

## APPROACHES TO THE DEVELOPMENT OF THE SYSTEM OF INFORMATION AND METHODOLOGICAL SUPPORT FOR COMPLEX EVALUATION OF CUSTOMER SOLVENCY

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**Abstract:** The issues of assessing the risks of commercial lending are one of the main factors for the effective sales management in an organization upon economic uncertainty conditions. In the context of solving the task of building an optimal system of settlements with debtors, it seems relevant to develop approaches to the systematization of the structural elements of the integrated customer solvency assessment system and development of its information and methodological support. The methodologies for investigating the counterpart reliability includes verification procedures for determining the legal status of a buyer, conducting a retrospective assessment of its financial status and payment discipline, analyzing cash flows, studying the dynamics and structure of receivables. The fundamental importance of effective implementation of each of these directions forms the prerequisites for proper substantive interpretation of the features of their practical application. On the other hand, the isolated nature of the components of analytical tools determines the need for justification of the algorithm for passing through the stages of economic evaluation of the counterparties' reliability and the establishment of a correlation between the results of their application and the magnitude of the final rating of the organization under study. The proposed areas of analytical evaluation are aimed at forming a comprehensive view of the risks of the upcoming business interaction with the buyer and form the basis for justifying the individual conditions of its commercial lending.

**Keywords:** assessment of customers' solvency, sales management, cash flow analysis, debtor evaluation, debtor solvency analysis, VAR methodology.

### 1 Introduction

Currently, there are alternative approaches in the specialized literature to assess the reliability of customers, but in spite of a significant amount of scientific and practical developments, a universal model that allows for a comprehensive assessment of the counterparty's solvency has not yet been developed. Formation of approaches to the solution of this task assumes the progressive development of the information component for the generally available standardized sources of information, among which are the data of accounting (financial) reporting. At the same time, the instant nature of the reporting indicators reduces

the ability to dynamically assess the solvency of counterparties and requires the search for alternative algorithms to solve the task.

### 2 Methodology

Generalization of discussion results for a set of problems put forward by practitioners for examination allows us to state that the receivables management at an enterprise is a rather complex category that requires an integrated approach to solving the tasks in hand (Asselbergh, 1999; Mian & Smith, 1992; Miriago, 2018). The formation of models that allow determining the appropriate conditions for interaction with customers is now widely spread (Orgler & Yair, 1975; Mao & Sarndal, 1974; Xu & Wang, 2009). It is important for a company to strive to improve the quality of control measures for dealing with debtors, since the efficiency of the organization's management is directly related to the financial condition of its counterparties (Altman & Hotchkis, 2006; Caouette et al, 1998; Minquan & XuZhong Yingtao, 2004; Wei, 1998). Recently, scientists have paid much attention to the creation of economic and mathematical models, thanks to which one can predict the solvency of a potential or existing counterparty and assess the degree of risk of sales on credit terms (Liu et al, 2007; Villalobos Antunez, 2016).

### 3 Results

The model for assessing the reliability of customers has been developed in the context of eliminating shortcomings of the retrospective analysis of financial statements. In the opinion of the authors, the results of applying an integrated approach to assessing the financial condition of debtors are the most important element in the development of commercial lending policies in the organization.

Figure 1 presents a list of actions according to which the buyer's solvency is assessed, which allows the algorithm for further relations with it to determine.

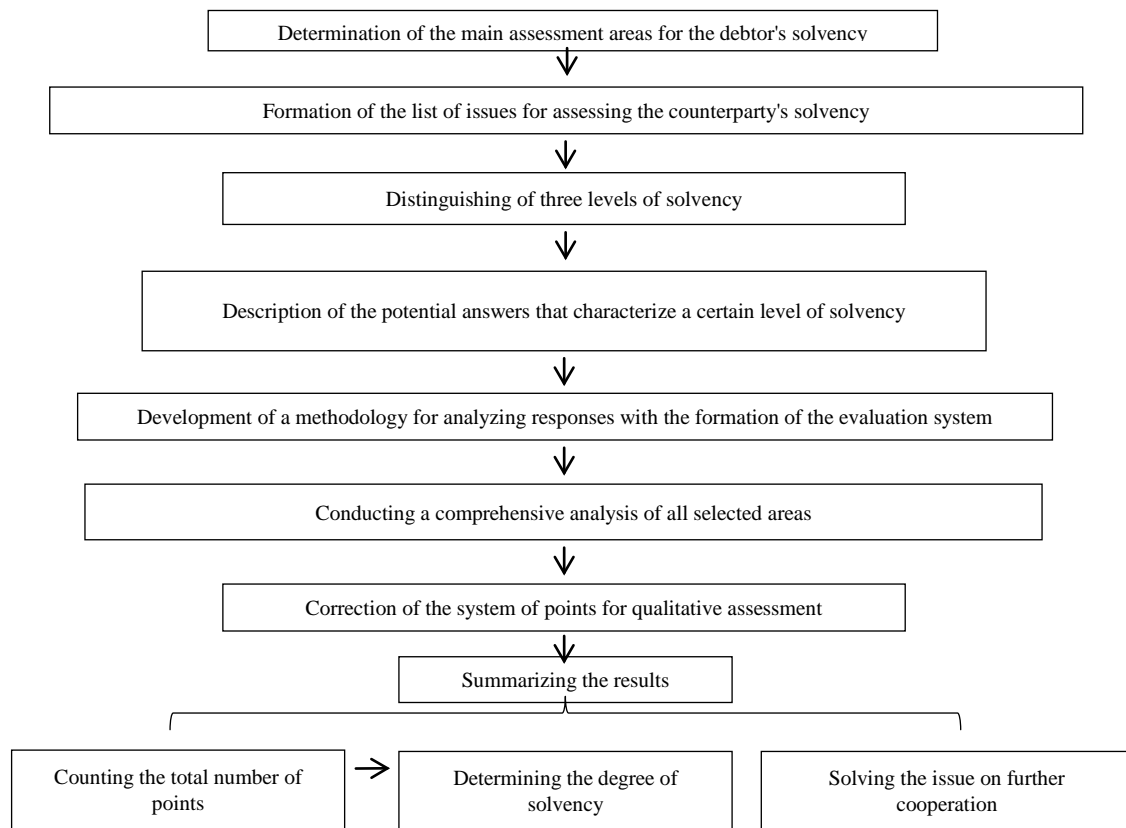


Fig. 1. Algorithm for carrying out an assessment of a buyer's solvency

At the first stage, it is necessary to determine the main areas of assessing the counterparty's solvency. The authors have built a block diagram shown in Figure 2, which describes the six key

areas in the assessment, according to which the analysis is carried out.

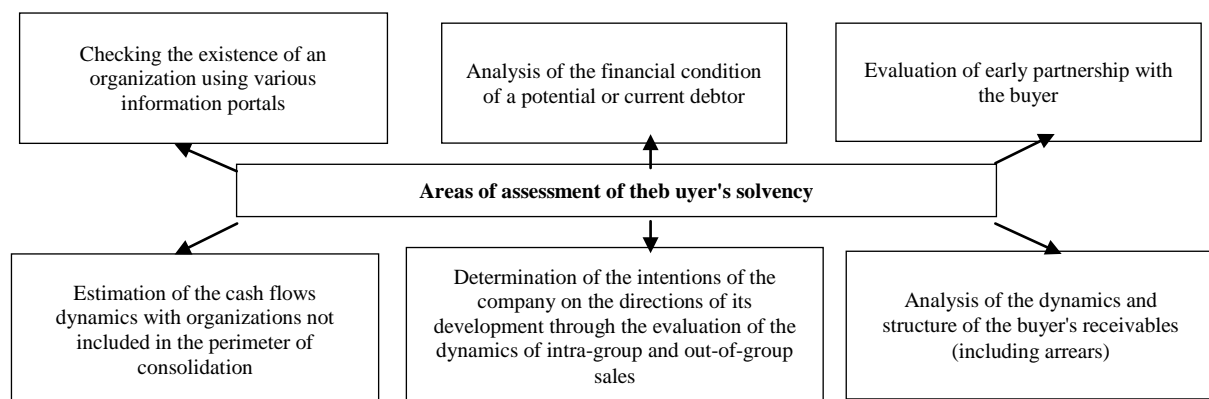


Fig. 2. The basic directions of an estimation of the buyer's solvency

For each direction of the assessment, an analyst needs to formulate a list of questions, the answers to which will give a complete idea of the elements that directly or indirectly affect the solvency of the analyzed buyer. For example, when evaluating the company's intentions about the direction of its further development, the analyst can ask the following questions: "What is the dynamics of cash receipts from organizations that are not members of the group of companies?", "What is the ratio of cash receipts from buyers entering and not entering the perimeter of consolidation at the time of the audit?", "What is the dynamics of the number of customers who are not a member of the group of companies?", etc.

In connection with the fact that the work stipulates determining the degree of solvency of counterparty, the authors propose to distinguish three levels of assessment: high, medium, low, each of which has its own characteristics. At the next stage, an analyst should form three types of answers to each question characterizing a specific level of solvency. For example, when answering the question: "Has a check on the existence of an organization passed?", the following answers can be given: 1) Yes, the organization exists and there are no doubtful facts (high level of solvency); 2) yes, but 1-2 facts have been revealed, which testify to the doubtfulness of its existence (medium level of solvency); 3) as a result of the audit, more than 2 significant

facts were revealed, which testify to the doubtfulness of the company's existence (low level of solvency).

Before proceeding to the interpretation of the most interesting aspects of the analysis from a methodical point of view, we will examine in detail the selected areas for assessing solvency.

The first direction for evaluating a potential or active customer is to test its existence using various information portals. Such sources allow a general director to check for the fact of being on the wanted list for suspicion of committing crimes, to determine whether the company is under the enforcement proceedings, whether it has debts to its creditors, and so on. Identification of negative facts at this stage is a weighty argument for refusing to cooperate with this counterparty or establishing stringent conditions for sales.

The second direction of the evaluation assumes an analysis of the financial condition of a buyer. Existing traditional approaches to analysis call for an understanding of the financial results of the company, its financial and economic activities, and identify the development trends that have been outlined. However, the existence of a temporary lag characterized by a lack of compliance with the financial condition of the company at the time of the analysis and / or conclusion of the transaction and the situation prevailing at the last reporting date reduces the value of this analysis, since the differences can be significant. Carrying-out of an analysis within the framework of the following direction is possible in the context of the information disclosure in public reporting.

Much attention is paid to the evaluation of information about cash flow of the debtor in its dynamics. Disclosure of operational information on cash flows of buyers will allow assessment of the effectiveness of counterparty's financial and economic activities and determine the possibility of timely fulfillment of obligations to pay off receivables. The authors propose a classification of the counterparty's cash receipts, which implies separation of cash flows from sales on the basis of activities from companies that are not members of the group of organizations. It is important to monitor in the process of analysis not only the dynamics of changes in the monetary receipts of certain groups of companies, but also the dynamics of the ratio of their shares. This division allows determining the intentions of the company to reduce, or, conversely, increase the volume of off-group sales which reflects the actual financial performance of the analyzed object for a certain period of time. In addition to the listed above indicators, the authors also suggest analyzing the average indicators per buyer, namely: the volume of cash receipts, the amount of one payment, and the number of cash receipts. The results of the aggregate analysis of these indicators and estimates of dynamics for the number of buyers and payments for recent periods will form an idea on the stability of the receipt of cash proceeds, being one of the key indicators of the company's stable market positioning, as well as the intensity of revenues, which will form the basis for determining the conditions for working with the buyer.

Calculation of the change rates of the selected indicators is the basis for determining the left and right quantiles. An  $\alpha$ -quantile

(or quantile of order  $\alpha$ ) is a numerical characteristic of the distribution law for a random variable; this is a such number that a given random variable lies to the left of it with a probability not exceeding  $\alpha$ .  $\alpha$ -quantile of a random variable  $\xi$  with distribution function  $F(x) = P\{\xi < x\}$  is any number  $x_\alpha$  satisfying the following conditions:

$$P(\xi < x_\alpha) \leq \alpha \text{ and } P(\xi > x_\alpha) \leq 1 - \alpha \quad (1),$$

Where  $\xi$  is a random value,  $\alpha$  is probability of hit of a random variable in a given interval,  $x_\alpha$  is a number such that a given random variable lies to the left of it with a probability not exceeding  $\alpha$ .

Calculation of quantiles for each selected indicator gives an idea of the potential change in the indicator in the future period. In addition to quantiles, authors are asked to determine the upper and lower boundaries of indicators, which will allow us to more accurately characterize the ranges of their values for the forthcoming period. The range calculations are based on the values of left and right quantiles, as well as the volatility of the exponent expressed in the form of a standard deviation.

The next direction for the evaluation is the analysis of the dynamics and structure of the counterparty's receivables. In order to conduct this evaluation, we propose to distinguish three criteria: the largest share of the largest debtor, the aggregate share of the largest 5 debtors, the direction and rate of dynamics in the share of the largest debtors in the total receivables. Such an analysis will allow you to assess the degree of concentration of sales and dependence on individual debtors. In addition, it is also important to analyze money, which is characterized by a high degree of non-return, namely, arrears. The analysis of overdue debt is carried out by two criteria: the share of aggregate overdue debt, the direction and rate of dynamics of the share of overdue accounts receivable.

If the company has previously cooperated with the counterparty, it is necessary to analyze the payment discipline based on the historical data, which will be the next direction of the evaluation. In the course of analysis of early partnerships, a comprehensive assessment is conducted to determine whether the buyer has outstanding debts at the stages of the previous cooperation, and if there is such a debt, determine its main characteristics: duration, frequency of occurrence, and share in the aggregate receivables of the counterparty.

Worthy of attention should be the methodology for calculating the weighted average duration of overdue accounts receivable, which we consider on an example. The companies "North" (buyer) and "South" (seller) cooperated with each other during the first half of 2018; for this period, according to the concluded contracts, there were 5 payments. However, the actual payment dates of the buyer differed from those established which contributed to the emergence of arrears.

Table 1 presents information on the planned and actual dates and amounts of payments made by the company "North", as well as results for the calculation of indicators serving as evaluation criteria.

Table 1. Evaluation of the payment discipline in the company "North" for the first half of 2018.

Date of payment (planned)	18.01	15.02	12.03	18.04	04.05	Average	
Amount of payment (planned), USD	1256	1526	2015	4050	2015	2172	
Dates and amounts of payments (actual)	1st payment	25.01	15.02	12.03	03.05	11.05	x
	amount, USD	1256	1012	745	1895	875	x
	2nd payment	x	02.03	03.05	07.05	18.05	x
	amount, USD	x	514	1270	688	315	x
	3rd payment	x	x	x	11.05	01.06	x
	amount, USD	x	x	x	1467	825	x

Arrears, YES / NO	YES	YES	YES	YES	YES	x
Weighted average duration of overdue debt, days	7.00	5.05	32.77	18.58	16.69	18.91
The average share of overdue debt	1.00	0.34	0.63	1.00	1.00	0.84

Calculation of the weighted average duration of overdue debt ( $WAD_{od j}$ ) for each planned payment j was carried out according to the following formula:

$$WAD_{od j} = \frac{\sum(\Pi_{i=1}^n (D_{i act} - D_{plan}))}{\Pi_{arrears j}} \quad (2),$$

where: n - the number of tranches for the j-th payment;  $\Pi_i$  - the amount of the i-th tranche of the j-th payment; i - tranche number for the j-th payment;  $D_{i act}$  - the actual payment date for the i-th tranche on the j-th payment;  $D_{plan}$  - planned payment date;  $\Pi_{arrears j}$  - the aggregate amount of overdue tranches for the j-th payment.

In order to calculate the average value of this indicator ( $WAD_{od av}$ ) the following formula of the arithmetic mean weighted was used:

$$WAD_{od av} = \frac{\sum(WAD_{od j} \cdot \Pi_{arrears j})}{\sum \Pi_{arrears j}} \quad (3),$$

Where:  $WAD_{od j}$  - weighted average duration of arrears for each payment j,  $\Pi_{arrears j}$  - the aggregate amount of overdue tranches

for the j-th payment,  $\sum \Pi_{arrears j}$  - the aggregate amount of overdue tranches for all payments.

According to the analysis of the payment discipline of the company "North", the weighted average duration of overdue accounts receivable was 18.91 days, the frequency of arrears occurrence - 1, the share of overdue accounts receivable in the aggregate - 0.84.

A comprehensive analysis is proposed for all the selected areas. Within each question, it is necessary to identify several possible options for an answer, which indicate a specific type of solvency for an individual element. If several criteria of evaluation are identified in the question, then the assignment to each of the criteria of various letter symbols characterizing a certain situation could serve in the capacity of a recommendation. The combination of letters will give an idea of the object under analysis by all criteria, indicating a specific type of solvency. A certain number of points are assigned to each group of answers within a single question, and the higher the solvency level, the greater the number of points. Let's consider this approach to the evaluation using the example of the previous question. Table 2 presents the criteria for assessing the payment discipline of a debtor with the conditions for assigning each parameter to a particular group.

Table 2. Criteria for analyzing the payment discipline of a debtor

Parameter	Duration of overdue debt			Frequency of arrear occurrence			Share of overdue debt		
	A	B	C	X	Y	Z	K	L	M
The letter designation of the group									
The conditions for assigning to the group	exceeds 40 days	Within the range of 10 to 40 days inclusively	Does not exceed 10 days	Each payment is accompanied by a violation of the payment deadlines	Every second or fifth payment is overdue	Less than 20% of the number of payments are overdue	30% and more	from 10 to 30%	less than 10%

After assigning a letter to each parameter, a combination is obtained that characterizes the situation with a certain degree of

risk. Table 3 presents possible combinations of letters and their corresponding scores.

Table 3. Combinations of letters ABC-XYZ-KLM and their corresponding scores

Degree of risk	Combination of letters	Number of points
Low	AZM, BYM, BZL, BZM, CXM, CYM, CZK, CZL, CZM	from 6 to 8
Mean	AYM, AZK, AZL, BXM, BYL, BZK, CXL, CYK, CYL	from 3 to 5
High	AXK, AXL, AXM, AYK, AYL, BXK, BXL, BYK, CXX	from 0 to 2

For the example under consideration, a combination of the letters VCK indicating a high degree of risk, was obtained. This combination is characterized by a range of points from 0 to 2,

which is determined based on the professional judgment of an analyst.

#### 4 Summary

Receiving answers to questions involves estimation by points that form the final rating of an organization. The definition of the cumulative number of points makes it possible to identify the degree of solvency characteristic for each of counterparties and to determine an individual algorithm for building relationships with it.

#### 5 Conclusion

The generated model of the multivariate evaluation of a buyer will provide a detailed idea of the reliability of its existence, assess the prospects for the financial condition and performance of the economic entity, and characterize the level of its financial discipline. Ultimately, these aspects reflect the company's ability to repay on its debts on a regular basis and form the basis for deciding on the conditions for conclusion of sales contracts and establishing the amount of trade receivables available to the counterparty.

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