Improving the Calculation of the Efficiency Assessment of Cash Flow Management in High-Tech Industries

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Abstract: *Relevance*: Information about cash flows is always being closely monitored by analysts, business managers and investors. The efficiency of money management determines the quality of the entity as a whole. And his management should use the integrated indicator of the effectiveness of cash flow management in making management decisions.

The novelty of the present scientific research is in the following:

- the advanced method of calculation of the integral indicator of the efficiency of cash flows management at the high-tech enterprises is proposed,

- the appropriate and efficient use of cash flow profitability indicators is identified.

Practical usefulness.

- It is justified that The Net Present Value (NPV) profitability of net cash flow is the indicator that reflects the efficiency of cash flow management.

- The proposed integral indicator of the effectiveness of cash flow management makes it possible to determine the impact of individual factors that influence the formation and use of NPV.

- the proposed efficiency assessment for effective cash management will determine the quality of management of activity of the economic entity.

E. S. Stoyanova defines: "financial management is the science of financial management of an enterprise aimed at achieving its strategic and tactical goals» (Stoyanova, 2004).

The quality of financial management of any business entity is determined primarily by the efficiency of management of its cash flows and is expressed in:

- the balance of revenue and the use of funds;

- growth of sales volumes and optimization of outflows due to operative maneuvering of money resources;

- increased flexibility in raising borrowed funds;

- the possibility of releasing money resources for investments into more profitable projects;

- using modern economic and mathematical models to assess the efficiency of structural units in the analysis of cash flows by activity;

- enhancing financial independence and neutralizing the threat of financial insolvency.

The ratio of cash flows of the organization or enterprise and their state are characterized as a result of its activities (Tolmacheva, 2016).

An important role in assessing the effectiveness of the management of cash flows of the entity is to determine the key parameters that affect the degree of management of cash flows, since any entity:

- aspires to financial stability of the entity, and this indicator is the integral indicator of its monitoring;

- to assess the effectiveness of cash flow management, it may use some integral indicator, which can be used by the entity's management in making management decisions, to ensure the effectiveness of cash flow management in all kinds of activities of the entity.

However, this integral indicator should combine not only general economic factors (objective) that determine the effectiveness of cash flow management, but also the most important specific (subjective) factors that reflect the peculiarities of this process in high-tech industries.

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The integral calculation method is based on the basic values of the selected indicators, and the calculation error is distributed equally between the factors.

The calculation of the integral indicator of the efficiency of cash flow management contains a number of difficulties in connection with the use of expert assessments of the impact of each factor analyzed on the final result, which does not bring about the desired objectivity to this indicator. Meanwhile, in recent years, the formula for calculating the integral index obtained by summing up of the weights of individual factors, which are determined on the basis of expert estimates, is used in the most studies:

$$K = \sum_{i=1}^{N} W_i K_i, \tag{1}$$

where: K_i - specific indicators of cash flow management of entities of the total number N

W_i - the weight of individual factors in total.

Different authors depending on the object of study and based on their scientific views justify different groups of factors to calculate the integral indicator as well as offer different ways of conducting expert assessments or simply indicate that "weight coefficients are determined expertly."

The results of such studies cause a lot of controversy in the literature. First of all, it is not clear what is expressed in the substantive sense of the number obtained by summing up the individual factors. Or maybe some factors should be reduced to the aggregate index characterizing the object of the article, according to an even more complex formula of a nonlinear nature? The basis of this calculation of integral indicators is an expert assessment of the weight of individual factors, which is completely subjective.

The proposed method of calculation of the integral indicator of the effectiveness of management of cash flows in high-tech enterprises will eliminate the expert evaluation in the calculations based on available information about the activities of entities.

Currently the generalizing indicator of the efficiency of cash flow management of the entity is considered to be the NPV efficiency coefficient or the liquid cash flow method. These indicators reflect the achievement of

financial sustainability, which is a summary goal for any organization.

The financial sustainability of any entity depends not only on its ability to pay its liabilities, but also on its ability to generate profits. There are many options for calculating profitability indicators, from different positions reflecting the efficiency of entity's activity.

Meanwhile, in this article it seems expedient to use indicators not of profitability in the general economic sense of the word, but profitability of cash flows as from the point of view of financial policy of the entity, its main purpose of activity being the achievement of the final financial result estimated in monetary terms. NPVs but not for all types of activities which may not be available for most high-tech industries, but only for the core activities, serve as a measure to evaluate this financial result:

$$P_{NPV} = NPV_{CA} / TC \tag{2}$$

where: P_{NPV} – NPV profitability from the core activity;

NPV_{CA} – NPV out of the core activity,

TC - Total capital.

This indicator characterizes the entity's ability to repay its monetary liabilities to creditors and borrowers, taking into account its material and financial resources.

This concept of profitability is more preferable, especially when the entity is experiencing significant difficulties due to the chronic shortage of funds for the settlements with contractors and for the settlements with the budget system.

The NPV profitability from operating activities more fully reflects the real financial condition of the business entity.

Thus, in high-tech entities, the efficiency of cash flow management, first of all, can be seen in the financial stability of the entity, which is characterized by financial independence and cash flows' profitability.

Traditionally, the assessment of financial independence is carried out using a system of liquidity indicators, which, however, have a number of disadvantages. Consider some of them.

When analyzing these coefficients, they are compared with the established normative values. The optimal value for the total liquidity ratio (coverage)

should be greater than one and range from 1 to 2 (sometimes 3).

Exceeding this value is considered to be undesirable and indicative of an inefficient capital structure. Therefore, the value of the total liquidity ratio (coverage) below the normative, officially proposed to be considered as a negative trend in the assessment of the financial independence of the entity.

This is quite natural, because in the event of an emergency, the entity can disburse the working capital for fifty percent of the real value and thus pay off its short-term obligations.

According to many economists, the optimal value of the absolute liquidity ratio for Russian entities is in the range from 0.2 to 0.25.

Russian enterprises face many problems in the practice of cash flow management (Hlusova, Birulina, 2015). One of them is as follows: in recent years, the value of this indicator in commercial entities in all sectors of Russia is constantly decreasing, which indicates an inefficient capital structure and low "quality" of assets.

High values of liquidity ratios indicate either a poor management of capital, either a purposeful desire to play it safe with the unused stock of the borrowed capital. All this, as a result, reduces the effect of financial leverage in the use of borrowed capital.

In addition, in determining the quantitative parameters of the general liquidity ratio, its qualitative characteristics, namely the structure of working capital and the dynamics of their changes, are not taken into account at all.

It is obvious that the increase in the overall liquidity ratio can be called "benign" only when the reasons for its growth are analyzed and it is found that it is caused by an increase in cash. If, however, the increase in the overall liquidity ratio was largely due to the growth of accounts receivable and inventory, then:

- on the one hand, this will indicate an increase in the so-called "external" financial independence;

- on the other hand- on excessive diversion of funds from circulation, which will subsequently affect the reduction of "potential" or "internal" financial independence. In this case, "external" financial independence will be observed at the expense of the deterioration of "internal" independence.

A study of the practice of applying these liquidity ratios of the balance sheet to assess financial independence showed that they have significant disadvantages, which include:

- low informativeness for forecasting of future cash receipts and payments;

- ignoring the possibility of participation of all working capital articles in current activity;

- the presence of potential liabilities not reflected in the balance sheet and not taken into account in the calculation of the liquidity ratios of the balance sheet, which leads to a decrease in the reliability of the data;

- exclusion of prospective payments that can cause significant cash outflows in the future;

- Failure to take into account the "quality" liquidity ratios of such constituent elements as short-term financial investments, equivalent to cash equivalents, some articles of receivables and accounts payable (debt of the founders on contributions to the authorized capital, advances issued, advances received), other debtors.

As we can see, it is not reasonable to consider the indices of liquidity of the balance sheet by the factors characterizing the financial independence of the entity, because they characterize the possibility of repayment of only short-term obligations and only in emergency circumstances.

These coefficients may characterize the liquidity of the balance sheet only as at the date of its compilation and, therefore, it is advisable to consider them only as liquidity ratios of the balance sheet, and not as financial independence.

When describing financial independence, it is legitimate to operate in such terms that will determine the adequacy of the cash received by the entity as a result of its current activities to meet its obligations.

The identified lack of financial resources will lead to a conclusion on the work of the entity to maintain its stable financial independence. Therefore, we consider it expedient to determine financial independence on the basis of cash flows by calculating various coefficients in the normal conditions of functioning of the entity.

Table 1: Indicators that Determine the Effectiveness of Cash Flow Management

№ п/п	Indicators
1	*Core performance indicators:* profitability of sales; the asset turnover ratio
2	*Indicators reflecting the ratio of business financing sources:* total solvency ratio; maneuverability coefficient; financial leverage coefficient
3	*Indicators characterizing the sectoral specifics of high-tech entities:* - the values of the science costs per unit of production; - the number of employees engaged in scientific activities vs. all involved in production (at the entity, in the industry); - expenses directed on scientific and technical projects or other developments vs. the price of production (cost of performed works, rendered services); - R & D expenses (minus the cost of work for other industries) vs. the amount of gross or commercial output; - the number of employed in industry science and that in scientific service vs. the number of industrial and production personnel of the industry.

This article compares the efficiency of cash flow management in all entities under consideration. A similar task can face an external investor, who chooses between different entities as the objects of possible investment decisions.

Considering the cumulative factors taken into account in the calculation of the integral indicator, it is important to identify the factors that are characteristic of the entire population of entities in this industry.

When calculating the integral indicator of the NPV efficiency, it is proposed to divide these factors into three groups:

- goals that determine the entire financial and economic activity of the entity. This is the maximization of the market value of the entity, ensuring its financial stability and solvency in the context of the economic crisis;

- amount of financial resources of the entity;

- factors of direct and indirect influence of the external environment on the activity of the entity (state regulation, financial and credit policy of the state, market conditions, etc.).

All the specifics of high-tech industries as high-yield sectors of the economy with large-scale production are concentrated in the mission of high-tech business, which is not to maximize profits, but to maximize the well-being of the entities' shareholders or in some cases, to maximize the value of the entity.

The effectiveness of cash flow management to achieve this goal can be determined by the system of indicators (Table **1**).

In general, the impact of these indicators on the efficiency of managing the cash flow of the enterprise is very complex and is unlikely to be reduced to their linear combination.

Therefore, integral efficiency of cash flow management of the entity will be represented as a function of three groups of variables, the specific kind of which is not to be clarified:

$$E_m ncf = K(\{Ti, i = 1, ..., Nt\}, \{Si, i = 1, ..., Ns\},$$
$$\{Ci, i = 1, ..., Nc\}, Wi, i = 1, ..., Nw\}) \tag{3}$$

where: $E_m ncf$ - profitability of Net Present Value from operating activities (cf) characterizing the efficiency of their management;

K- indicators of integrated efficiency of cash flow management of the entity;

T - performance indicators of the main activity of the entity;

S - indicators characterizing the ratio of sources of business financing;

C - indicators characterizing the sectoral specifics of high-tech industries;

W - weight coefficients;

i - the number of observable values of the variable that it takes in the investigated period.

Thus, when deciding on the choice of one of several alternatives, it is necessary to calculate the indicators of the integrated assessment of the efficiency of cash flow management in the enterprise, and for this purpose it is necessary to determine the coefficients by the degree of influence of each factor on the NPV profitability.

In order to assess the effectiveness of cash flow management, it is proposed to use eight indicators, the most frequently used and which most fully characterize the financial condition, which is a reflection of the quality of cash flow management.

The regression task of selection of such weight ratios of W_i is solved for definition of the integral estimation, so that calculated values of NPV profitability maximum closely corresponded to their actual values.

At the same time, the number of observed values of the integrated assessment of the efficiency of the cash flow should be by an order of magnitude greater than the explained values.

Expression (3) can be checked by building up two different functions - additive[1] and multiplicative[2]:

$$D = \sum_{i=1}^{n} W_i K_i \qquad (4)$$

$$D = \prod_{i=1}^{n} (K_i)^{W_i} \qquad (5)$$

where K_i - a summing up indicator of the impact on the efficiency of cash flow management of all the factors considered, the value of which is determined by:

$$K_i = \frac{R_i}{norm(R_i)}, \qquad (6)$$

where: R_i - value of indicator;

norm (R_i) - the normative value of the indicator.

According to the formula (6), each of the factors given is considered at the top level of the normative

value below which the individual parties of the financial condition are recognized as unsatisfactory.

It is the upper level of the standard for each coefficient most fully and accurately reflects the financial stability:

- total solvency coefficient – more than 0.5;

- maneuverability coefficient – from 0.3 to 0.4;

- the financial leverage coefficient - is less than 1.

When no such standards exist (e.g., return on sales, asset turnover ratio, length of the financial and technological cycle, share of work-in-progress, volume and timing of payments to suppliers and contractors), it is advisable to use the highest values obtained in the calculation of these indicators for the year.

Thus, NPV profitability on the main activity used in further calculations is defined as the relation of the received indicator of each group in the considered period to its normative value.

If the values of financial indicators fully comply with regulatory or maximum levels, their amount will be equal to one, which is chosen by us as an integral indicator of "conditionally satisfactory entity".

The proposed model for assessing the effectiveness of cash flow management allows to assess it from the point of view of remoteness from the critical state.

Therefore, when choosing the basis of reference of the integral indicator, there is a need to introduce the concept of "conditionally satisfactory entity", which has financial indicators corresponding to the normative maximum values.

Then the value of the integrated indicator of cash flow management of the entity < 1 should be assessed as unsatisfactory.

By logarithm, the multiplicative form (6) of the analysis is converted into an additive form (7):

$$\ln(D) = \sum_{i=1}^{n} W_i \ln(K_i) \qquad (7)$$

As a result of calculation of the given equations for each factor the group of weight ratios {W_i, i = 1,..., n} is obtained.

However, in numerical experiments, some groups of indicators have negative values, which do not allow the

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[1]Additive-property of values, consisting that the value of the amount corresponding to the whole object is equal to the sum of values of quantities corresponding to its parts (model summing).
[2]Multiplicativity is a multiplying model showing the relationship between values.

use of the formula (4), since it is impossible to logarithm a negative number.

Then the nature of the dependence of the integral indicator on the selected factors affecting the NPV profitability, will take the form (3).

The calculation of the final integrated indicator of the efficiency of cash flow management is based on the comparison of entities for each coefficient corresponding to the normative maximum value determined on the basis of the criteria of efficiency of economic activity and that of organization of finances for the entity, principles of sufficiency, liquidity and profitability of its capital.

In the calculation of the formula (3) the data of quarterly financial reports of KLM; SRV; SPG for the years 2015-2017 were used.

On the basis of correlation analysis it was revealed that the close relationship between the indicators for the enterprises under consideration is at large intervals.

KLM entity shows a strong correlation between the parameters:

- the coefficient of maneuverability and profitability of sales (-0.47);

- shares of unfinished production and profitability of sales (+ 0.41);

- the ratio of the overall solvency and asset turnover (-0,4);

- the coefficient of maneuverability and the amount and timing of payments to suppliers and contractors (-0.39).

As we can see, the most close (negative and positive) and often recurring connection have a coefficient of maneuverability and profitability of sales.

However, the values of correlation coefficients do not contradict the requirements of regression analysis on the independence of variables, and they will be taken into account in the future.

The SRV entity shows a close relationship between the following parameters:

- coefficients of financial independence and financial leverage (-0.54);

- coefficients of total solvency and profitability of sales (-0.58);

- coefficients of financial leverage and profitability of sales (+ 0.51);

- profitability of sales and volumes and terms of payments to suppliers and contractors (+0.55).

In the given data the most close and often repeated connection has shown the coefficient of profitability of sales, but from further calculations it has not been excluded in the view of the low value of correlation coefficients.

For SPG entity, a close relationship is observed only by two factors: financial independence and the duration of the financial and technological cycles – (-0.41). But for the reasons stated above, they were also left in the calculations.

On the basis of the obtained correlation dependence by the method of regression analysis we calculate the coefficients of the integral indicator for each of the entities under consideration (Table **2**).

As we can see from Table **2**, out of the performance indicators of the main activity, the greatest directly proportional dependence is revealed at the entity between the value of the NPV profitability and the coefficient of assets turnover.

Thus with the increase in the assets turnover in the same proportion NPV and, therefore, its profitability will increase by 1.08 %.

The coefficient of profitability of sales at the KLM and SPG entities has a negative impact on the amount of NPV (Table **3**), which results in the decrease in profits and the growth of expenses incurred by the entities (respectively:-0.005;-0.39).

Indicators reflecting the ratio of sources of financing affect the NPV profitability in different ways.

In two entities KLM and SPG values of the coefficients of maneuverability and financial leverage are inversely proportional to the value of NPV profitability, which means:

- reduction of NPV profitability by 67 % with increasing flexibility ratio by 1%;

- the need to borrow capital to cover cash outflows, which, in turn, will reduce the solvency of the entity.

The explanation for this can be found in the use of net profit, which is one of the most important sources of

Table 2: Coefficients of the Integral Indicator of the KLM, SRV, SPG Entities

Indicator	KLM	SRV	SPG
Y-intersection (Profitability of NPV)	1,06	-0,78	1,38
Core performance indicators			
Profitability of sales	-0,005	0,38	-0,39
The asset turnover ratio	-0,24	1,08	-0,03
The indicators reflecting a parity of sources of financing			
Total solvency ratio	0,33	-0,03	0,31
Maneuverability coefficient	-0,67	0,46	-1,09
Financial leverage coefficient	0,17	0,04	-0,05
Indicators characterizing the sectoral specificity of high-tech production			
Duration of financial and technological cycles	0,007	0,03	-0,15
Share of work in progress	0,02	0,38	0,48
Volume and timing of payments to suppliers and contractors	-0,18	0,23	0,01

increasing equity, however, in our case, it has another purpose.

This may explain the situation in the KLM entity, where there is a positive but weak (0,33) dependence between the coefficient of financial independence and NPV profitability.

Indicators characterizing the specific features of the core business show that in SPG entity the most negative impact on the NPV profitability is caused by the growth factor of the duration of the financial and technological cycles (-0.15).

At the same time, in the SRV entity, the influence of this indicator is directly proportional (0.03). The increase in the duration of the financial and technological cycles has a positive impact on the NPV profitability as a result of the use of the system of "acceleration-deceleration" of the payment turnover, providing a balance of deficit cash flow for the short term period.

Considering the relationship of NPV profitability and the share of work in progress (Table **2**), we can see that in all entities it is in direct proportion to each other.

However, the calculated coefficients indicate a weak relationship, which is explained only by the long cycle of high-tech industries.

The low value of this coefficient at the KLM entity (0,02) which has large scientific projects that directly

influences decrease in NPV profitability attracts attention.

KLM entity refers to a large business, so ensuring solvency and financial stability refers to its priority objectives.

For high-tech industries the value of the factor - the duration of the financial cycle, approaching to zero, means that:

- the balance of scientific works, materials and items in the warehouse, as well as unfinished scientific developments are financed at the expense of suppliers and contractors;

- the term of payment of scientific developments and the share of possible payment in installments are correctly determined.

Thus, all identified factors are reflected in the coefficients showing their relationship to NPV profitability.

On their basis the model of calculating the integral indicator can be constructed, allowing to evaluate the efficiency of cash flow management in entities of high-tech industries.

All the indicators characterizing cash flows are ranked according to their priority for entities in the current economic conditions.

Table 3:   Model of Calculation of the Integral Indicator

Entity	Algorithm for calculating the integral indicator	Integral indicator value
KLM	PNPV=1,06-0,005POS-0,24TAT+0,33 Cts -0,67 См +0,17 FL +0,007 FC +0,02 Swip -0,18ΔAP	0,48
SRV	PNPV=-0,78-0,38POS+1,08TAT-0,03 Cts +0,46 См +0,04 FL +0,03 FC +0,38 Swip +0,23ΔAP	1,8
SPG	PNPV =1,38-0,39POS-0,03TAT+0,31 Cts -1,09 См -0,05 FL -0,15 FC +0,48 Swip +0,01ΔAP	0,46

where:
P_{NPV} – NPV profitability from the core activity;
POS – profitability of sales
TAT – total assets turnover coefficient
C_{ts} - total solvency coefficient;
FC – financial cycle duration
C_M - Maneuverability coefficient;
FL – financial leverage coefficient;
ΔAP - change in accounts payable;
S_{wip} - share of work in progress.

The results of calculations of the integrated indicator model for high-tech entities are presented in the Table **3**.

The value of the integral index is determined (Table **3** column 3) on the basis of its coefficients received in the Table **2** by summing up all the components of the model (Table **3** column 2).

The values of each factor were taken as a unit (only when calculating the integral indicator), because in this case the numerator of the fraction (Formula 6.) is assumed to be equal to the upper level of the normative value (denominator of fraction), in which the value of the factor is maximum.

The values of the integral indicator characterize the quality of cash flow management in the entity.

When the value of the integral indicator varies from 0 to 1, the efficiency of cash flow management is low, due to the fact that the relationship of industry factors and NPV profitability is characterized by too small values (for example, in SPG - 0.46 and KLM - 0.48), and it is insufficient to draw a conclusion about the quality of cash flow management.

If the value of integral indicator > 1, it identifies a high connection between the selected industry factors and the NPV amount, and the NPV profitability indicator testifies for the effective cash flow management.

This situation is typical for the SRV entity, where the integral indicator is equal to 1.8, which differs from other entities studied by the structure of capital and the positive value of liquid cash flow.

Thus, it is determined that:

1) from the known system of indicators for assessing cash flows, only one indicator – NPV profitability for core activities fully reflects the efficiency of cash flow management, and, therefore, the financial stability of a high-tech entity;

2) the proposed integrated indicator for assessing the effectiveness of cash flow management makes it possible to assess the factors influencing the formation and use of NPV.

The numerical value of the integral indicator, as well as the construction of a model that reveals its dependence on private indicators, allow financial services of all the economic entities under consideration to do the following:

-   on the basis of analysis of the private indicators of the efficiency of cash flow management to monitor the quality of cash flow management in entities of high-tech industries. Analysis of the dynamics of the integral indicator allows to adjust the cash flow management system operatively. And if in the course of the assessment the threshold values of private indicators are established, the need to adjust the operational management system will be established after the first calculation of the integral indicator;

-   systematically undertake measures to improve the operational management of cash flows, paying particular attention to the private indicators included in the described function with relatively large weights. Development of measures aimed at increasing the values of the factors, which

have received the greatest weight, will significantly improve the quality of cash flow management;

3)   the developed formalized model for defining the integral indicator allows to replace the expert estimation of influence of separate factors by their quantitative calculation;

4)   to calculate the integral indicator of the efficiency of cash flow management it is necessary to use an additive formula (4), instead of multiplicative formula (5);

5)   objective estimation of weight coefficients in the developed model allows to speak confidently about the relative weight of separate factors influencing NPV profitability, and enables financial manager to take effective measures on weakening actions of negative character.

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