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LARYSA SAVCHUK, LILIA BANDORINA, KATERYNA UDACHINA

Ukrainian State University of Science and Technologies

IRYNA SOKYRYNSKA

Zahidnodonbaskyy Institute of IAPM

ROMAN SAVCHUK

Ukrainian State University of Science and Technologies

## DEVELOPMENT OF SOFTWARE MODULE FOR DETERMINING RATIONAL CAPITAL STRUCTURE OF THE ENTERPRISE

*The relevance of research on the use of information technologies to solve applied problems, in particular, financial policy management at the micro level has been revealed in this article. The own definition of the concept of financial policy at the enterprise level has been proposed as a triad of the main content principles, namely: asset management, cash flow management, liability management. It has been established that research in the field of financial policy is mostly theoretical, therefore the development of software module based on the model of solving a practical problem presented in the article is relevant for Ukrainian enterprises.*

*After structurization and determination the list of financial policy tasks, an original improvement of one of the important components in asset management, namely the task of modeling the amount of receivables, has been proposed. In order to obtain the maximum economic effect, it has been proposed to suggest to calculate the optimal level of accounts receivable. Using of the method of approximation of the non-linear dependence of receivables on the credit period, which was initiated by O. I. Luchkov, has been substantiated. The principles of the methodics have been defined, its modification and clarification have been proposed in the direction of the development of methods for calculating the numerical values of all components of the model in the article. This method allows the obtaining the optimal term of the credit period in days and the optimal amount of receivables in monetary terms.*

*Model experiment has been executed to test the model's operation, during which data from the financial statements of one of the operating enterprises have been used. The obtained results testify to the effectiveness and correctness of the proposed methodics are served as an information basis for management decisions regarding the assessment of the effectiveness of measures to manage the company's financial policy.*

*The software module has been developed that, based on the results of certain calculations, allows to make quick and well-founded decisions about balancing the structure of assets and liabilities in order to restore financial stability and increase profits.*

*Keywords: software module, information technology, financial policy, triad, asset management, receivables, approximation of nonlinear dependence, model experiment*

ЛАРИСА САВЧУК, ЛІЛІА БАНДОРІНА, КАТЕРИНА УДАЧИНА

Український державний університет науки і технологій

ІРИНА СОКИРИНСЬКА

Західнодонбаський інститут ПрАТ «ВНЗ Міжрегіональна академія управління персоналом»

РОМАН САВЧУК

Український державний університет науки і технологій

## РОЗРОБКА ПРОГРАМНОГО МОДУЛЯ ДЛЯ ВИЗНАЧЕННЯ РАЦІОНАЛЬНОЇ СТРУКТУРИ КАПІТАЛУ ПІДПРИЄМСТВА

*У статті розкрито актуальність дослідження питань використання інформаційних технологій для вирішення прикладних задач, зокрема, управління фінансовою політикою на мікрорівні. Надано власне визначення змісту поняття фінансової політики на рівні підприємства як триади основних змістовних засад, а саме: управління активами, управління грошовими потоками, управління пасивами. Виявлено, що дослідження у сфері фінансової політики переважно теоретичні, тому розробка програмного модуля на основі моделі вирішення практичної задачі, що надається у статті, є актуальною для підприємств України.*

*Після структурування і визначення переліку задач фінансової політики запропоновано оригінальне удосконалення однієї з важливих складових в управлінні активами, а саме задачі моделювання розміру дебіторської заборгованості. З метою отримання максимального економічного ефекту запропоновано розрахувати оптимальний рівень дебіторської заборгованості.*

*Обґрунтовано використання методики апроксимації нелінійної залежності дебіторської заборгованості від кредитного періоду, що була започаткована О. І. Лучковим. У статті чітко визначені всі засади методики, запропонована її модифікація і уточнення у напрямку розробки методів розрахунку числових значень всіх складових моделі. Даний метод дозволяє отримати оптимальний термін кредитного періоду в днях та оптимальний обсяг дебіторської заборгованості у грошовому еквіваленті.*

*Для перевірки роботи моделі здійснено модельний експеримент, при проведенні якого були використані дані фінансової звітності одного із діючих підприємств. Отримані результати свідчать про дієздатність і коректність запропонованої методики і виступають інформаційним підґрунтям для управлінських рішень стосовно оцінки ефективності заходів по управлінню фінансовою політикою підприємства.*

*Розроблено програмний модуль, який за результатами певних розрахунків дозволяє приймати оперативні та обґрунтовані рішення стосовно балансування структури активів й пасивів для відновлення фінансової стійкості та нарощування прибутку.*

*Ключові слова: програмний модуль, інформаційні технології, фінансова політика, триада, управління активами, дебіторська заборгованість, апроксимація нелінійної залежності, модельний експеримент.*

### Introduction

The use of information technologies to solve applied business problems is an actual problem for many entrepreneurs. The implementation of the software contributes to the reduction of time for data processing, allows quickly and reasonably make appropriate decisions, which affects the overall effectiveness of the work of organizations.

An important role in the activity of the enterprise is the economic subsystem, namely: the issue of effective management of the capital structure of the enterprise, which is a guarantee of the stability of its development, ensuring its solvency, strengthening the financial condition, increasing the market value and the wellbeing of the owners. The capital structure determines the possibilities of the enterprise to form the composition of its assets, provided that a safe level of financial stability is maintained.

Analysis of the actual state of sources of finance and, accordingly, the capital structure of enterprises shows that their financial resources are not used efficiently enough. This is a consequence of the irrational distribution of the company's funds and the source of their financing. The formation of a rational capital structure should begin with the determination of factors that affect the current financial state, using this selected algorithm for calculating indicators. The detection of the magnitude of the further change of the factor and the possibility of its change should determine the further financial strategy of the enterprise, and the proposed recommendations for choosing ways to improve the financial state and stabilize its activity in the future.

The structure of investment capital plays a role in the formation of the market value of the enterprise. The relationship is determined by the weighted average cost of capital. Therefore, it is expedient to explore the concept of capital structure together with the concept of market value of enterprise, and to improve the model for determining the rational capital structure.

Usually a company can choose any capital structure it wants. But the main management purpose of the enterprise is the choice of such a structure to maintain stable income and dividends at the lowest capital value.

That is, the optimal capital structure should minimize the average capital value and at the same time maintain the credit reputation of the enterprise at a level that would allow attracting new types of capital on terms acceptable to this enterprise.

Management of the financial component of capital is based on a process that can be formalized by defining a certain sequence of actions during managing the capital structure..

The purpose of capital structure management is to find the optimal ratio between equity and debt capital, various short-term and long-term sources of its formation (the share in the total amount of equity liabilities, long-term liabilities, short-term liabilities in the form of bank loans, credit lines, accounts payable, etc.) [1].

The optimal capital structure is the result of a compromise between the achievement of the maximum possible the tax savings due to the attraction of borrowed funds and additional costs associated with an increase in the probability of financial difficulties with an increase in the share of loan capital [2, 3].

### Related Works

Capital is one of the fundamental economic categories, the meaning of which scientific thought has been investigating for many centuries [2, 3]. 4,5

Among the theoretical foundations of capital management formation, one of the basic ones is the theory of its structure. This is associated with the fact that the theoretical concept of the capital structure forms the basis for choosing a number of strategic directions of the financial development of the enterprise, which ensure the growth of its market value [6]. Therefore, this theory is a wide enough field of practical application.

The definition of capital structure is disputable and so needs clear definition.

With condition of widespread practical use of the definition of capital structure, many economists proposed to expand the composition of loan capital by adding various types of short-term bank credit to it. They associated the possibility of approach to the concept of "capital structure" with the increased role of bank credit in financing the economic activity of enterprises and the expanded practice of restructuring short-term to long-term types of it [7].

Many specialists think that the definition of "capital structure" it is necessary to consider all types of both equity and loan capital of the enterprise in current conditions.

At the same time, the composition of equity capital should include not only the initially invested amount (shareholder capital which participates in the formation of the company's statutory fund), but also the share in the form of certain reserves and funds created in the activities of the enterprise, and retained earnings . Based on this, loan capital must be considered according to the forms of use, taking into account financial leasing, commodity credit, accounts payable, etc.

This interpretation of the concept of "capital structure" allows to significantly expand the area of practical application of this theoretical concept in the financial activity of an enterprise, because [8]: it effectively allows to investigate the specifics and develop appropriate recommendations for enterprises with limited financing opportunities on the long-term capital market; makes it possible to connect the capital structure with the use of assets financed by its various components.

Taking into account the considered provisions, the concept of "capital structure" has the following definition: "capital structure is the ratio of all forms of own and borrowed funds used by the enterprise for the purpose of financing assets" [2].

The formation of the financial structure of the capital as a way of financing the activity of the enterprise as a whole occupies an important place in the theory of financial management in the process of managing the capital of the enterprise, as it is a complex factor that is interdependent with many indicators and characteristics of the economic activity of the enterprise.

Researchers have different views on issues related to capital structure. Different views on this problem led to the emergence of five stages in the development of the theory of capital structure, and, accordingly, five theoretical concepts [3, 9-11]:

- the concept of indifference of the capital structure;
- traditionalist concept of capital structure;
- compromise concept of the capital structure;
- the concept of "subordination of sources";
- the concept of conflicts of interests in the formation of the capital structure.

The first step towards the development of the theory of the capital structure was the hypothesis proposed in 1958 by the American economists M. Miller and F. Modigliani, which was called the concept of indifference of the capital structure. According to this concept, the market value of the firm and the value of capital under certain conditions do not depend on its structure, which means that they cannot be optimized and the market value cannot be increased by changing the capital structure [12].

According to the founders of this theory, the cost of a corporation's capital is determined solely by its profit stream, which depends on investments. To justify this approach, the authors used a number of restrictions, some of which were later weakened.

Representatives of the traditional concept believe that, firstly, the cost of capital enterprise depends on its structure; secondly, there is an optimal capital structure that minimizes the value of the weighted average cost of capital and, therefore, maximizes the market value of the enterprise [13]. Based on this, an increase of specific weight of loan capital in all cases leads to decrease of weighted average cost of capital, and, accordingly, to an increase of the market value of the enterprise. The use of this concept in practice encourages the enterprise to increase of use of loan capital in economic activity, which can lead to negative consequences under certain conditions.

Having considered the advantages and disadvantages of these concepts of capital structure formation, we can conclude that it is expedient for the company to use loan capital until the tax benefits from the additional amount of credits and loans are equal to the costs associated with the growth of debt service and the increased probability of financial complications. This theory was formulated by S. Ross and was called the "static" theory of the capital structure [12].

### **Selection of previously unsolved parts of the overall problem**

Considering the modern market of information systems, it is possible to conclude about the insufficiency of application software for determining the optimal capital structure of enterprise based on the model of the formation of the financial structure of capital depending on the property structure.

### **Purpose**

The purpose of the article is the systematization of methodical approaches to the formation of the capital structure of the enterprise and the development of software module based on an advanced model of the formation of the financial structure of the capital depending on the property structure.

### **Results**

The economic independence of enterprises in modern economic conditions is expressed by the size and structure of their capital. So there is a question about at the expense of what property, at the expense of what sources (own or borrowed) of its acquisition and in what ratio should be formed the total capital of separate enterprise? Its solution requires only an individual approach [12-16].

Only optimal approach to the ratio of structural elements of capital for different enterprises or for one enterprise for the entire term of its operation cannot be determined. However, the process of choosing a rational capital structure of the enterprise should be carried out on the basis of the formation of the target capital structure.

So the dilemma of an enterprise's choice of one or another structure of its capital can be resolved only under the condition of choosing a certain criterion characteristic of optimality of the ratio of structural elements of capital. Different authors interpret the optimality of capital structuring differently according to certain criterion indicators. [17].

For example, such authors as Van Horn, Podderyogin, Ross, [8, 12, 18] define the optimal capital structure as a certain ratio of equity and borrowed capital, which leads to the maximization of the value of the company's shares.

That is, as a criterion for determining the optimality of the capital structure, these authors determine the maximum price of shares of enterprises.

The second group of authors determine value of the enterprise (firm) as a criterion for optimizing the ratio of own and borrowed capital. This group includes R. Clark, V.V. Kovaleva, O.O. Tereshchenko and others. Thus, according to these authors, the goal of optimizing the capital structure of the enterprise is the formation of an optimal ratio of various sources of financing the enterprise's activities, which maximizes the value of the enterprise itself [9, 19].

During investigation of the criterion for determining the optimality of the capital structure of the enterprise, some authors emphasize the selection of another criterion aspect, which maximizes the value of the enterprise. This is the ratio of profitability of own capital and financial stability of the enterprise. This criterion was highlighted by such authors as Blank, Ivko, Kvasnytska, Kostyrko and others [2, 9, 16, 17]. Blank I.O. notes that the optimal capital structure is such a ratio of the use of own and borrowed funds that ensures the most effective proportionality between the coefficient of financial profitability and the coefficient of financial stability of the enterprise, that is, its market value is maximized [2, 213 - 214].

Thus, the problem was considered the most detailed by I.O. Blank. In particular, it was highlighted [2, 213 - 214]:

- optimization method of the capital structure based on the criterion of maximizing the level of predictable financial profitability (own capital profitability). This method is based on multivariate calculations of the level of financial profitability (own capital profitability with different capital structure). The latter is expressed through such an indicator as the effect of financial leverage;
- optimization method of the capital structure based on the criterion of minimizing its cost. The method is based on a previous assessment of own and borrowed capital under various conditions of their formation, maintenance and realization of multivariate calculations of the weighted average cost of capital and, thus, finding the most realistic market value of the enterprise;
- optimization method of the capital structure based on the criterion of minimizing the level of financial risks. It is connected with the process of differentiated selection of funding sources for various components of the company's assets: non-current assets, current assets (with emphasizing of permanent and variable parts).

During choosing a rational capital structure of enterprise, it is necessary to achieve such a capital structure that will lead to the lowest value of the weighted average cost of capital at the same time as minimizing the risk of excessive dependence on short-term loan funds. The proposed model is based on the optimization model of the target capital structure of Raisa Kvasnytska, head of the Department of Finance and Banking of Khmelnytskyi National University [3, 11].

Therefore, the rational capital structure of the enterprise will be achieved while simultaneously minimizing the weighted average cost of capital and minimizing the risk of excessive dependence on current liabilities. The main measures, the purpose and the expected effect of the change in the capital structure are presented in table 1.

Table 1

**Purpose, measures and effect of choosing a rational capital structure**

Measures	Purpose	Effect
Increase of the share of loan capital	Using the effect of tax savings	Minimization the weighted-average cost of capital
Reducing of the share of short-term loan capital	Reducing the risk associated with mainly use of current liabilities.	Minimization the risk of excessive dependence on short-term loans

To reduce the weighted average cost of capital of the enterprise, it is necessary to increase the share of loan capital. The coefficient of financial leverage shows the ratio of the amount of loan capital to equity and is directly proportional to the financial risk of the enterprise. However, for the correct calculation of the choice of the capital structure, a large level of the financial leverage ratio determines a decrease of weighted average cost of capital and at the same time, as a rule, leads to deteriorate of the financial condition of the enterprise. That is, it is necessary to calculate the level of financial leverage not only in the structure of sources of financing of the enterprise's property (in the financial structure of capital), but also in the assets structure (in the property structure of the enterprise) [3, 11].

As financial stability is related to the possibility of financial support for repaying the company's debts, so determining ways to optimize the financial rational structure of capital, it is advisable with the study of the features of the financial structure of capital ( which is the ratio of own and borrowed capital) to evaluate its property structure.

It is the rational structure of the company's property that is a positive factor for increasing the level of financial stability of the company. What is meant by the property structure of an enterprise's capital? Although the property ranking of the company's capital can be carried out in various aspects, in our opinion, the property structure of the capital should be considered in terms of all assets in circulation and property in non-monetary form.

Current assets are cash itself (both in national and foreign currency), short-term (current) financial investments and receivables. Non-monetary property form are production stocks, work-in-progress, finished products and goods.

Basis for calculating the financial security of covering liabilities in relation to the borrowed capital of the enterprise is achieved by separating current assets from non-monetary assets [3, 11].

So, in the financial aspect, we will consider the financial leverage of the property structure of the capital (the ratio of own and borrowed capital), in the property aspect it will be the financial leverage of the property structure of the capital (the ratio of circulate assets and in non-monetary assets).

It is necessary to determine the values of the group of indicators of the company's solvency for correct conclusions of the formation of both the property and financial structure of the capital. In our opinion, when choosing a rational capital structure of an enterprise based on the definition of the level of financial support for its obligations, the dominant indicator (exactly for our study) is the ratio of quick (critical) liquidity.

The indicator of quick liquidity, or "acid test", shows how all current financial obligations of the enterprise are secured by means of payment that it has on a certain date. Payment Means when calculating this indicator are cash, current financial investments and accounts receivable. It is worth noting that for our study these are circulate assets. The quick liquidity ratio is calculated as:

$$QLR = \frac{Cash + CFI + R}{CL}, \quad (1),$$

where QLR – quick liquidity ratio, CFI – Current financial investments, R – Receivables, CL – поточні зобов'язання.

It is on the basis of the calculation of this indicator we can evaluate the compliance of the share of the company's assets in circulation with certain regulatory values. The value of this indicator should be between 0.8 and 1.2 for the metallurgical industry.

Thus the following inequality is [20, 21]:

$$0.8 \leq QLR \leq 1.2, \quad (2)$$

It can be highlighted also the limit of the amount of assets in circulation, which is the most favorable for conducting economic activity based on the limit values of the critical liquidity ratio. After certain calculations formula is [4, 13]:

$$0.8 \leq \frac{CA}{CL} \leq 1.2 \quad (3)$$

or

$$CL * 0.8 \leq CA \leq 1.2, \quad (4)$$

де CA –активи в обігу.

The obtained inequality allows to evaluate the optimality of providing the enterprise by cash, current financial investments and receivables.

So, it is clear that for the criteria chosen by us for determining the rational capital structure of the enterprise, the level of financial leverage in the financial structure of the capital must prevail over the level of financial leverage of its property structure:

$$FLF > FLP, \quad (5)$$

where FLF – financial leverage if the financial structure;

FLP – financial leverage of property structure.

The calculation of financial leverage in the property structure of the enterprise's capital is carried out according to the following formula:

$$FLF = \frac{LC}{EC}, \quad (6)$$

де LC – loan capital;

EC –equity capital.

The level of financial leverage in the property structure of the enterprise's capital is calculated as [17, 20, 21]:

$$FLP = \frac{CA}{NA}, \quad (7)$$

where NA – non-monetary assets.

Financial leverage in both the financial and property capital structures based on the above formulas is calculated as:

$$\frac{LC}{EC} > \frac{CA}{NA}, \quad (8)$$

Thus, using this model, Ukrainian enterprises are able to form a rational capital structure for the combined effect of minimizing the weighted average cost of capital and reducing the risk of excessive dependence on short-term loan funds.

But, as was proven by previous calculations, the use of only this model for the formation of the optimal capital structure of the enterprise is insufficient, since the ratio between circulate assets and property in non-monetary form consists with a significant advantage in favor of the former - they exceed by 6.4 times assets in material form. It gives the enterprise certain additional opportunities to soften the financial structure of the capital in favor of loan sources. But it led to critical risky level for studied company: loan funds exceed the amount of equity capital by 13.7 times.

As to the property structure of the capital. It is determined by the features of the enterprise's economic activity. As to the financial structure, the sources of financing and the capital structure should be formed taking into account the property structure of assets.

Based on this, we believe that it is advisable to add clarifications to the model of R. Kvasnytska regarding the amount of own current assets, because a significant amount of current liabilities has led to lack of own working capital.

Since the main condition for ensuring an acceptable level of financial stability of enterprises in trade areas should be the presence of a positive amount of own capital and own working capital, we will analyze the trends of their changes.

Equity working capital (EWC) characterizes that part of equity capital and equivalent funds that is used to finance current assets. And although scientists discuss about the place of this indicator, in trade its role is important given the peculiarities of the field related to the volume, condition and dynamics of current assets.

In summary, we believe that R. Kvasnytska's model should be supplemented with the condition of having a positive value of own working capital. That is, for the studied company the conditions of formation of the optimal capital structure, taking into account the peculiarities of the property structure of its assets, it will be following conditions:

$$\begin{cases} FLF > FLP, \\ CL * 0.8 \leq CA \leq CL * 1.2 \\ OWC > 0, \end{cases} \quad (12)$$

where OWC – own working capital.

Thus, including additional restriction the risk of loss of financial stability will not be excessive.

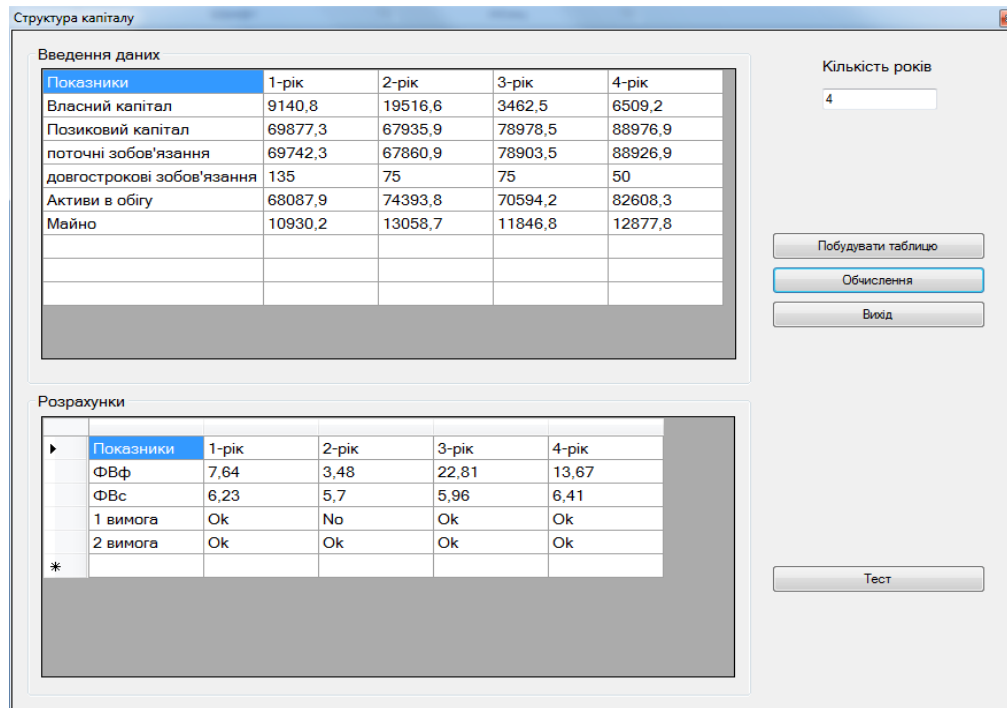
Also compliance with the specified conditions is possible provided rational proportions are maintained between assets in circulation and short-term loan funds. The most active and influential components of both of these indicators are receivables and payables, respectively. At the same time, with a synchronous decreasing of the amount of equity due to losses, this control should be more stringent. After all, the growth of current liabilities against the background of a sharp drop of financial results leads to excessive risk of the capital structure.

Verification of the model was performed using a model experiment. Financial data of one of the operating enterprises were used.

Program module was developed based on proposed model, which starts to work with the main form. After entering the data, the rational capital structure is calculated. Figure 1 shows the external design of the main form with the results of the model.

After entering the input data in the table and pressing the "Calculation" button, calculated indicators of the company's capital structure assessment will be obtained, which will be placed in the appropriate fields.

The application is created in the Microsoft Visual Studio environment. This product and the tools included in it allow you to develop both console programs and programs with a graphical interface, including those with support for Windows Forms technology, which was used during the development of this application.



**Fig. 1. The main modul form with results**

The obtained results serve as an information basis for management decisions regarding the optimal amount of receivables at the enterprise.

### Conclusions

Software module was created in the work to increase the efficiency of the company's activities. This module will allow to make operational decisions regarding the management of the company's assets, namely, regarding the balancing of the structure of assets and liabilities to restore financial stability and increase profits.

The model of R. Kvasnytska was chosen as the basis of this system. The essence of the model is that all property is divided into circulate assets and assets in non-monetary form.

It has been assumed that the circulate assets are financed at the expense of loan sources, and property in non-monetary form are financed at the expense of own funds. For this purpose, the financial leverage of the financial structure and the financial leverage of the property structure are calculated, and additional restrictions are introduced regarding the ratio of circulate assets and loan funds

Approbation of the model on the data of the investigated enterprise proved that despite the fulfillment of all requirements, the capital structure remains excessively risky. So in the article proposes to improve the model by introducing an additional limitation is the need to have a positive amount of own working capital. So improved model with additional restrictions was proposed. Modeling on the basis of the proposed model made it possible to form such a system of management of funding sources, which minimizes financial risks even with the predominance of short-term loan funds.

Range of short-term loan funds has been formed for studied company based on proposed model, within which financial stability will be remain acceptable even with a small amount of equity capital.

Thus, the application of the created software module based on the proposed model in the process of work will make it possible to clearly and timely assess the level of the company's receivables.

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<b>Larysa Savchuk</b> <b>Лариса Савчук</b>	Candidate of Economic Sciences, Professor, Dean of Faculty of Applied Computer Technologies, Ukrainian State University of Science and Technologies, Dnipro, Ukraine, e-mail: <a href="mailto:l.m.savchuk@ust.edu.ua">l.m.savchuk@ust.edu.ua</a> <a href="http://orcid.org/0000-0003-2603-7218">http://orcid.org/0000-0003-2603-7218</a>	к.е.н., професор, декан факультету прикладних комп'ютерних технологій, Український державний університет науки і технологій, Дніпро, Україна
<b>Liliia Bandorina</b> <b>Лілія Бандоріна</b>	Candidate of Economic Sciences, Associate Professor, Head of the Department of Economic Informatics, Ukrainian State University of Science and Technologies, Dnipro, Ukraine, e-mail: <a href="mailto:l.m.bandorina@ust.edu.ua">l.m.bandorina@ust.edu.ua</a> <a href="http://orcid.org/0000-0003-1383-3098">http://orcid.org/0000-0003-1383-3098</a>	к.е.н., доцент, зав. каф. економічної інформатики, Український державний університет науки і технологій, Дніпро, Україна
<b>Kateryna Udachyna</b> <b>Катерина Удачина</b>	Candidate of Economic Sciences, Associate Professor of the Department of Economic Informatics, Ukrainian State University of Science and Technologies, Dnipro, Ukraine, e-mail: <a href="mailto:k.o.udachyna@ust.edu.ua">k.o.udachyna@ust.edu.ua</a> <a href="http://orcid.org/0000-0002-0043-6010">http://orcid.org/0000-0002-0043-6010</a>	к.е.н., доцент, доцент кафедри економічної інформатики, Український державний університет науки і технологій, Дніпро, Україна
<b>Iryna Sokyrynska</b> <b>Ірина Сокиринська</b>	Candidate of Economic Sciences, Associate Professor of the Department of Economic and Management, Zahidnodonbaskyy Institute of IAPM, Pavlograd, Ukraine, e-mail: <a href="mailto:sokirinska@gmail.com">sokirinska@gmail.com</a> <a href="https://orcid.org/0000-0001-6140-8518">https://orcid.org/0000-0001-6140-8518</a>	к.е.н., доцент, доцент кафедри економіки і менеджменту, Західнодонбаський інститут ПрАТ «ВНЗ Міжрегіональна Академія управління персоналом»
<b>Roman Savchuk</b> <b>Роман Савчук</b>	Senior Instructor of the Department of Economic Informatics, Ukrainian State University of Science and Technologies, Dnipro, Ukraine, e-mail: <a href="mailto:d.v.savchuk@ust.edu.ua">d.v.savchuk@ust.edu.ua</a> <a href="https://orcid.org/0000-0002-3336-6565">https://orcid.org/0000-0002-3336-6565</a>	ст. викладач кафедри економічної інформатики, Український державний університет науки і технологій, Дніпро, Україна