

Accounts receivable management in transport organizations

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Abstract. In a crisis in the international settlement system, there is a need to strengthen payment discipline and accelerate payments. The consequences of the COVID-19 pandemic have also led to a reduction in the liquid means of transport organizations and also increased the problem. Acceleration of repayment of accounts receivable increases cash security. The methods of accounts receivable management integrated into the system based on a client-oriented approach are investigated. The proposed system allows you to track the balances of accounts receivable, comparing them with sales volumes and turnover indicators. The concept of the cycle of accounts receivable circulation is formulated. It is revealed that the existing indicators of turnover of accounts receivable and the volume of sales do not accurately reflect the quality of repayment of accounts receivable, the relationship between these indicators is not revealed. They do not disclose the possibility of additional release of funds from settlements with debtors. To solve this problem, a new indicator has been introduced – the rate of repayment of receivables. An approach is proposed to substantiate the expediency of accelerating payments based on the elasticity of revenue from the sale of transport services to the rate of repayment of receivables. Keywords: accounts receivable; the rate of repayment of accounts receivable; the cycle of circulation of accounts receivable; payment for transport services; customer-oriented approach; acceleration of payments; release of funds from turnover; turnover; management of accounts receivable.

1 Introduction

Many transport organizations have a wide network of clients with whom they conclude contracts for the provision of transport services and their payment. In the process of paying for the transportation and delivery of goods, accounts receivable arise. A long delay in accounts receivable leads to the diversion of funds from circulation – immobilization, which prevents their effective use in financing the activities of a transport organization.

The consequences of the COVID-19 pandemic have led to a weakening of payment discipline due to a decrease in the liquid funds of organizations. External sanctions pressure

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on the Russian economy leads to changes in the directions of cooperation, the choice of partners, the directions of cash flows, reduces cash receipts, which also slows down payments. The sanctions confrontation is in contradiction with the fundamental laws of the market, the principles of pricing disclosed in publications [1]. All this gives rise to crisis phenomena, in conditions of which it is necessary not only to improve the national logistics model on an international scale, but also to ensure an uninterrupted financing system. Structural changes are taking place in corporations [3, 4].

We see how the dynamics of cargo turnover of various modes of transport and types of exported and imported products are changing. There is an intensification of the development of South Asian transport routes and the reorientation of logistics to the East [5]. Logistics systems and the level of their organization forming ecosystems are changing [6]. The risk of payment delays and the occurrence of debt that is uncollectible increases [8]. All this generates crisis phenomena, in conditions of which it is necessary not only to improve the national logistics model on an international scale [9], but also to ensure a reliable financing system [10]. In addition, large territories of the Russian Federation and especially remote areas need transportation, uninterrupted supplies [11]. To do this, it is necessary that transport enterprises work sustainably and efficiently [12, 13, 14], which is impossible without stable financing – sufficient and timely receipt of payment for transport services rendered.

In the conditions of the ongoing crisis phenomena, customers of transport organizations are experiencing difficulties in providing cash for timely payments. Therefore, it is necessary to take into account the real conditions in which customers of transport services are located and their financial difficulties in order to avoid customer losses. And in this sense, a client-oriented approach is required [15]. It is necessary that the payments take into account the capabilities of customers as much as possible and minimize the losses of the transport organization in the settlements. When producing high-tech products, it is necessary to ensure its life cycle with financial resources [16]. Settlements with transport service providers on the terms of a commodity loan contribute to the uninterrupted financing of innovative manufacturers.

In these conditions, a more thorough accounting and analysis of accounts receivable is required in order to prevent interruptions in cash payments, slow down the receipt of funds for transport services rendered, strengthen payment discipline and increase the efficiency of settlements with debtors, which determines the relevance of the study and the practical significance of its results.

The problems of managing the transport component of economic security in coordination with the interests of the state are considered in the publication [17]. However, in the current conditions of the aggravation of international relations and the crisis caused by them, the need to stabilize payment is of no small importance.

The purpose of the study is to improve the system of settlements with debtors based on their turnover, a more rational distribution of repayment terms using the matrix method, methods of calculations payments and recommendations for their improvement based on calculations of accelerating receipts in order to increase the efficiency of monetary settlements and strengthen economic security.

The result of the study was the creation of a system for managing accounts receivable. Scientific novelty is the formulation of the concept of the cycle of circulation of receivables, the introduction of the indicator the rate of repayment of receivables and the development of formulas for its calculations, as well as the rationale for accelerating the payment of receivables based on the elasticity of revenue from the sale of transport services to the rate of repayment of receivables.

2 Materials, Methods

Accounts receivable management is aimed at accelerating its turn-round. Turn-round is measured in turnover days. With an increase in the number of turnover days, turn-round slows down, leading to the immobilization of funds in the form of an increase in accounts receivable. This reduces the efficiency of accounts receivable management, reduces cash receipts and leads to the emergence of uncollectible debts that can absorb the profit of a transport organization.

If, following a customer-oriented approach, the contract provides for payment within 30 days from the moment of rendering transport services, such a condition is called "gross 30". In order to encourage faster payment, the organization can set a 2% discount if the payment is made within 15 days. The rest of the payment must be made within 30 days with payment at full cost. Such changes in the order of calculations are designated "2/15 gross 30". As a result, the money will be transferred to the transport organization faster for the purpose of their additional use in commercial turnover. Consumers of services will regard the discount as a price reduction. This will lead to an acceleration of the turn-round of accounts receivable, which compensates for losses from the provision of discounts for speeding up settlements.

The turn-round of accounts receivable (days sales outstanding, DSO) is also called the average repayment period (average collection period, ACP). The turn-round calculation is carried out according to the formula:

$$DSO(ACP) = \sum_{i=1}^n D_i t_i$$

where D – is the share of the debt repaid within t days;

t – is the number of days of repayment of the debt share D ;

i – is the ordinal number of the debt share D in period t ;

n – is the number of repayment periods of accounts receivable.

If the settlements are carried out on the terms of "2/15 gross 30", and the contract provides for payment of 70% within 15 days with a discount, and the rest of the 30% debt is repaid within 30 days, then the accounts receivable will be:

$$DSO = 0,7 \cdot 15 + 0,3 \cdot 30 = 20 \text{ days.}$$

To determine an acceptable amount of accounts receivable, it is necessary to determine one-day revenue (average daily sales, ADS) as the ratio of revenue from the sale of services for the period to the number of days in the period. Then the average amount of accounts receivable during the period is determined by the product:

$$\bar{D} = DSO \cdot ADS$$

The use of the turn-round indicator of accounts receivable in the management of settlements with debtors and the assessment of payment discipline will be considered by example. There are data on the sale of transport services for the year and accounts receivable (Table).

Table 1. Systematization of the movement of accounts receivable (monetary units).

Month	Implemented in installments	Accounts receivable	By quarters		Cumulative	
			ADS	DSO. days	ADS	DSO. days
January	90000	76 500	2833.33	50	2833.33	50
February	80000	122000				
March	85000	142750				
April	75000	134750	3611.11	56	3222.22	62
May	120000	168250				
June	130000	201250				
July	135000	222750	3833.33	47	3425.93	53
August	125000	219750				
September	85000	181000				
October	80000	150250	2777.78	52	3263.89	45
November	75000	133000				
December	95000	145750				

According to the condition, 15% of customers pay for services during the month, 25% in the next month, 35% in the third month, and 25% in the fourth. This payment orderliness is maintained throughout the year. Based on these data, accounts receivable are determined at the end of the month (Table).

According to the table. in January, sales amounted to 90,000 monetary units. Within a month, 15% of sales were paid. Then the balance of the debt at the end of January will be 85% or 76,500 monetary units ($90,000 \cdot 0.85$). By the end of February, 40% plus 15% of the revenue for February will be repaid: $90\ 000 \cdot 0,6 + 80\ 000 \cdot 0,85 = 122\ 000$ At the end of March, 75% (25% left) of the debt for January, 40% (60% left) for February and 15% (85% left%) for March: $90,000 \cdot 0,25 + 80\ 000 \cdot 0,6 + 85\ 000 \cdot 0,85 = 142\ 750$ monetary units, etc.

Then we determine the one-day revenue from the sale of services (ADS), the time of the circulation of accounts receivable (DSO) in days by quarters. For the first quarter, one-day revenue will be:

$$\text{ADS} = (90\ 000 + 80\ 000 + 85\ 000) : 90 = 2833,33 \text{ monetary units}$$

Turnover (DSO) is found by the ratio of the balance of accounts receivable at the end of the quarter to one-day revenue. So the turnover for the first quarter will be 50 days ($142750 : 2833.33$).

We find cumulative values based on sales accumulated since the beginning of the year. The one-day turnover at the end of the second quarter will be:

$$\text{ADS} = (90\ 000 + 80\ 000 + 85\ 000 + 75000 + 120000 + 130000) : 180 = 3222,22 \text{ monetary units.}$$

Cumulative turn-round is found by the ratio of the balance of accounts receivable at the end of the corresponding quarter to the cumulative one-day revenue of the same quarter.

From the table. we see that a change in the volume of sales of services does not lead to a proportional change in the turn-round of accounts receivable (DSO). With an increase in sales and the balance of accounts receivable in the second quarter, we observe an increase in the DSO circulation time (II quarter). However, the largest increase in sales and the balance of accounts receivable in the third quarter is accompanied by the lowest value of the time of circulation (DSO). Therefore, the time of circulation of receivables does not fully characterize the degree of its repayment.

3 Research results

The study showed that with equal DSO indicators, the release of funds from the turnover of accounts receivable can be different. With an equal amount of repayment of receivables during the life cycle of its circulation, the funds will be used to a greater extent if the majority of customers pay it in the first month of the life cycle. The remaining part of the debt will be paid to a greater extent in the second month. So that the minimum possible part of the outstanding debt remains for each subsequent month. Thus, the acceleration of the return of receivables during the cycle of its circulation can be achieved.

The life cycle of the circulation of receivables is the period from the occurrence to the repayment of receivables.

To assess this acceleration, an indicator of the rate of repayment of receivables is needed. Such an indicator can be calculated as the sum of the ratio of debt repaid in the first month of the circulation cycle to the amount of debt repaid in subsequent months in the cycle, plus the ratio of the proportion of debt repaid in the first two months to payment for the third and subsequent months, etc. The calculation of the **rate of repayment of receivables** can be presented as a formula:

$$S = \frac{p_1}{\sum_{i=2}^n p} + \frac{\sum_{i=2}^2 p}{\sum_{i=3}^n p} + \frac{\sum_{i=2}^3 p}{\sum_{i=4}^n p} \dots \text{ etc.},$$

where p – is the amount of payment of receivables, rubles;

i – is the ordinal number of the period in the cycle of circulation of receivables;

n – is the number of periods in the cycle of accounts receivable circulation.

The repayment rate of accounts receivable can also be calculated as the sum of the ratio of the share of debt repaid in the first month of the cycle of its circulation to the share of debt paid for subsequent months, plus the ratio of the share of debt repaid in the first two months to the share of payment for the third and subsequent months, etc. This calculation can be expressed using the formula:

$$S = \frac{D_i}{\sum_{i=2}^n D} + \frac{\sum_{i=2}^2 D}{\sum_{i=3}^n D} + \frac{\sum_{i=2}^3 D}{\sum_{i=4}^n D} \dots \text{ etc.},$$

where D – is the specific weight of payment of accounts receivable;

According to the conditions of the task on the specific weights of debt payment by month, the repayment rate of accounts receivable for the quarter will be:

$$S = \frac{15}{25 + 35 + 25} + \frac{15 + 25}{35 + 25} + \frac{15 + 25 + 35}{25} = 3,84.$$

If we assume that the payment for the first month will be 25%, for the second 35%, for the third 30% and for the fourth 10%, then the repayment rate of accounts receivable will

be 10.83, which significantly exceeds the repayment rate of the same amount of debt for the same period – 4 months (the cycle of accounts receivable circulation), at which most of it occurred in later months in the circulation cycle.

When determining the repayment rate of accounts receivable, it should be taken into account how much customers are able to pay most of the debt at an earlier period of life cycle of the circulation. This can be determined using the sales elasticity indicator to the rate of repayment of payments by debtors.

$$E = \frac{S_0}{N_0^P} \cdot \frac{\Delta N^P}{\Delta S},$$

where N_0^P - is the revenue from the sale of transport services before the change in the repayment rate of accounts receivable;

ΔN^P - change in revenue from the sale of transport services as a result of changes in the repayment rate of accounts receivable.

For detailed management of accounts receivable, it is necessary to use data from analytical accounting of debtors. If such accounting is carried out using information technology, then it is easy to automatically determine the timing of the occurrence and repayment of receivables based on the relevant invoices and systematize the data in detail using the knowledge base of artificial intelligence [18, 19].

4 Conclusions

In the course of our research, having linked the volume of sales of transport services with the balance of accounts receivable and its turn-round, we found that turn-round does not have a sufficient relationship with the volume of sales of transport services and the balance of accounts receivable, and therefore does not sufficiently characterize the degree of release of funds when payments are returned by debtors. To identify ways to accelerate revenue from customers, we have introduced a new indicator – the repayment rate of accounts receivable, which determines the level of repayment of payments during the life cycle of the circulation of receivables. This indicator makes it possible to identify differences in the release of funds from debtors with equal amounts of debt over the period of its life cycle. It is proposed to check the expediency of such acceleration from the point of view of customer orientation using the indicator of sales elasticity to the rate of repayment of payments by debtors.

The results of the study will make it possible to increase the amount of cash or make up for the lack of liquid funds using the indicator of the repayment rate of accounts receivable. They are recommended for use by transport organizations to accelerate cash receipts, as well as by other organizations that sell products, works, services with payment on the terms of a commodity loan.

References

1. E. Fasoula, K. Schweikert, Journal of Transport Economics and Policy (JTEP) **54(1)**, 21-39(19) (2020)
2. V.A. Chernov, Finance: Theory and Practice **22(2)**, 124-133 (2018) DOI: 10.26794/2587-5671-2018-22-2-124-133

3. A. Gerasimenko, *Transportation Research Procedia* **63**, 21-26 (2022)
<https://doi.org/10.1016/j.trpro.2022.05.003>
4. Nannan Yu, Bo Yu, Tao Hong, Martin de Jong, *International Journal Of Transport Economics* **XLV/2** (2018)
5. E.A. Kulyagina, *Transport business in Russia* **3(160)** (2022) DOI
10.52375/20728689_2022_3_56
6. O. Pokrovskaya, R. Fedorenko, A. Musatkina, *Transportation Research Procedia* **63**, 69-77 (2022) <https://doi.org/10.1016/j.trpro.2022.05.008>.
7. V.A. Chernov, *The World of the New Economy* **16(3)**, 113-124 (2022) DOI:
10.26794/2220-6469-2022-16-3-113-124
8. O. Zhemchugova, V. Levshina, L. Levshin, *Transportation Research Procedia* **63**, 1–12 (2022) <https://doi.org/10.1016/j.trpro.2022.05.001>
9. E. Karanina, E. Selezneva, S. Chuchkalova, *IOP Conference Series: Materials Science and Engineering. VIII International Scientific Conference Transport of Siberia* **918**, 012041 (2020) doi:10.1088/1757-899X/918/1/012041
10. S.Y. Ilyin, *Transport business in Russia* **3(160)** (2022) DOI
10.52375/20728689_2022_3_6
11. M. Kuklina, V. Filippova, A. Savvinova et al, *Transportation Research Procedia* **63**, 41-47 (2022) <https://doi.org/10.1016/j.trpro.2022.05.005>
12. V.A. Chernov, *IOP Conference Series: Materials Science and Engineering. VIII International Scientific Conference Transport of Siberia* **918**, 012036 (2020)
doi:10.1088/1757-899X/918/1/012036
13. E.A. Pankratova, *Transport business in Russia* **1**, 59-61 (2020) URL:
<http://www.morvesti.ru/izdaniya/tdr/archive/2020/01.php>
14. O. Yuldashev, M. Mirkomilov, B. Eshchanov, *Journal of Transport Economics and Policy (JTEP)* **53(2)**, 135-149(15) (2019)
15. Y.A. Astafeva, E.V. Ribokene, M.Y. Makovetsky, *Transport business in Russia* **3(160)** (2022) DOI 10.52375/20728689_2022_3_53
16. A.S. Krasnikova, A.G. Podolskiy, A. Mikhalkin, *Transport business in Russia* **3(160)** (2022) DOI: 10.52375/20728689_2022_3_77
17. M. Kivarina, A. Vetkina, L. Sazhneva et al, *IOP Conference Series: Materials Science and Engineering. VIII International Scientific Conference Transport of Siberia* **918**, 012211 (2020) doi:10.1088/1757-899X/918/1/012211.
18. V.A. Chernov, *Economy of region* **16(1)**, 283-297 (2020)
<https://doi.org/10.17059/2020-1-21>
19. E.I. Pavlova, *Transport business in Russia* **1**, 100-102 (2020)