts in the world and the intensification of terrorism. In the past, the focus has been on the uninterrupted flow of goods, security against disruptions such as theft or smuggling, and interaction between government organizations and supply chain players. But then some countries introduced new security and security programs to protect against terrorism. This has had a major impact on companies' approach to logistics and supply chain operations. Security issues are more important than ever, and supply chain actors work together with governments and international organizations to ensure supply chain efficiency and protect people, infrastructure and the economy.

Supply chain security management can be defined as policies, procedures and technologies aimed at protecting supply chains (products, tools, equipment, information and personnel) from theft, damage or terrorism and preventing the unauthorized smuggling of people or weapons. The purpose of security of supply management is to prevent adverse events, maintain the stability and continuity of procurement, production, storage, transportation and flow of information, as well as reduce security costs, delays in supply and production. The problem is especially important in case of timely delivery. Safety issues focus on man-made factors (prevention of human actions) as opposed to safety issues related to incidents such as natural disasters, fires, traffic accidents, political events or failures in technical infrastructure.

Thus, the expansion of the AEO institution and the subsequent increase in the number of concluded agreements will facilitate easier and safer exchange of goods. Clarity and control of supply chains should reduce the risk of theft, loss, and threats of organized crime. Below is a list of definitions from the Customs Code of Ukraine [1] on AEO (Table 2).

Table 2. Entities that can obtain AEO status and AEO definitions

Term	Definition
Authorized economic operator	An enterprise that performs any role in the international supply chain of goods, to which the bodies of revenues and fees have granted the authorization of the AEO
Producer	An enterprise that directly manufactures goods intended for export
Exporter (importer)	An enterprise that, on the basis of foreign economic agreements (contracts) concluded by it directly or through an intermediary (commission agent, agent, consignor) exports (imports) goods with their movement across the customs border of Ukraine, regardless of the customs regime in which such goods are placed
Customs representative	An enterprise that acts as an intermediary (customs broker, commission agent, agent, consignor) during the execution of a foreign trade agreement (contract)
Carrier	Legal or natural person who has undertaken obligations and responsibilities under the contract of carriage of goods for delivery to the destination of the goods entrusted to him, carriage of goods and their issuance (transfer) to the consignee or another person specified in the document governing the relationship between freight forwarder and carrier

Table 2, Continued

Term	Definition
Forwarder	Business entity that, on behalf of the client and at his expense, performs or organizes the performance of freight forwarding services specified in the freight forwarding agreement
Warehouse holder	Enterprise, which owns or uses a customs warehouse, temporary storage facilities, objects of a free customs zone

Source: systematized on [22]

AEO authorization can be of the following types:

1) on granting the right to apply special simplifications (hereinafter – AEO-C);

2) on confirmation of safety and reliability (AEO-S)

The company independently chooses the type of authorization provided and can have both types of authorizations at the same time. The following criteria are used to grant AEO authorization (Table 3).

Table 3. AEO compliance criteria

Indexes	AEO-C	AEO-S
1) compliance with the requirements of customs, tax and currency legislation of Ukraine, as well as the absence of facts of criminal prosecution	+	+
2) proper system of accounting, commercial and transport documentation	+	+
3) stable financial condition	+	+
4) ensuring practical standards of competence or professional qualification of the responsible official of the enterprise	+	
5) compliance with safety and reliability standards		+

Source: systematized on [22]

Enterprises that have received AEOs have the opportunity to use special simplifications (Table 4). The benefits received by enterprises with the status of AEO are given below (Table 5).

Table 4. Simplification in the presence of AEO

Indexes	AEO-C	AEO-S
1) general financial guarantee	+	
2) self-application of seals of a special type	+	+
3) simplified declaration procedure	+	
4) location procedure	+	

Source: systematized on [22]

Table 5. Advantages of the automated economic operator

Indexes	AEO-C	AEO-S
1) fulfillment of customs formalities for goods, commercial vehicles as a matter of priority	+	+
2) reduction of the degree of risk by the automated customs clearance system to determine the list of customs formalities during the customs clearance of goods, commercial vehicles	+	+
3) use of a specially defined (if any) lane at the checkpoint across the state border of Ukraine for the movement of commercial vehicles	+	+
4) use of the AEO national logo	+	+
5) receiving a notification from the body of revenues and fees that the relevant goods and vehicles for commercial purposes on the basis of risk analysis on the general declaration of arrival selected for customs inspection at the checkpoint (control point) across the state border of Ukraine until their movement through customs border of Ukraine		+

Source: systematized on [22]

DISCUSSION

The threat of terrorism, human trafficking and fraud means that countries and trade blocs are developing measures to ensure that supply chains are and remain secure. To strengthen security controls, an authorized economic operator (AEO) regime has been introduced to protect the domestic market and the international supply chain. This issue applies to every business, regardless of its size or the area of trade that owns or moves goods through the international supply chain. The AEO certificate provides a wide range of benefits that have been reported.

Given the results of the study, it can be argued that the introduction of AEO significantly contributes to improving the security of international trade, as well as affects the functioning of international supply chains. There

is now a need for an integrated and globally supported international data model that covers data exchange throughout the cross-border process. The WTO data model will not apply to all non-governmental areas related to trade, will not define data requirements for customs and other government agencies. The lack of an integrated international data model for the whole cross-border process poses major problems for operators and administrators of international supply chains, as they have to prepare several copies of information in different formats for different countries and for different processes.

Exporters-manufacturers, importers, distributors, customs brokers, warehouse and postal operators, freight forwarders and carriers can apply for AEO status.

AEOs are of two types: "B" and "S".

1) Type "B" – on granting the right to apply special simplifications;

2) Type "S" – on confirmation of safety and reliability.

The company independently chooses the type of authorization and can have both types of authorizations at the same time. Authorization of AEO is recognized throughout Ukraine, at the same time, the recognition by customs administrations of foreign countries of the authorization of AEO obtained by resident enterprises is carried out in accordance with international agreements of Ukraine.

Companies with a systemic level of organization and formalized procedures have a significant chance of obtaining AEO status. In such companies, processes must be formed, a quality system, certified software, etc. must be established.

The AEO certificate allows organizations to become a trusted member of international supply networks and adhere to high safety standards. The certificate demonstrates the reliability and commitment of the company to adhere to safety procedures. It is also proof of the solvency of the enterprise. Acquiring the status of AEO determines the increase of efficiency of the company's activity and more effective cooperation in the supply chain due to time savings and reduction of bureaucracy related to international trade and transport. However, so far only one company has received such status, and the State Customs Service is considering another application for authorization.

The provision of simplifications by customs authorities for those holding AEO certificates, with due regard to the security of the supply chain, determines efficient cross-border operations. To use the accumulated simplifications, the optimal solution is to create the status of secure supply chains. The more participants in the international supply chain have the status of AEO, the more complete the benefits and rights for its members. Responsible information management and partner relationship management have a positive impact on the effectiveness of security in the supply chain. AEO operators seek to start cooperation with other authorized operators, taking into account the security of the international supply chain. Proceeds from the joint recognition of AEO status may also cover sources that lead to a revival of trade. The creation of a mechanism of continuity of joint actions in order to respond to trade violations allows the customs authorities to improve and accelerate, as far as possible, the service of priority clearance of goods supplied by AEO.

The advantages of AEO are the result of simplified control of cargo and documents, reducing the amount of data contained in consolidated declarations, the possibility of prior information about the planned control of deliveries, priority treatment in the situation of choosing an AEO unit for control, the ability to apply for management. The AEO program has been evolving since its inception, and there are now more than 85 countries with AEO programs from more than 30,000 certified companies. In addition, 11 more AEO programs are being developed in other countries. However, it should be clearly emphasized that further expansion of the AEO institution is needed. This is extremely important for Ukrainian operators, despite the fact that the main export markets for Ukraine are the member states of the European Union, but third countries are also important.

Unlike other studies, the paper systematized the risks of international supply chains and identified the benefits of AEO that can minimize them. In addition, an analysis of entities that can obtain the status of AEO and the criteria for their compliance.

CONCLUSION

AEO is an important part of integration processes, as in the process of AEO implementation it is necessary to work on reducing the time spent on routine processes, for example, to verify the correct classification of goods according to UKTZED. Upon acquiring the status of AEO, the company is inspected for 120 days. Due to the limited staff of the customs, only 10 enterprises will be able to pass such an inspection in the first year, in the second – 20, in the third – 30. This restriction can be attributed to the shortcomings of the implementation of this status. The disadvantages also include the following:

1. The actual need to acquire the status of AEO for all participants in the supply chain (within the FEA) in Ukraine. In the absence of status, the benefits will not be in full force.

2. Lack of procedure for assessing enterprises for compliance with the criteria. Even taking into account that this procedure is under development, it will mean testing it in real enterprises after the changes on the AEO come into force, which can lead to unexpected consequences.

The deadlines for inspecting enterprises for compliance with the criteria mentioned above may not meet the demand for AEO status, so it is worth looking for ways to increase the number of enterprises that can be inspected simultaneously.

Thus, the expansion of the AEO institution and the subsequent increase in the number of concluded agreements will facilitate easier and safer exchange of goods. Clarity and control of supply chains should reduce the risk of theft, loss, and threats of organized crime.The results of the study can be used by future researchers to continue work on bringing domestic customs practices closer to European standards through the use of the AEO program.

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Програма авторизованого економічного оператора в рамках удосконалення митної політики України

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Анотація. Запровадження програми авторизованого економічного оператора означає для бізнесу спрощення декларування, оперативність митних процедур та зниження ризиків. Це дозволяє підприємцям економити час та кошти на послуги митних терміналів і створює прозорі та зрозумілі процедури митного оформлення. Однак, наразі такий статус отримало лише одне підприємство, а на розгляді Державної митної служби перебуває ще одна заява про надання авторизації. Метою роботи є оцінка умов та переваг програми авторизованого економічного оператора в рамках удосконалення митної політики. Об'єктом дослідження виступає програма авторизованого економічного оператора в Україні. У роботі були виділені ризики міжнародних ланцюгів постачання. Детально представлені суб'єкти, що можуть отримати статус автоматизованого економічного оператора та умови надання авторизації автоматизованого економічного оператора. Систематизовано одержувані суб'єктами спрощення та переваги статусу автоматизованого економічного оператора. В процесі дослідження використовувались такі методи, як: аналіз та синтез, індукція та дедукція, порівняння, системний підхід. Проведений аналіз допоміг визначити недоліки статусу автоматизованого економічного оператора, що може в подальшому використовуватися дослідниками для рекомендацій щодо удосконалення нормативно-правової бази

Ключові слова: авторизований економічний оператор, митна політика, ризики ланцюгів постачання, митна безпека, спрощення декларування, митні формальності

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Legal Regime of Securities of Joint Investment Institutions

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Abstract. The article examines the peculiarities of legal regulation, emission and circulation of securities of joint investment institutions on the basis of which their comparative legal analysis was conducted for the first time. The subject of the study is the legal regime of securities of joint investment institutions – shares of corporate investment funds and investment certificates of unit investment funds. The purpose of the article is to study the features of the legal regime of securities of joint investment institutions – shares of corporate investment funds and investment certificates of unit investment funds, as well as to identify problems of their legal regulation. As far as methodology is concerned, in the course of the research general scientific and special legal methods of cognition were used. The comparative and legal methods made it possible to study the current legislation on the activities of joint investment institutions to establish common and distinctive features of securities of joint investment institutions. Methods of scientific induction and deduction provided an opportunity to investigate the legal nature of the relations that arise from securities of institution of joint investment. The problematic aspects of legislative regulation of securities of joint investment institutions were identified. The peculiarities of shares of corporate investment funds and investment certificates of unit investment funds were investigated. Common and distinctive features of securities of joint investment institutions were identified. Special attention is given to the fact that shares of corporate investment funds and investment certificates of unit investment funds, although assigned by the legislator in one category – securities of joint investment institutions, significantly differ in the legal nature of certifying relations. It is stated that the corporate investment fund shares give the investor of such a fund corporate rights instead of investment certificates of unit investment funds certify ownership. The article will be useful for practitioners in the field of law and economics, students of higher education, scientific and pedagogical workers of law and economics faculties, as well as all interested readers

Keywords: corporate investment, institutional investor, corporate investment funds, unit investment funds, investment certificates, shares of corporate investment funds, legal regulated

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INTRODUCTION

At the present stage of development, Ukraine is in the position of instability which extends to the legal regulation of corporate and investment relations. The state faces such problems as attracting investment without which industry development and implementation of investment projects is impossible due to lack of state funds or the reluctance of investors to risk their own capital. The reasons for this problem are the lack of sufficient funds in the state or the investors' unwillingness to risk equity as a result of imperfect legal regulation and the state guarantees of investment activity. According to the Ukrainian Investment Business Association, as of 27.06.2022, the number of joint investment institutions in Ukraine is 1,753 and there are 309 asset management companies. As of November 30, 2021, the assets managed by the asset management company of corporate and mutual investment funds amounted to UAH 522,907 million [1].

Regain and development of economic processes in Ukraine are determined by the size and structure of investments, quality and speed of their placement. Joint investment institutions (corporate and unit funds) play a very important role in attracting investment to Ukraine's economy.

In Ukraine, the law defines two types of joint investment institutions, which, depending on the order of formation and operation, are divided into corporate investment funds and unit funds (Law of Ukraine "On Joint Investment Institutions" [2]). The collective form of investment through the joint investment institutions is becoming

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more attractive to individual investors due to the fact that participation in the joint investment institution is carried out through the purchase of securities of joint investment institutions such as shares of corporate investment funds or investment certificates of unit funds.

The legal regime of securities of joint investment institutions is determined by the Law of Ukraine "On Joint Investment Institutions" [2], "On Capital Markets and Organized Product Markets" [3] and other regulations on the functioning of the stock market. The basis of legal regulation of securities of joint investment institutions is the Law of Ukraine "On Joint Investment Institutions" [2], as its effect extends to public relations in the field of joint investment as part of the formation and operation of joint investment entities, to ensure guaranteeing the ownership of securities of joint investment institutions and protection of the rights of participants of joint investment institutions. The main legal acts regulating the activities of joint investment institutions at the international level are the Directive 85/611/EEC on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS) of 12/20/1985 [4], as well as the EEC Directive 93/22/EEC [5] on investment services in the securities field of 05/10/1993.

To date, the legal framework for the activities of investment funds in Ukraine has been formed, but due to constant changes in legislation it has many internal contradictions and certain problems and shortcomings.

A problematic aspect of the legal regulation of securities of joint investment institutions, in particular, shares of corporate investment funds is the fact that the provisions of the Law of Ukraine "On Joint Stock Companies" [6], which determines the order of emission and circulation of shares, as well as the rights certified by shares, are not implemented to the definition of legal regime of shares of corporate investment funds. These provisions can be found in Part 2 of Art. 3 of the Law of Ukraine "On Joint Investment Institutions" [2]. The legislation on joint stock companies does not apply to the regulation of corporate funds. This position of the legislator, in our opinion, is unfounded and inconsistent for the following reasons:

– firstly, the legislator defined the organizational and legal form of the corporate fund as a joint-stock company (JSC);

– secondly, the Law of Ukraine "On Joint Stock Companies" [6] is applied to:

insurance companies – in accordance with Art. 2 of the Law of Ukraine "On Insurance" [7], insurers are financial institutions established in the form of JSC;

stock exchanges – in accordance with Art. 33 of the Law of Ukraine "On Capital Markets and Organized Commodity Markets" [3], stock exchange is a JSC, which concentrates on the supply and demand of securities, promotes the formation of their exchange rate and operates in accordance with this Law, other legislation of Ukraine, the statute and rules of the stock exchange;

commercial banks – in accordance with Art. 6 of the Law of Ukraine "On Banks and Banking" [8], banks in Ukraine are created in the form of a public JSC or a cooperative bank;

holding companies – in accordance with Art. 1 of the Law of Ukraine "On Holding Companies in Ukraine" [9] a holding company is a JSC, which owns, uses and disposes of holding corporate shares (parts, units) of two or more corporate enterprises.

All these entities, as well as the corporate fund, are also specialized joint-stock companies.

The purpose of the article is to study the features of the legal regime of securities of joint investment institutions such as shares of corporate investment funds and investment certificates of unit funds, as well as to identify problems of their legal regulation.

LITERATURE REVIEW

Regarding the theoretical approaches to the study of securities of joint investment institutions in the legal aspect, the authors believe that the level of research on the problems of legal regulation and theoretical understanding of the legal regime of securities of joint investment institutions are insufficient.

Problems of legal regulation of joint investment institutions were studied in the works of V. Butuzov [10], O. Garagonich [11], M. Danyliuk [12], Yu. Zhornokuy [13], O. Susch [14], O. Slobodyan [15]. The works of V. Butuzov [10] were focused on the study of legal and organizational principles of the functioning of collective investment institutions in Ukraine. The scientific research of O. Garagonich [11] reveals the features of the economic legal personality of joint-stock companies, among which the legal status of corporate investment funds is partially analyzed. M. Danyliuk [12] paid attention exclusively to the legal status of corporate investment funds, while O. Slobodyan [15] determined the peculiarities of the activity of joint investment funds. Scientific research by Yu. Zhornokuy [13] and O. Susch [14] is devoted to the characteristics of legal relations on corporate (joint) investment. The authors state that scholars mostly studied the peculiarities of the legal status of joint and corporate investment funds and the legal nature of the relationship between the investor and the investment fund, or studied general issues of the legal regime of securities: O. Yavorska [16], V. Yarotsky [17]. Y. Kovalenko, T. Bilovus focused on the study of the macroeconomic indicators of individual investors and collective investment institutions in the securities market of Ukraine [18], Serdar Çelik and Mats Isaksson's article provides a framework for analysing the character and the degree of ownership engagement by institutional investors [19]. Among the foreign researchers who have studied the legal regulation of corporate investment funds, mutual funds, their asset management companies and securities in various aspects, the following should be mentioned: D. Gaukrodger [20], J. Morley [21] offer the first general examination of mutual fund capital structure regulation under the Investment Company Act of 1940. Thus, the problems of the peculiarities of the legal regime of shares of corporate investment funds and investment certificates of unit funds, as well as the legal nature of the relationship between the investor and the investment fund remain unexplored.

MATERIALS AND METHODS

In the course of the research, general scientific and special legal methods of cognition were used. The comparative and legal methods made it possible to study the current legislation on the activities of joint investment institutions

and to establish common and distinctive features of securities of joint investment institutions – shares of corporate investment funds and investment certificates of union investment funds.

Using such methods of scientific induction and deduction, the legal nature of the relations that arise between the investor of the joint investment institution and the investment fund or asset management company on the basis of the acquisition of securities is studied and determined.

The information basis of the study was formed by the current legal acts, which determine the legal regime of securities of joint investment institutions: Civil Code of Ukraine [22], Law of Ukraine "On Institutions of Joint Investment" [2], Law of Ukraine "On Capital Markets and Organized Commodity Markets" [3].

RESULTS AND DISCUSSION

Securities are a specific object of civil rights and legal relations. The basic principles of legal regulation of securities in Ukraine are reflected in the rules of the Civil Code of Ukraine [22]. In particular, art. 177 of the Civil Code of Ukraine [22], identified among other objects of civil rights, securities, art. 194 reveals the meaning of the concept of a security and art. 195 defines securities groups that can be in civil turnover in Ukraine.

According to art. 194 of the Civil Code of Ukraine [22], a security is a document of the established form with the corresponding details which certifies monetary or other property rights, determines the relations of the issuer of the security (a person who issued a security) and a person who is entitled to a security, and envisages the fulfillment of obligations on such security, as well as the possibility of transferring rights on the security and rights of security to other persons.

Securities according to the order of their placement or issuance are divided into emission or non-emission. Emission securities are securities that certify the same rights of their owners within the limits of one issue of securities in relation to a person who assumes appropriate obligations (issuer) (p. 1 art. 8 Law "On Capital Markets and Organized Commodity Markets" [3]). These include corporate investment funds and investment certificates. In addition, by p. 7 art. 8 Law "On Capital Markets and Organized Commodity Markets" [3] shares of corporate funds and investment certificates are classified as a group of unit securities. Unit securities are securities that certify the owner of such securities (investor) in the authorized capital and/or assets of the issuer (including assets in the management of the issuer) and give the owner (investor) the right to receive part of the income, in particular in the form of dividends and other rights established by law, as well as a prospectus or decision on issue, and for securities of joint investment institutions – a prospectus (decision on issue) of the joint investment institute.

Securities of the joint investment institution have the peculiarities of legal regulation, issue and circulation which are combined into one legal category "legal regime of securities of joint investment institutions".

In accordance with paragraph 18 of Part 1 of Art. 1 of the Law of Ukraine "On Joint Investment Institutions" [2], securities of the joint investment institution are shares of the corporate fund and investment certificates of the unit fund. The study of the legal regime of securities of joint investment institutions should begin with the very category of "legal regime". In legal documentation, the legal regime is considered in a broad and narrow sense. In a broad sense, the legal regime is a special procedure for legislative regulation of activities, actions or behaviour of individuals and legal entities in various spheres of public relations or at certain facilities, including the establishment of the mechanism to ensure the actual implementation of permits, incentives, regulations, guarantees, prohibitions, restrictions, obligations, as well as competent implementation and application of coercive measures and bringing the perpetrators to justice. In a narrow sense, the legal regime should be understood as a special combination of legal tools (legal means) enshrined in the rules of law, characterized by special conditions, specificity (certainty) of social relations, the state of attitude to a particular object and pursues a useful purpose for society and the state [23].

The study of the legal regime of securities of joint investment institutions is relevant because:

– firstly, there are hardly any scientific papers devoted to the study of the legal regime of shares of a corporate investment fund and investment certificates of a unit investment fund;

– secondly, since the shares of corporate investment funds are the object of corporate investment [14] and give investors of such funds corporate rights, it is extremely important to properly regulate this type of securities in order to ensure the rights of investors of corporate investment funds;

– thirdly, the main law, regulating legal relations on corporate investment, is the Law of Ukraine "On Joint Investment Institutions" [2]. Although it has the character of a special law, its norms are references to other laws and bylaws (regulations) such as NCSSM (National Commission on Securities and Stock Market) decisions, statutes and agreements. This creates certain difficulties in their understanding for non-professional investors.

Features of shares of corporate investment funds. As far as shares of a corporate investment fund are concerned, the legislator understands a security issued by a corporate investment fund which certifies the property rights of its owner (corporate fund participant), including the right to receive dividends (for a closed corporate fund), part of the corporate fund in case of liquidation, the right to manage the corporate fund, as well as non-property rights provided by this Law (Paragraph 2, Article 1, Part 1). The Law of Ukraine "On Securities and the Stock Market" [3] also contains a definition of shares of corporate investment funds, but this definition actually duplicates the concept in the Law of Ukraine "On Joint Investment Institutions" [2].

Taking the concept of shares of a corporate investment fund as a basis, the authors can distinguish the features of their legal regime:

1) is an issue security;

2) the issuer is a corporate investment fund – a legal entity that is formed in the form of a joint stock company and conducts exclusively joint investment activities;

3) it certifies the corporate rights of a corporate investment fund participant;

4) dividends are charged and paid only on shares of a closed corporate investment fund;

5) dividends on shares of open and interval type of corporate investment funds are not charged and are not paid;

6) shares of a corporate investment fund may be only registered;

7) shares of the corporate fund are extremely simple and exist in an undocumented form;

8) shares of the corporate fund are not subject to the mandatory listing procedure.

The circulation of shares of corporate investment funds depends on the type of corporate investment funds: shares of corporate investment funds of closed type are subject to free circulation on the securities market; shares of corporate investment funds of interval type in the period between intervals are subject to free circulation on the securities market, and during the interval are subject to free circulation exclusively on stock exchanges; shares of corporate investment funds of open type are subject to free circulation exclusively on stock exchanges.

The Law of Ukraine "On Joint Investment Institutions" [2] uses different terminology to denote a person who acquires shares of corporate investment funds: investor, or a corporate fund member, but does not use the term "shareholder" [23]. Given Part 2 of Art. 3 of the Law of Ukraine "On Joint Investment Institutions" [2], according to which the legislation on joint stock companies does not apply to the regulation of corporate funds, it is clear why the term "shareholder" is not used. However, no matter how the purchaser of the shares of the corporate fund is called, his legal position will correspond to the term "shareholder" and the legal status of "shareholder" for the following reasons:

– firstly, the security that the investor acquires is a share of a corporate investment fund. The rights of investors-shareholders of the corporate fund appear from the moment of acquisition of shares of the corporate fund, each of which gives the shareholder a certain amount of authority;

– secondly, the issuer of such securities is a corporate investment fund, that is, a joint stock company;

– thirdly, the legal relationship that arises between the owner of shares of a corporate investment fund and the corporate investment fund itself is of legal nature.

Based on the analysis of the Law of Ukraine "On Capital Markets and Organized Commodity Markets" [3] and the Law of Ukraine "On Joint Investment Institutions" [2] the authors can affirm that the main interest of a corporate investment fund investor are securities of a corporate investment fund. These are shares and corporate rights from them (property rights and non-property rights).

Both the corporate investment fund and its investor-shareholder have a property interest, which is expressed in the fact that the shareholder, placing investments in the authorized capital of the corporate fund, pursues the goal of obtaining corporate rights, securities and dividends, and the recipient, corporate investment fund, in its turn, is interested in making a profit from the placement of investments in securities of other issuers (in the form of dividends or the difference between buying and selling shares), corporate rights and real estate.

Corporate rights from the shares of a corporate investment fund may arise on the basis of purchase and sale of shares of the corporate fund on the secondary securities market or redemption of shares by private placement at the stage of creation of the corporate fund by its founders.

Features of investment certificates of unit investment funds. The legal regime of investment certificates of unit investment funds is determined by the Laws of Ukraine "On Joint Investment Institutions" [2], "On Capital Markets and Organized Commodity Markets" [3] and the Regulations of the NSSMC "On the procedure for registration of the emission and issue of investment certificates of unit investment fund prospectus" [24].

The concept of investment certificate is defined in paragraph 8 of Part 1 of Art. 1 of the Law of Ukraine "On Joint Investment Institutions" [2], according to which the investment certificate of a unit investment fund is a security issued by an asset management company of a unit investment fund and which certifies the ownership right of a unit fund participant to a share in a unit fund and the right to receive dividends (for a closed unit fund).

The features of investment certificates are manifested in the following characteristics:

1. The issuer of the investment certificate is the asset management company of the unit investment fund, as the unit fund is not a legal entity (Part 3 of Article 41 of the Law "On Joint Investment Institution" [2]), but is a set of assets belonging to the participants of such fund on the right of joint ownership, managed by the asset management company and accounted separately from the results of its economic activity (Part 1 of Article 41 of the Law "On Joint Investment Institution" [2]);

2. The certificate is a unit security in accordance with the Law of Ukraine "On Capital Markets and Organized Commodity Markets" [3]. The investment certificate assures the ownership right of the unit fund participant to a part in the unit fund. The investor does not lose ownership of the property transferred to the unit fund. Only the regime of property rights changes – from the right of private property to the right of joint partial ownership. Thus, all the property that constitutes the unit fund belongs to the participants of the unit fund on the right of joint partial ownership;

3. In exceptional cases, the investment certificate entitles the unit fund participant to receive dividends, but this applies only to investment certificates of a closed unit fund.

4. Investment certificates of a mutual investment fund exist exclusively in undocumented form (Part 2 of Article 51 of the Law of Ukraine "On Joint Investment Institutions" [2]).

5. A person who purchases securities of a unit investment fund from their issuer is obliged to pay for such securities within the period provided by the prospectus of the securities emission, but not later than three working days from the date of concluding the agreement on their acquisition. Paid securities in undocumented form are credited to the investor's account opened with the custodian, solely on the basis of the relevant order of the issuer of such securities (Part 4 of Article 51 of the Law of Ukraine "On Joint Investment Institutions" [2]).

Existing scientific research on the legal regulation of investment funds [10-13] and their securities does not pay enough attention to the peculiarities of the issue and circulation of securities of collective investment institutions [15-17]. For the first time a comparative and legal study of the legal regime of securities of joint investment

institutions with the separation of their common and distinctive features was conducted. On the basis of which it was established that investment certificates of unit investment funds and shares of corporate investment funds, although were united by the legislation in the name of "securities of joint investment institutions", have significant differences in the rights that certify the specified securities, the mechanisms of their issue and circulation.

Considering that the corporate investment fund is the corporate investment fund issuer, and the issuer of investment certificates of the unit investment fund is the asset management company, authors propose to exclude a unit investment fund from the concept of "joint investment institute". In our opinion, the contractual construction "unit investment fund" only complicates the mechanism of relations that arise between the investor and the asset management company.

CONCLUSIONS

Thus, on the basis of a conducted study authors have identified problems of legal regulation and features of the legal regime of securities of joint investment institutions, which was not subject to previous scientific research. Authors can affirm that the shares of corporate investment funds and investment certificates of unit funds, although classified by the legislator in one category as securities of joint investment institutions, differ significantly in the legal nature of the relationship. Shares of a corporate investment fund give the investor of a corporate investment fund corporate rights, while investment certificates of unit funds certify the ownership of a unit fund participant for a share in a unit fund and the right to receive dividends (for a closed unit fund). In addition, issuers also differ. The issuer of shares of a corporate investment fund is a joint investment institution – a corporate investment fund (joint stock company), and the issuer of investment certificates of a unit investment fund is an asset management company of a unit investment fund, which is not a joint investment institution. A unit investment fund is not an issuer of securities because it does not acquire the status of a legal entity and has no legal personality, but is only a collection of assets belonging to investors of the share fund in the right of joint partial ownership. On behalf of the unit investment fund in the interests of the participants of the unit investment fund, operates a professional participant in the securities market – asset management company. Due to the fact that the unit fund is a holistic property complex, and therefore, the object of legal relations, authors believe that it must be deduced for the scope of the concept of "joint investment institution".

The researched securities also have certain things in common. This fact unites them in the concept of "securities of joint investment institutions". First of all, the common features of shares of corporate investment funds and investment certificates of unit investment funds are that they are: issued securities; can only be nominal; exist in undocumented form; payment for securities of the joint investment institution is made exclusively in cash and is not allowed in installments; dividends on securities of an open and interval joint investment institution are not accrued or paid.

Authors have come to the conclusion that the features of the legal regime of shares of corporate investment funds are: the emission nature of securities; the issuer is a corporate investment fund – a legal entity formed in the form of a joint-stock company and conducts exclusively to joint investment activities; certifies corporate rights of the participant of the corporate investment fund; dividends are charged and paid only by shares of a closed corporate investment fund; dividends for shares of open and interval type of corporate investment funds are not charged and not paid; shares of the corporate investment fund can be only registered; corporate fund shares are extremely simple and exist in a non-documentary form; corporate fund shares are not subject to a mandatory listing procedure. Features of the legal regime of investment certificates of unit investment funds are: the emission nature of securities; the issuer is the asset management company of such a unit investment fund; certifies the liability of the participant of a unit investment fund; dividends are charged and paid only on investment certificates of a closed unit investment fund; exist exclusively in non-documentary form.

It should be noted that the study of the features of their legal regime of securities of joint investment institutions is a promising direction of research, which is due to insufficient research of legal relations that are certified by such securities, and the availability of legal regulation issues, which generates certain difficulties in understanding for unprofessional investors and protecting their rights.

The directions of further research in the field of corporate investment should be related to the development of proposals for improving the legislation in the protection of the rights of securities owners of joint investment institutions.

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Правовий режим цінних паперів інститутів спільного інвестування

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Анотація. У статті досліджено особливості правового регулювання, емісії та обігу цінних паперів інститутів спільного інвестування, на підставі чого, вперше проведено їх порівняльно-правовий аналіз. Предметом дослідження є правовий режим цінних паперів інститутів спільного інвестування – акцій корпоративних інвестиційних фондів та інвестиційних сертифікатів пайових інвестиційних фондів. Метою статті є дослідження особливостей правового режиму цінних паперів інститутів спільного інвестування – акцій корпоративних інвестиційних фондів та інвестиційних сертифікатів пайових інвестиційних фондів, а також визначення проблем їх правового регулювання. У роботі застосований комплекс методів наукового пізнання, що дало можливість усвідомити концептуальну єдність наукового дослідження. У ході дослідження застосовувалися загальнонаукові та спеціально-правові методи пізнання. Порівняльно-правовий метод надав змогу дослідити чинне законодавство з питань діяльності інститутів спільного інвестування, методи наукової індукції та дедукції надали можливість дослідити правову природу відносин, що виникають з цінних паперів інститутів спільного інвестування. Визначено проблемні аспекти законодавчого регулювання цінних паперів інститутів спільного інвестування. Було досліджено особливості акцій корпоративних інвестиційних фондів та інвестиційних сертифікатів пайових інвестиційних фондів. Виділено спільні та відмінні ознаки цінних паперів інститутів спільного інвестування. Акцентовано увагу на тому, що акції корпоративних інвестиційних фондів та інвестиційні сертифікати пайових інвестиційних фондів хоча і віднесені законодавцем до однієї категорії – цінні папери інститутів спільного інвестування, але суттєво відрізняються за правовою природою відносин, що посвідчують. Зазначено, що акції корпоративного інвестиційного фонду надають інвесторові такого фонду корпоративні права, натомість інвестиційні сертифікати пайових інвестиційних фондів посвідчують право власності. Стаття буде корисна для практикуючих фахівців у сфері права та економіки, здобувачам вищої освіти, науково-педагогічним працівникам юридичних та економічних факультетів, а також усім зацікавленим читачам

Ключові слова: корпоративне інвестування, інституційні інвестори, корпоративні інвестиційні фонди, пайові інвестиційні фонди, інвестиційні сертифікати, акції корпоративних інвестиційних фондів, правове регулювання

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Development of Information Model of Color Reproduction Process in Polygraphic Systems

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Abstract. Color calibration is a common procedure in polygraphic reproduction, and there are enough tools to guarantee accurate digital or analog reproduction (printing on paper, screen or display projectors, etc.). The topical task is to achieve the correspondence of colors formed on different devices of the printing process. The color on the monitor screen must match the color on the printer print. In addition, if there are several monitors and printers at the enterprise, it is necessary to ensure color matching between them. The aim of the article is to develop a model of step-by-step conversion of color images in order to achieve high quality reproduction in reproduction systems. The methods of automatic algorithmic conversion (using Convert to Profile in Adobe Photoshop) and conversion by the color separation operator were used in the work. Conversion of the image from the LAB color space to the CMYK color space was carried out using various conversion methods: Relative Colorimetric, Absolute Colorimetric, Perceptual, Saturation. This sequence of actions allowed to identify the nature and level of change of color coordinates. The maximum saturation reduction is observed when using the Relative Colorimetric and Absolute Colorimetric conversion algorithms. The minimal one – when using Saturation and Perceptual algorithms. Thus, the use of different conversion algorithms to varying degrees affects the saturation of different colors. The practical significance of the study is that the information model has been developed which will make it possible to implement the technology of priority color reproduction, depending on the purpose of the reproduction process, which increases the accuracy of the conversion of color information of the originals and, accordingly, the quality of production of printed publications

Keywords: color space, color management system, data flow model, color coordinate conversion algorithms

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INTRODUCTION

There is a massive introduction of computer systems into polygraphic prepress processes.The author, the publishing house and the printing house started performing technological operations in different proportions. There is a lack of regulations for the performance of operations [1]. These and other reasons led to the violation of established industrial relations. As a result, the quality of printed products often does not satisfy the customer, especially in terms of color.

Reproduction of color images involves the transition from colorimetric models to printing space. In this case, information is compressed from the color coverage of the original to the reduced color coverage of the print.

This situation has created the prerequisites for the creation of color management systems (CMS – Color Management System) [2] designed to solve the problem of ensuring the quality of color reproduction in the conditions of modern territorial openness of the production cycle. The International Color Consortium (ICC – International Color Consortium) in the mid-nineties proposed a standard [2] that allows to determine the color parameters of various devices involved in both prepress and printing processes.

The color management system copes well with the task of accurate color reproduction if all equipment is well calibrated and the output signal is greater than or equal to the input signal.

Thus, the task of achieving the correspondence of colors which are formed on different devices of the printing process is relevant. The color on the monitor screen must match the color on the print obtained on the printer. In addition, if there are several monitors and printers at the enterprise, it is necessary to ensure color matching between them. Without CMS, this situation is extremely difficult and time-consuming to correct.

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Color calibration is a common procedure for photographing natural objects and there are enough tools to guarantee an accurate digital image or analog reproduction (printing on paper, screen or display projectors, etc.). Color models, obtained both photogrammetrically and by scanners, have not yet reached such level of development and are often built without attention to the colorimetric quality of the result [3-5]. The color information of the original usually exceeds the amount of information that can be reproduced in the reproduction process, so information compression is performed [6]. But in these studies there is no algorithm for color conversion depending on the properties of the original.

When reproducing multicolor halftone originals, the choice of color transformation parameters is determined mainly by the experience and artistic taste of the operator [7]. At the same time, the possibilities of the reproduction process are often not fully used due to the lack of complete information about the optimal transformation of color information of a particular original [8; 9]. However, these works do not take into account the fact that since the choice of control objects is determined by the semantics of the original, an information classification of fine art originals for polygraphic reproduction is necessary.

The distribution of color fields of information within the gradation interval, the contrast in the plot-important and background areas of the gradual interval lead to the need to develop some additional requirements for the parameters of color originals. [10]

The CMYK color space (Cyan, Magenta, Yellow, Key color – a subtractive color model used in printing) has a limited color gamut, which depends on the applied components of polygraphic production – paper, inks and on the process settings in general – the parameters of the printing process, which must be taken into account when information about the real CMYK used in this process is entered into the processing system [11-13].

The developed HiFi-technologies [11; 12], which use from 5 to 8 synthesis inks, combined as a rule with stochastic rasterization, have limited application for technological and economic reasons. This makes it impossible to accurately reproduce pictorial originals, which are slides or photographic prints of natural scenes [14-16].

Thus, *the aim of the work* is to build a model of step-by-step transformation of graphic objects in order to achieve high-quality color reproduction characteristics in reproduction systems.

The novelty of the work lies in the construction of a model of data flows in the reproduction system, which allows to analyze information about the parameters of the polygraphic process and to adjust the equipment settings to achieve the required quality of color images.

MATERIALS AND METHODS

The process of developing an information model is to obtain a system object of modeling as well as a model of data flows. This approach will allow to analyze and generalize information about numerous parameters of the reproduction process and identify those of them by changing which it is possible to achieve the required quality of color information reproduction.

In colorimetric calculations, it is customary to express the values of RGB color coordinates as decimal fractions from 0 to 1, where 0 corresponds to black and 1 to white, while in digital image processing systems these coordinates are usually stored as 8-bit integer variables in the range from 0 (black) to 255 (white). The values of color coordinates of an image in the internal CMS color space, on the contrary, are stored as fractional variables in the range from 0 to 1. To get the value of XYZ coordinates in the usual units, they must be multiplied by 100 and vice versa, when entering XYZ color coordinates for color calculations based on color profiles – they must be divided by 100.

Compression of information at the stage of prepress processes can occur both automatically (with the help of algorithms for recalculation of color spaces, the so-called Rendering Intents, built into the software) and manually by the color correction operator.

The following methods are considered as comparative methods of conversion: automatic algorithmic conversion (using Convert to Profile in Adobe Photoshop) and conversion by the operator of color separation.

The original image and the image converted from LAB color space to CMYK color space are compared using different methods. The psychological accuracy of color reproduction of images obtained using the following conversion algorithms is evaluated: Relative colorimetric, Absolute colorimetric. Perceptual, Saturation, and on images subjected to address transformations by the color separation operator who controls the changes using the "Info" panel in Adobe Photoshop.

The methodology of the experiment was to control the color coordinates of real objects with the highest saturation in the LAB space. Automatic transformations using compression algorithms in Adobe Photoshop were performed according to the scheme below.

Then the image was converted from LAB color space to CMYK color space using the necessary parameters (target color space and conversion algorithm). Immediately after conversion LAB – CMYK using different conversion methods: Relative Colorimetric, Absolute Colorimetric, Perceptual, Saturation, the image was again subjected to CMYK – LAB conversion. This sequence of actions allows to identify the nature and extent of changes in color coordinates.

RESULTS AND DISCUSSION

The set of color information conversion operations can be represented in the data flow model (Fig. 1) [10; 17]. The original image in the input device is element by element transformed into an array of discrete values of color characteristics – first in the RGB space (Red, Green, Blue), then in LAB, which ensures consistency with the subsequent stages of the color reproduction process and the correct output of the print. At the same time, the method of determining the correspondence of color coordinates of hardware-dependent and hardware-independent spaces ensures the accuracy of color information conversion.

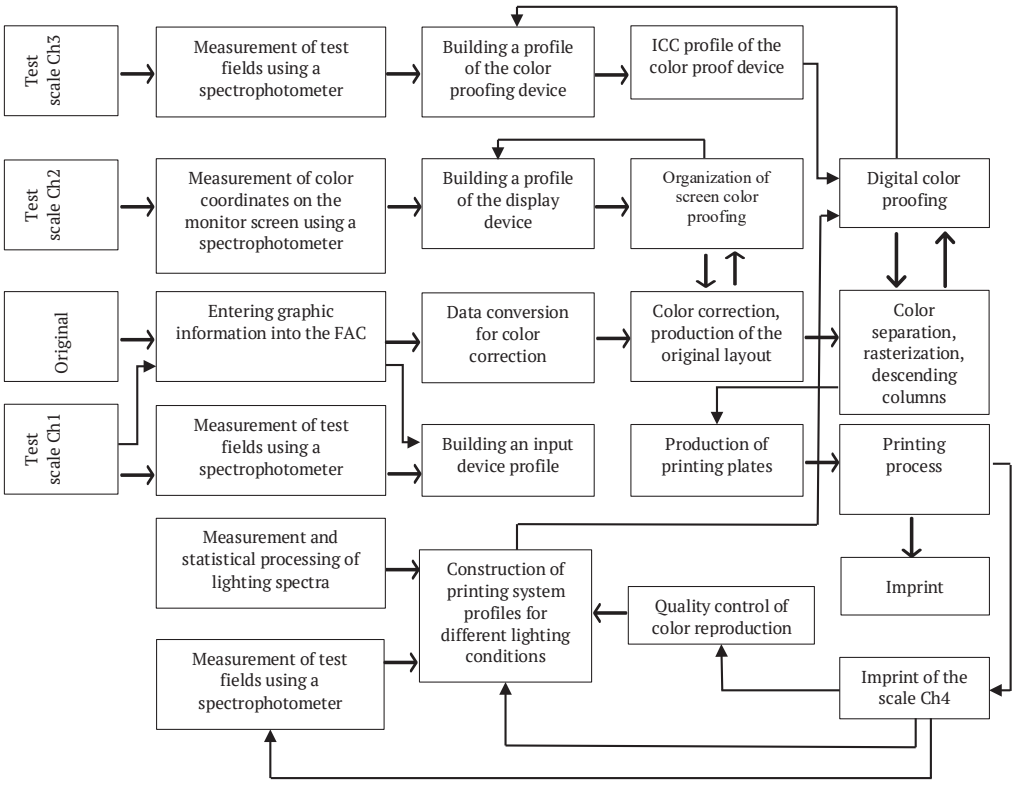

Figure 1. Information flows of color characteristics in the reproduction system

Information conversion in color image processing can be described by a system of equations that contains a set of functions and can be represented as the following relations:

The first equation describes the coordinates of the image elements that characterize the print:

$$X = F(O, v, U, C, M)\,. \tag{1}$$

The coordinates of image elements X are a function of F operators describing the technological process of reproduction in the polygraphic system and include such variables as: a set of coordinates of image pixels, characteristics of the original O; device profiles v; gradation transformations U; viewing conditions of the polygraphic product (spectral characteristics and color coordinates of the white emitter point) C; characteristics of ink and paper M.

A set of pixel coordinates of an image O is described by a set of coordinates in the *RGB* color model system:

$$O = \{R_i, G_i, B_i\}_{i=1,\dots n}\,, \tag{2}$$

where R_i, G_i, B_i – elements of the additive color model, which describes the way of color coding to reproduce colors using three colors (R (red) – red; G (green) – green; B (blue) – blue), which are called primary colors.

Device profiles v, given by a set of mappings Φ_i^j and Ψ_i^j, which perform the direct and inverse transformation between the hardware-dependent and hardware-independent color spaces of the i-th device for the j-th color rendering purpose:

$$v = \{\Phi_i^j, \Psi_i^j\}\,. \tag{3}$$

The conditions for viewing the printing product C include the lighting parameters determined by the spectral composition of the i-th radiation source

$$C_i = \{S_i(\lambda)\}\,, \tag{4}$$

where S_i is the spectrum of the actual radiation source in the visible wavelength range λ=380...720 nm.

The characteristics of ink and paper include the color coordinates of the white point M_1 and the spectral reflection coefficients M_2, which depend on the characteristics of polygraphic inks and the reflectivity of the printed material

$$M=(M_1, M_2). \tag{5}$$

The reproduction process aims to obtain the predicted colors on the print by solving the objective function

$$P(X, X^*) \to X_{min}\,, \tag{6}$$

where P is a color difference determined by a metric in the hardware-independent LAB space, X is the desired LAB values of the print coordinates for a given type of lighting.

At the stage of prepress preparation of images, it should be taken into account that the human eye perceives graphic information in the conditions of the existing light sources. The formation of the final image in the human visual system during the visual assessment of the final polygraphic product by the consumer is influenced by such factors as viewing conditions, as well as the characteristics of ink and paper [18; 19].

The change of color gamut occurs in distributed systems "computer – color information interpretation device". The differences between the configurations of input, display and output devices create many problems related to the coordination of color gamuts and the same color interpretation. At the same time, device profiles are the main elements of the system since all computer color conversions are performed using profiles.

The main function of the CMS is to convert the image from the hardware-dependent color space of the device to the hardware-independent internal color space of the CMS. And there is also the reverse conversion from the internal color space to the color space of a particular device in accordance with the selected color rendering algorithm. This conversion is performed based on data taken from the color profile of this device.

In general, the process of image visualization using CMS can be represented as follows. Conversion of the image from RGB color coordinate space to the internal CMS color space is carried out in two stages:

1. Linearization of the image (inverse gamma correction) as a result of which nonlinear distortions are compensated.

2. Conversion of the image to the internal CMS color space (XYZ or L * a * b *) with the recalculation, if necessary, of the color coordinates to the standard D50 emitter (adopted as a reference white light source in the internal CMS color space) [2].

To preserve the values of the nonlinear distortion gamut in the color profile file, image linearization is used, which is carried out by reducing to the power of γ the brightness values of the image pixel in three RGB channels:

$$r_0 = r_D^{\gamma_r}; g_0 = g_D^{\gamma_g}; b_0 = b_D^{\gamma_b}, \quad (7)$$

where γ_r=r*TRC*, γ_g=*gTRC*, γ_b=*bTRC* – gamma values (γ) for red, green and blue channels; r_D, g_D b_D – gamma-corrected coordinates of red, green and blue colors in the color space of the device, recalculated to the range [0 ... 1]; r_0, g_0, b_0 – their linear values.

If gamma correction is used for any other function than the steady-state one, it is specified in the profile in a tabulated form as a one-dimensional matrix of π elements, the ordinal number of which determines the values of r_D, g_D, b_D and the values of the elements themselves – the values of r_0, g_0, b_0:

$$\begin{gathered} rTRC = [r_{01}, r_{02}, r_{03}, \dots, r_{0n}] \\ gTRC = [g_{01}, g, g_{03}, \dots, g] \\ bTRC = [b_{01}, b_{02}, b_{03}, \dots, b_{0n}] \end{gathered} \quad (8)$$

Thus, it is possible, if necessary, to set any non-linear transformations of color coordinates (for example, to strengthen or weaken certain tonal areas of the image without affecting others, to change the brightness and contrast of the image, and so on).

After linearization, the color coordinates of the image are converted to the internal CMS color space (XYZ CIE) by linear recalculation of color coordinates:

$$\begin{bmatrix} X_{pcs} \\ Y_{pcs} \\ Z_{pcs} \end{bmatrix} = \begin{bmatrix} rX & gX & bX \\ rY & gY & bY \\ rZ & gZ & bZ \end{bmatrix} \times \begin{bmatrix} r_0 \\ g_0 \\ b_0 \end{bmatrix} \quad (9)$$

where X_{pcs}, Y_{pcs}, Z_{pcs} – color coordinates of the image in the internal color space of CMS; r_0, g_0, b_0 – linear values of color coordinates; *rX, rY, rZ, gX, gY, gZ, bX, bY, bZ* – color coordinates of reference color-forming stimuli of this color space, defined in the tags rXYZ, gXYZ, bXYZ.

Particular attention should be paid to one important detail: the CMS internal color space almost always uses the standard D50 emitter as a reference white light. At the same time, a color profile describing a particular device (for example, monitor profile and printer profile) or an abstract color space (such as Adobe RGB and sRGB color profiles [14; 20]) may use a completely different standard emitter. Most monitors and desktop printers are calibrated to a color temperature of 6500K (D65 emitter), not 5000K (D50 emitter). And it is customary to calibrate equipment intended for use in poligraphy to a color temperature of 5000K. This means that in the process of recalculation of color coordinates from the color space of the device (for example, RGB) to the internal color space of CMS, not the values of color coordinates in the internal color space of CMS are obtained but the values calculated relative to another standard emitter (for example, D65), which will inevitably lead to errors.

According to the ICC recommendation, the conversion of color coordinates to the D50 standard emitter is carried out by the Bradford method, although different profiles may use other algorithms [2]. The coefficients of the chromatic color conversion matrix of the image from the standard emitter specified in the profile (the default reference white light source in this color space) to the standard D50 emitter are stored in the *chad* tag.

Most often, changes in color models consist of a chain of transformations: a graphic object from the color space of the scanner is converted to the working color space of image processing and its storage in a file; to display the image, it is converted from the working color space to the color space of the monitor; To obtain a replicated copy, graphic information is converted to the color space of the printing device, which is used for the final reproduction of the image. CMS allows image conversion from one color space to another and from this color space to a third any number of times.

Color discrepancies between different printing devices result in some colors not being reproducible. In this case, these colors are replaced with colors that can be reproduced on this device and that produce similar color sensations to the observer.

Therefore, the ICC standard provides for four different conversion algorithms that can be used to harmonize the representation of color between different color spaces.

The results of the experiment show that after the conversion from LAB to CMYK color space, there is indeed some loss in saturation, change in color tone and photographs. Experiments were conducted and measurements were made, based on which the following conclusions about the magnitude and nature of the change in information during compression (i.e. after conversion) were obtained.

Saturation. Converting image information from LAB color space to CMYK color space leads to loss of saturation. However, the degree of saturation change is not the same for different colors. The degree of saturation loss of a particular color depends on both the conversion algorithm used in the conversion process (Perceprual, Saturation, Relative Colorimetric, or Absolute Colorimetric) and the color tone.

Green and red colors lose saturation to the greatest extent. In yellow color, saturation is lost to a much lesser extent. When converting the same colors using different ICC profiles, saturation is lost to a greater extent when using the ICC profile for coated paper.

The maximum saturation reduction is observed when using the Relative Colorimetric and Absolute Colorimetric conversion algorithms. Minimal – when using Saturation

and Perceptual algorithms. The use of the Peceptual and Saturation conversion algorithms leads to almost identical results, namely, to the preservation of maximum saturation. A slight difference is observed only in some cases in the area of green colors. Thus, the use of different conversion algorithms to varying degrees affects the saturation of different colors.

Lightness. Magenta color. Converting the original image from the LAB color space to the CMYK color space for magenta shows a characteristic decrease in the values of the photo. To the greatest extent, this situation occurs when using the Saturation method. To a lesser extent, the decrease in lightness is caused by the recalculation of the Perceptual algorithm. Such recalculation algorithms as Absolute Colorimetric and Relative Colorimetric show the least influence on the change of image lightness.

Red color. When converting saturated red colors, the greatest change in lightness occurs when using the Absolute Colorimetric conversion algorithm. To a lesser extent for saturated colors, changes are noticeable when using the Saturation algorithm. When converting unsaturated colors in shadows, the maximum changes in lightness are observed when using the Absolute Colorimetric conversion algorithm. Other conversion algorithms have practically no effect on lightness.

The application of the Relative Colorimetric conversion algorithm leads to a slight reduction of the photo, or does not affect it at all.

Blue color. For blue color, the lightness conversion process changes differently. In light (70<L<100) when using the Absolute Colorimetric algorithm, the lightness increases. In the case of using the Perceptual and Saturation conversion algorithms, the lightness is reduced. The Relative Colorimetric algorithm practically does not affect the lightness.

For coated paper, the Saturation and Perceptual algorithms lead to reduction of the photo. Relative Colorimetric and Absolute Colorimetric algorithms have almost no effect on lightness. In the shadows (0<L<30), after conversion, the lightness is basically unchanged.

Light blue color. After the conversion process, the lightness of the light blue color is mainly reduced. Lightness decreases to the greatest extent when using Saturation and Perceptual algorithms. In the case of conversion of unsaturated colors in light, lightness also decreases when using the Saturation and Perceptual algorithms. When using the Absolute Colorimetric algorithm, lightness, on the contrary, increases.

Yellow color. For yellow color, the use of the Absolute Colorimetric conversion algorithm leads to an increase in the photo. When using the Saturation and Perceptual algorithms, there is a decrease in lightness. The Relative Colorimetric conversion algorithm practically does not affect the lightness.

Green color. After the conversion process, the lightness of the image undergoes little change. In the case when an unsaturated color is converted, the lightness is reduced to the greatest extent when using the Saturation and Perceptual conversion algorithms. The use of Relative Colorimetric and Absolute Colorimetric conversion algorithms either does not affect the lightness at all, or leads to a slight change in one direction or another. If an unsaturated color is converted using the Absolute Colorimetric algorithm, the lightness increases. After the conversion process, the lightness changes to different degrees for different color ranges, i.e. it depends on the color tone:

– when converting dark colors of the image, the lightness is increased;

– in the light areas of the image the lightness practically does not change or decreases slightly;

– when using different conversion algorithms to perform the conversion, the results of the lightness change are basically the same (for dark areas of the image).

At the first stage of work with the image, the image was scanned in Lab color space. Then the color correction operator converted the images from Lab color space to Adobe RGB color space using the Convert to Profile function in Adobe Photoshop.

Then the resulting image is corrected in the raster image processing program Adobe Photoshop according to the following scheme:

1. The Curves command was mainly used for transformations.

2. In the dialog boxes, RGB colors were aligned using the curve.

3. In the situations where additional color correction was required (for example, for additional processing of natural colors, paying special attention to memorable colors), the Color Balance tool was also used.

4. Next, the Levels and Brightness/Contrast adjustment layers were added. When manually correcting the original image with the presence of grayscale (to achieve gray balance), 3-4 control points were used. Using the "Curves" tool, the areas of highlights, shadows and penumbra were adjusted by channels so that the RGB values were approximately the same.

5. At the final stage, the RGB image is converted to CMYK space.

During the experiment, the color coordinates of real objects with the highest saturation in the LAB space were controlled. Automatic transformations using compression algorithms in Adobe Photoshop were performed according to the following scheme. To set the conversion method in Photoshop, you need to enter the Convert to Profile window of the Image/Mode submenu, where you can change the appearance of the conversion algorithm (Rendering Intents).

Then the image was converted from LAB color space to CMYK color space using the necessary parameters (target color space and conversion algorithm). Immediately after conversion LAB – CMYK using different conversion methods: Relative Colorimetric, Absolute Colorimetric, Perceptual, Saturation, the image was again subjected to CMYK – LAB conversion. This sequence of actions allows to identify the nature and extent of changes in color coordinates.

The results of the experiment show that after the conversion from LAB to CMYK color space, there is indeed some loss in saturation, change in color tone and photographs. Experiments were conducted and measurements were made, based on which the following conclusions about the magnitude and nature of the change in information during compression (i.e. after conversion) were obtained.

Converting image information from LAB color space to CMYK color space leads to loss of saturation. However, the degree of saturation change is not the same for different colors. The degree of saturation loss in a particular color

depends on both the conversion algorithm used in the conversion process (Perceprual, Saturation, Relative Colorimetric, or Absolute Colorimetric) and the color tone.

The maximum saturation reduction is observed when using the Relative Colorimetric and Absolute Colorimetric conversion algorithms. Minimal – when using the Saturation and Perceptual algorithms. Thus, the use of different conversion algorithms to varying degrees affects the saturation of different colors.

CONCLUSIONS

The model obtained in the work allows to analyze the information about the parameters of the reproduction process at all stages of the polygraphic process, from prepress directly to the printing process. This information provides high-quality conversion of graphic information with the required accuracy. With targeted correction in terms of saturation, the saturation is mostly slightly reduced, but sometimes significantly increased. After the conversion process, the color loses saturation. The more saturated the color is, the more it loses saturation. However, in some cases, targeted processing leads to an increase in saturation when processing images with a predominance of saturated colors. The nature of the change in lightness depends largely on the color, and either increases or decreases. After a series of transformations, the lightness and saturation of the image subjected to processing changed markedly. If the color is light and saturated, then its lightness in the process of transformation decreases significantly. If the color is saturated, but dark – lightness, on the contrary, increases.

The scientific result of the article consists in building a model of data flows in the reproduction system, taking into account the partial loss of graphic information at different stages of the reproduction process. Further work in this direction involves the development of regulatory documentation taking into account the quality of the original images and the specifics of printing equipment.

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Розробка інформаційної моделі процесу кольоровідтворення в поліграфічних системах

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Анотація. Калібрування кольору є звичайною процедурою при поліграфічному репродукуванні, водночас існує достатньо інструментів, що гарантують точне цифрове або аналогове відтворення (друк на папері, екранні або дисплейні проектори тощо). Актуальним є завдання досягнення відповідності кольорів, що формуються на різних пристроях друкованого процесу. Колір на екрані монітора повинен відповідати кольору на відбитку принтера. Крім того, за наявності на підприємстві кількох моніторів та принтерів потрібно забезпечити колірну відповідність між ними. Метою статті є розробка моделі поетапного перетворення кольорових зображень задля досягнення якісного відтворення у репродукційних системах. У роботі використовувалися методи автоматичного алгоритмічного перетворення (за допомогою Convert to Profile в Adobe Photoshop) та перетворення оператором кольороподілу. Конвертування зображення з колірного простору LAB в колірний простір CMYK проводилося за допомогою різних методів перерахунку: Relative colorimetric, Absolute colorimetric, Perceptual, Saturation. Така послідовність дій дозволила виявити характер і рівень зміни колірних координат. Максимальне зменшення насиченості спостерігається під час використання алгоритмів перерахунку Relative Colorimetric та Absolute Colorimetric. Мінімальні – при використанні алгоритмів Saturation та Perceptual. Таким чином, застосування різних алгоритмів перерахунку різною мірою впливає на насиченість різних кольорів. Практичне значення дослідження полягає в тому, що розроблена інформаційна модель дозволить реалізувати технологію пріоритетного відтворення кольорів, залежно від мети репродукційного процесу, що підвищує точність перетворення колірної інформації оригіналів і, відповідно, якість виробництва друкованих видань

Ключові слова: колірний простір, система управління кольором, модель потоків даних, алгоритми перерахунку кольорових координат

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