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**Ionin Y.**
Doctor of Economic Sciences, Professor, Head of the Department of accounting, analysis and audit, Vasyl' Stus Donetsk National University
ORCID: 0000-0002-2903-3143
ionin.iyy@donnu.edu.ua
**Tarasenko L.**
PhD in Economics, assistant of the Department of Business Economics,
Taras Shevchenko National University of Kyiv
ORCID: 0000-0001-8224-5113
liliia.tarasenko@knu.ua

## TOOLS FOR PREDICTIVE MODELING IN THE FINANCIAL DEBT RESTRUCTURING PROCESS OF BUSINESS ENTITIES

This article explores the possibilities of applying predictive modeling tools in the process of financial debt restructuring of business entities operating in a critical financial condition. The role of forecast financial statements – namely the forecast balance sheet, income statement, and cash flow budget – is substantiated as a key analytical basis for assessing solvency and the entity's ability to operate in accordance with the going concern principle, in compliance with the requirements of ISA 570. Particular attention is paid to net cash flow from operating activities as a decisive indicator of the debtor's actual ability to fulfil monetary obligations within a restructuring plan. The importance of using historical financial reporting indicators to diagnose the causes of financial difficulties and incorporate them into forecast models is emphasized. The expediency of applying the direct method of cash flow forecasting is justified as the most reliable approach to assessing the feasibility of debt servicing and repayment. It is demonstrated that the use of predictive financial modeling enhances the soundness of independent expert conclusions regarding the restoration of solvency of business entities, the repayment of loan obligations of clients of banking institutions, and their further functioning

**Key words:** financial restructuring; obligations; creditors; clients of banking institutions; loan repayment; predictive modeling; cash flow budget; forecast financial statements
Fig.2, ref.10

**Іонін Є.,**
доктор економічних наук, завідувач кафедри обліку, аналізу і аудиту
Донецький національний університет імені Василя Стуса
ORCID: 0000-0002-2903-3143
ionin.iyy@donnu.edu.ua
**Тарасенко Л.,**
доктор філософії, асистент кафедри економіки підприємства
Київський національний університет імені Тараса Шевченка
ORCID: 0000-0001-8224-5113
liliia.tarasenko@knu.ua

## ІНСТРУМЕНТИ ПРЕДИКАТИВНОГО МОДЕЛЮВАННЯ В ПРОЦЕСІ ФІНАНСОВОЇ РЕСТРУКТУРИЗАЦІЇ ЗАБОРГОВАНОСТІ СУБ'ЄКТІВ ГОСПОДАРЮВАННЯ

У статті досліджено можливості використання інструментарію предикативного моделювання у процесі фінансової реструктуризації заборгованості суб'єктів

господарювання, що перебувають у критичному фінансовому стані. Обґрунтовано роль прогнозної фінансової звітності, зокрема прогнозного балансу, звіту про фінансові результати та бюджету руху грошових коштів, як ключової аналітичної основи оцінки платоспроможності та здатності суб'єкта господарювання функціонувати на засадах принципу безперервності відповідно до вимог МСА 570. Особливу увагу приділено чистому грошовому потоку від операційної діяльності як визначальному індикатору реальності виконання боржником грошових зобов'язань у межах плану реструктуризації. Наголошено на значущості використання показників історичної фінансової звітності для діагностики причин фінансових труднощів та їх урахування у прогнозних моделях. Обґрунтовано доцільність застосування прямого методу прогнозування грошових потоків як найбільш надійного підходу до оцінки можливості обслуговування та погашення заборгованості. Доведено, що використання предикативного фінансового моделювання підвищує обґрунтованість висновків незалежного експерта щодо відновлення платоспроможності суб'єктів господарювання, погашенні кредитної заборгованості клієнтів банківських установ та їх подальшого функціонування.

***Ключові слова:*** фінансова реструктуризація, зобов'язання, кредитори, клієнти банківських установ, погашення кредитної заборгованості, предикативне моделювання, бюджет руху грошових коштів, прогнозна фінансова звітність.

Рис. 2, літ. 10

**Problem statement.** A stably functioning business is an important element of a country's economy, which, among other things, plays a significant role in ensuring national defence capability. This is especially relevant for Ukraine in the context of the full-scale invasion by Russia and the subsequent post-war recovery. Currently, business entities are influenced by a complex set of external and internal factors that significantly increase the risks of deterioration in their financial condition and may lead to critical financial situations and loss of solvency. Under such conditions, the need for timely diagnosis of the financial condition of enterprises and the assessment of their potential to restore solvency is increasing. This can be achieved through enhanced use of analytical tools and the involvement of independent experts within the framework of the financial debt restructuring procedure.

The implementation of a financial restructuring program simultaneously involves three main components – legal, economic, and administrative – aimed at solving a comprehensive problem: preserving the business, its resources, and restoring solvency. An important role in this process is played by an independent expert conducting a review of financial and economic activities, as the validity of conclusions regarding the entity's ability to continue operations largely depends on their professionalism. Expanding the analytical toolkit in the expert's work through the use of financial modeling in the restructuring of business entities' debt based on predictive modeling will significantly enhance the soundness of conclusions regarding going-concern capability.

**Analysis of recent research and publications.** Issues of financial debt restructuring have been addressed in scientific studies by Ukrainian and foreign scholars. Davydenko N. [1] examined the paradigm of financial restructuring within the system of anti-crisis management. Vdovichen A. and Shpatakova O. [2] identified financial restructuring strategies under martial law conditions. Vladyka Y., Skyba H., and Turova L. [3] focused on the economic essence of financial restructuring, its mechanism, scope of application, main objectives, and expected results. Krakhmalova N. and Puzyrova P. [4] investigated the theoretical and methodological foundations of the financial restructuring process of enterprises as a factor in strengthening their financial potential. At the same time, insufficient attention has been paid to the use of financial models in the restructuring of business entities' debt based on predictive modeling tools.

**Purpose of the article.** The purpose of this study is to examine the possibility of using predictive modeling tools in the process of financial debt restructuring of business entities that are in a critical financial condition, as well as in the recovery of their operations.

**Presentation of the main material.** The procedure of voluntary financial restructuring of a debtor in Ukraine provides for the following main stages: the preparatory stage, initiation of the procedure, independent expert review, development and approval of a restructuring plan, and implementation of the restructuring plan. Within this process, which is aimed at "facilitating the recovery of business activities of debtors in a critical financial condition through the restructuring of their monetary obligations" [5], three components can be distinguished: economic, legal, and managerial.

The economic component involves analytical processing of a large volume of historical and forecast (short-term and long-term) information. Despite the significance of factual information in diagnosing "the real causes of financial difficulties and identifying adequate measures to restore the debtor's efficient operations" [6], in substantiating the feasibility of financial restructuring the regulatory framework gives priority to forecast information, taking into account its realism and underlying assumptions.

This requirement is detailed in paragraph 4, "Analysis of operational and financial forecasts of the debtor's/Group's activities and the restructuring plan" [6], which is performed by an independent expert who meets the requirements of current legislation and is selected by the creditors' meeting. Particular emphasis is placed on cash flow as a financial model, classified by types of activities: operating, investing, and financing. Undoubtedly, their algebraic sum, as a result of performance in each type of activity, also plays an important role, as it directly affects changes in cash balances in bank accounts.

In contemporary academic research, predictive analytics in finance is considered a decision-support tool for managerial decision-making, based on the application of statistical and computational methods to forecast the future financial condition of business entities and integrated into information systems and decision support systems [7]. A significant share of such studies focuses on the early prediction of corporate financial distress through the classification of companies according to solvency, based on financial ratios and machine learning methods, in particular artificial neural networks [8].

At the same time, within the framework of predictive analytics, financial models can be constructed in the form of forecast financial statements, including projected balance sheets, income statements, and cash flow budgets. Such predictive models make it possible not only to anticipate future financial performance of an enterprise but also to assess solvency levels, manage financial risks, and formulate more substantiated managerial decisions under conditions of uncertainty.

Thus, one of the tools of the mechanism for achieving the effective functioning of an enterprise is the forecasting of financial statement indicators, which belongs to predictive-type models that have a forecasting nature and are aimed at predicting changes in the financial condition of enterprises.

The results of predictive modeling require mandatory presentation in three financial statements: the balance sheet, the cash flow statement, and the income statement. Each of these statements has its own functional purpose and a defined sequence of preparation following the relevant business calculations (Fig. 1). The input data for predictive modeling comprise a large volume of information structured by each group.

Operational parameters shape the production potential and the ability of assets to generate future economic benefits, namely revenues, profits, and cash flows as key indicators of a business entity's capacity to meet its obligations to creditors. This is particularly important in the process of financial restructuring of monetary obligations and in facilitating the recovery of business operations.

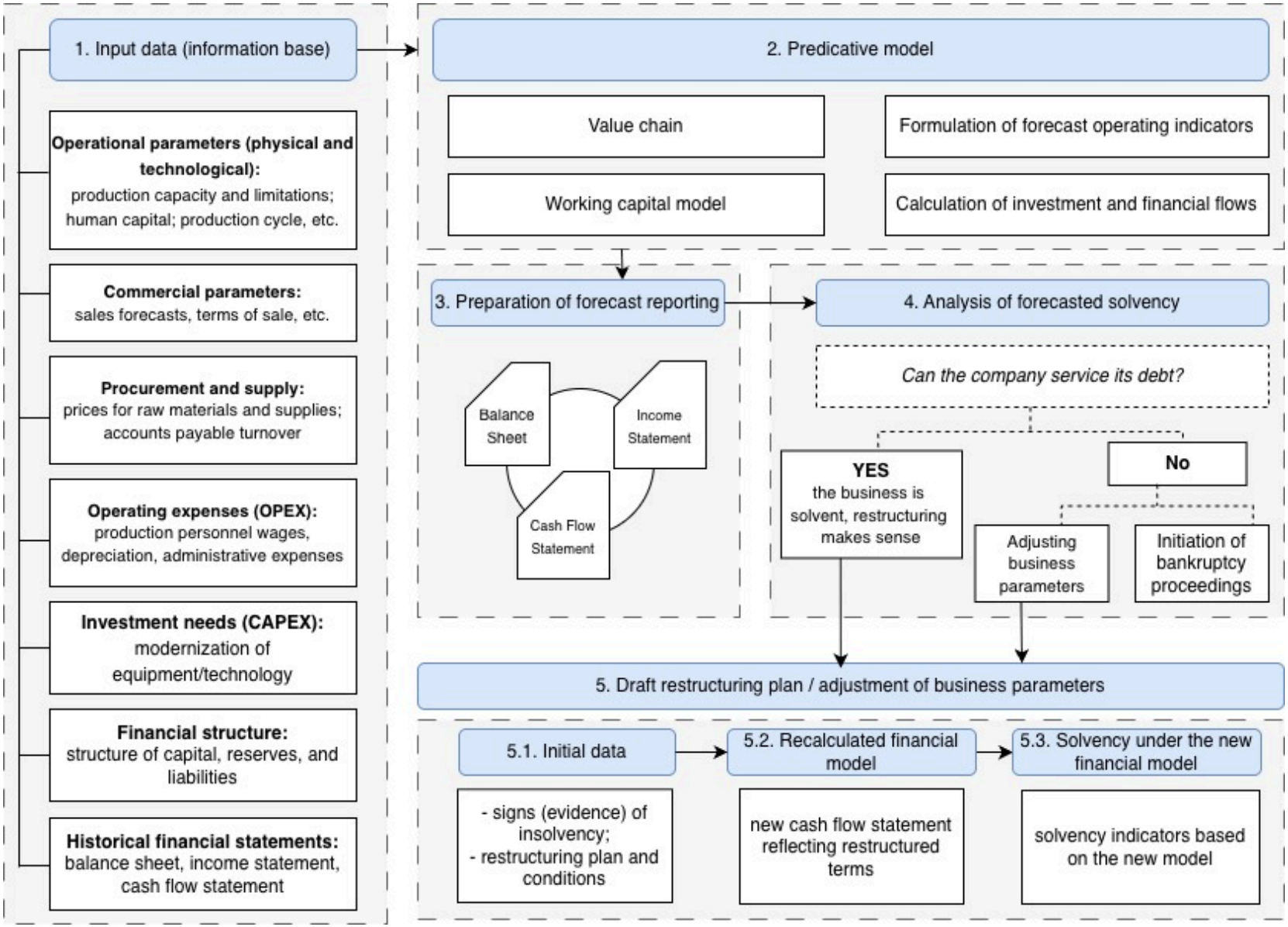


Fig. 1. Predictive mechanism for assessing solvency and debt restructuring

The realization of production potential, in turn, requires the use of labor resources, which makes it possible to analytically estimate the comprehensive reserve of activity volumes, taking into account the rhythm and continuity of this process.

The block of commercial parameters provides for the adjustment of forecast activity volumes to sales conditions, including shipment terms, payment methods, payment periods, discount systems by each customer (and by type of product, works, or services), as well as other relevant information. This block of parameters makes it possible to generate forecast information on gross and net sales as an initial approximation of cash inflows, as well as on the state of accounts receivable. Within the predictive model, this serves as the basis for completing the relevant forecast financial statements:

1. Statement of Financial Position (Balance Sheet): balances of accounts receivable and finished goods.
2. Income Statement: revenues from sales.
3. Cash Flow Budget: sales cash inflows with detailed specification of exact dates, payment terms, and incoming cash flows.

The operating expenses of a manufacturing enterprise include processing information related to the purchase of raw materials and supplies, inventories, work in progress, and accounts payable; payroll expenses for production personnel, depreciation, administrative expenses, and selling expenses. When constructing a predictive model, these elements are reflected in the following three main forms of forecast financial reporting:

1. Statement of Financial Position (Balance Sheet): balances of accounts payable, production inventories, and work in progress.
2. Income Statement: operating expenses; their comparison with revenues makes it possible to determine the operating financial result.
3. Cash Flow Budget: cash outflows; their comparison with cash inflows provides the basis for determining net cash flow.

One of the key questions in conducting this modeling, which the expert must answer, is whether or not the business entity is capable of servicing and repaying its debts. In other words, it is a matter of actual solvency, which in turn requires the use of a system of analytical indicators, among which cash flow indicators play a central role, namely net cash flow from operating activities and net cash flow from all activities.

The information support of this process has a significant impact on the quality and reliability of modeling results and, consequently, on the expert's final decision regarding the feasibility or inexpediency of conducting financial restructuring.

In the first case, this is predominantly a non-judicial form of resolving issues related to the settlement of obligations by an arbitration committee; in the second case, it involves judicial proceedings through bankruptcy procedures. The provision of information to involved creditors and investors (if any), the independent expert, and the arbitration committee is the responsibility of the debtor.

The primary link in the information support block is historical financial statement "for each of the three financial years preceding the commencement of such a procedure" [5]. This requirement enables the independent expert to diagnose the causes of financial difficulties that led to actual insolvency over time and, most importantly, to take them into account when modeling the potential restoration of solvency and, accordingly, the continuation of operations in the future. This logical sequence fully complies with the fundamental assumption of the accounting system – the going concern principle – provided for by international and national standards, namely IFRS and Ukrainian National Accounting Standards (NAS).

The indicators of a threat to going concern are defined in ISA 570 and are classified into three main groups: financial, operational, and other indicators. Given the significance of financial relationships in the activities of business entities, the financial group of indicators

occupies the first place. This group includes indicators directly related to operating performance, namely the excess of liabilities over assets (i.e., a negative value of equity) and the excess of short-term liabilities over current assets (i.e., a negative value of net current assets or working capital) [9].

In both the first and the second cases, the underlying cause is the same – the presence of systematic losses, which confirms the inefficiency of business operations. This indicator should be considered over a longer-term horizon through the following chain of interdependence of indicators (Fig. 2).

Thus, the primary element in this chain of indicator interdependence is a net loss (which may also be a loss before taxation) as evidence of inefficient operations, while the consequence is a reduction in equity. This contradicts the concept of financial capital maintenance and ultimately leads to a situation in which liabilities exceed assets or current liabilities exceed current assets.

Cash flows (cash inflows and net cash flows), as the actual source for meeting obligations, become the primary focus in the short term, which is envisaged by a debt restructuring plan. In this regard, ISA 570 points to "negative operating cash flows indicated by historical or prospective financial statements" [10]. In this context, it is also appropriate to draw attention to other going concern risk indicators directly related to cash flows, namely " fixed-term borrowings approaching maturity without realistic prospects of renewal or repayment," as well as "inability to pay creditors on due dates" [10].

In predictive modeling, this important information is reflected in the cash flow forecast, which is formed according to the following algorithm in the form of an additive model:

$$CF_{in} - CF_{out} = NCF + C_{in\ bank_1} = C_{in\ bank_2}; \quad (1)$$

where:
$CF_{in}$ – cash inflows;
$CF_{out}$ – cash outflows;
NCF – net cash flow;
$C_{in\ bank_1}$ – bank account balance at the beginning of the period;
$C_{in\ bank_2}$ – bank account balance at the end of the period.

The additive model (1) links two groups of indicators:
1. Dynamic indicators – $CF_{in}$ , $CF_{out}$ , NCF
2. Static indicators – $C_{in\ bank_1}$ , $C_{in\ bank_2}$

Under IFRS and National Accounting Standards (NAS), when preparing the statement of cash flows for operating activities, either the direct method or the indirect method may be applied. Given the significance of the cash flow indicator, especially net cash flow, in confirming the reality of the debtor's payment of a certain amount of money to the creditor in accordance with the agreement, i.e., the fulfilment of a monetary obligation, preference should be given to the direct method in predictive modeling. This approach makes it possible, for each operating activity transaction, to calculate cash inflows and cash outflows step by step, with adjustments for payment terms and settlement conditions.

It is precisely within the cash flow budget that this algorithm is implemented. This form of predictive modeling enables the expert, the supervisory board, creditors, and banking institutions to clearly assess the certainty (cash-backed nature) of meeting obligations and repaying clients' credit liabilities within specified timeframes through a key performance indicator – the net cash flow from operating activities. In general, cash flows are considered as "available for debt servicing and repayment" [6].

A positive net cash flow at a specific date serves as evidence of forecast solvency and, accordingly, the ability to meet obligations. Conversely, the presence of a negative net cash flow does not confirm solvency and necessitates the mandatory elimination of this outcome.

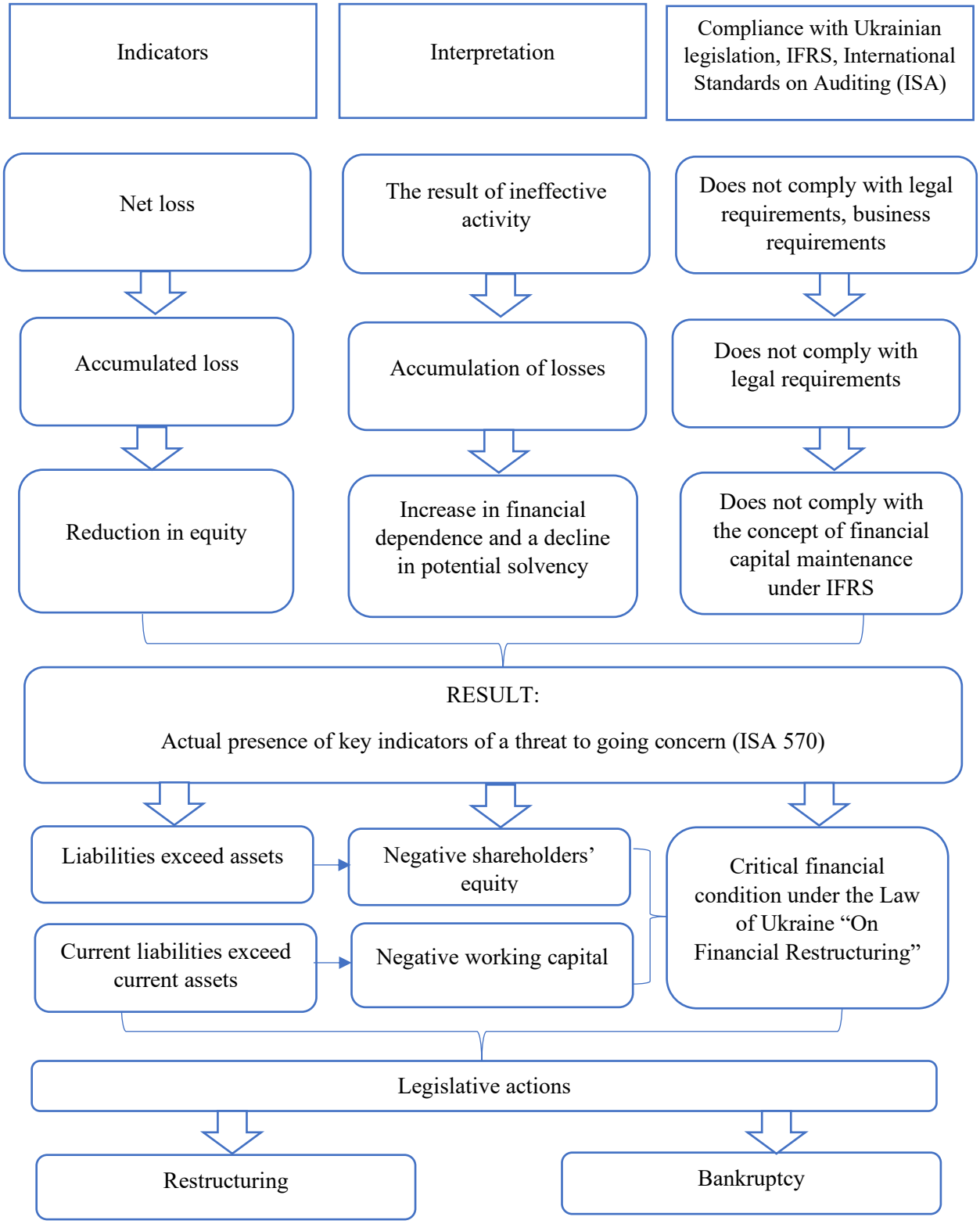


Fig. 2. Causal chain of operational inefficiency with going concern risk indicators according to ISA 570 in the process of financial debt restructuring

Standard decision-making options in such cases include increasing cash inflows or reducing cash outflows by making adjustments to the relevant calculations.

At the final stage of predictive modeling, operating profit (as projected in the income statement) and the cash balance at the end of the period (from the cash flow budget) are automatically transferred to the forecast balance sheet as of the end of the period. This balance sheet serves as a kind of "snapshot" of the debtor's financial position, while comparison with the previous state makes it possible to form an understanding of changes in its financial condition. This serves as an objective criterion for assessing the potential effectiveness of a financial model based on predictive modeling.

**Conclusions.** The voluntary debt restructuring procedure of a debtor provides an opportunity to restore the business activities of enterprises that are in a critical financial condition, i.e., are unable to meet their obligations to creditors. The use of a comprehensive analytical toolkit by an expert conducting a review of financial and economic activities in the process of independent assessment is a key prerequisite for the soundness of conclusions regarding the entity's ability to continue operations. One of the tools for substantiating the possibility of restoring the debtor's solvency in meeting its obligations and ensuring further functioning is the forecasting of financial statement indicators based on predictive modeling, which has a forward-looking nature and is oriented toward both short-term and long-term time horizons.

The use of historical financial reporting enables the independent expert to diagnose the causes of financial difficulties that led to actual insolvency over time and, most importantly, must be taken into account when modeling the potential restoration of solvency and, accordingly, the continuation of operations in the future.

In accordance with ISA 570, the main causes of indicators of financial distress stem from inefficient operations over time, which lead to a situation where liabilities exceed assets or current liabilities exceed current assets. Such a situation contradicts the concept of financial capital maintenance under IFRS and indicates the inability to finance a portion of current assets with equity.

Given the significance of the key indicator – net cash flow – in confirming the debtor's actual ability to pay a certain monetary amount to a creditor in accordance with a contract, that is, to fulfil a monetary obligation, predictive modeling should give preference to the direct method. This approach makes it possible to calculate cash inflows and outflows step by step for each core operating transaction, with adjustments for payment terms and settlement conditions.

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