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Methodology of estimating the cost of credit resources taking into account the complexity of attracting them based on the equivalence theorem

Metodología de estimación del costo de recursos de crédito, teniendo en cuenta la complejidad de atraerlos, a partir del teorema de equivalencia

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Content

1. Introduction
2. Methodological Basis
3. Methodology
4. Results And Discussion
5. Conclusion
Acknowledgement
References

ABSTRACT:

This research studies the current state and tendencies of developing aircraft industrial enterprises. Statutory and regulatory, and methodological estimation of the credit resources cost is researched. Ways to repay the principal and interests on credits and loans are analyzed. Based on this analysis, the research formulates and proves the theorem of the equivalence of methods to repay a credit, as well as develops the methodology of estimating the cost of credit resources taking into account the complexity of attracting them, stipulates the methodic approach to defining the factor of complexity and forming the structure of financial resources of the enterprise. It is recommended to apply the offered methodology to analytically supplement the management system, to improve the efficiency of

RESUMEN:

Esta investigación estudia el estado actual y las tendencias de desarrollo de las empresas industriales de aviones. Se investiga la estimación estatutaria y regulatoria y metodológica del costo de los recursos de crédito. Se analizan las formas de amortizar el capital y los intereses de los créditos y préstamos. Con base en este análisis, la investigación formula y demuestra el teorema de la equivalencia de métodos para el pago de un crédito, así como desarrolla la metodología de estimación del coste de los recursos de crédito teniendo en cuenta la complejidad de atraerlos, El factor de complejidad y formando la estructura de los recursos financieros de la empresa. Se recomienda aplicar la metodología ofrecida para complementar analíticamente el sistema de gestión, mejorar la eficiencia de las

management solutions on implementing industrial projects on the strategic, tactical and operative levels of planning taking into account the organizational structures and peculiarities of the processes that exist at industrial enterprises.
Keywords: import substitution, industrial policy, investment resources, equivalence theorem, factor of complexity to attract credit resources, expenses on attracting credit resources, cost of credit resources.

soluciones de gestión en la implementación de proyectos industriales en los niveles estratégico, táctico y operativo de la planificación teniendo en cuenta las estructuras organizativas y las peculiaridades de los procesos existentes empresas industriales.
Palabras clave: sustitución de importaciones, política industrial, recursos de inversión, teorema de equivalencia, factor de complejidad para atraer recursos crediticios, gastos de atracción de recursos crediticios, costo de recursos crediticios.

1. Introduction

In Russia there is a concept of implementing federal programs of technological development and modernization of aircraft enterprises coordinated by the Russian President's Council. The most important task of the industrial policy of the state is to develop the aircraft industry (On State Regulating of Aircraft Development" Federal Law dated 08.01.1988; Development of Aircraft Industry for 2013-2015" State Program of the Russian Federation). Under the modern conditions, the efficiency of the industrial (technical) policy of aircraft enterprises directly depends on successful implementation of investment projects that require high volumes of financing. Such investment projects include construction of new production complexes, modernization of production capacities, and scientific and research developments. The program of stage-by-stage update of technological equipment at aircraft enterprises and their technical re-equipment is an important area of the investment activity. Import substitution and technical re-equipment of enterprises, including modernization of production capacities, acquire the primary importance (Pospelova, 2013). The conducted analysis of the aircraft enterprises state has shown that the main production funds went out-of-date, and do not comply with the modern production requirements, and the exploitation expenses are too high (Moskvicheva 2013; Moskvicheva, and Melik-Aslanova 2015). The equipment requires to be modernized in order to successfully pursue the industrial policy on the microlevel. Special role for implementing the industrial policy is given to the investment component, searching for various forms and methods of financing. Efficient management of attracting credit resources taking into account the complexity of attracting contributes to the growth of production potential of industrial enterprises (Melik-Aslanova 2016). Thus, there is a need to formulate and prove the theorem about the equivalence of ways to repay the principal of credits and loans, and to develop the methodology of estimating the cost of credit resources taking into account the complexity of attracting them.

Works of national and foreign authors consider various types of crediting, ways of repaying the principal and interests, fundamental methods of estimating the cost of credit resources for improving the efficiency of managing the strategic development of enterprises (Horn and Vahovich 2015; Troshin, et al. 2009; Troshin, Burdina, Moskvicheva, et al. 2016; Brealy and Myers 1995).

However, the theory still requires to solve issues related to proving the theorem about the equivalence of ways to repay the principal of credits and loans, to develop the methodology of estimating the cost of credit resources taking into account the complexity of attracting them, to form economic mechanisms to manage the investment component of the industrial policy for aircraft enterprises taking into account the complexity of attracting resources.

The goal of the research is to prove the theorem about the equivalence of ways to repay the principal of credits and loans and to develop the methodology of estimating the cost of credit resources taking into account the complexity of attracting them.

2. Methodological Basis

The methodological basis of the research includes provisions of the economic theory, production and banking management, investment analysis, and works of national and foreign scientists in

the area of estimating ways to repay credits and loans (Horn and Vahovich 2015; Troshin, et al. 2009; Troshin, Burdina, Moskvicheva, et al. 2016; Brealy and Myers 1995). The methodological base of the research includes modern concepts, principles of managing the strategic development of the enterprise in the context of implementing real projects (Burdina, et al., 2012). In order to solve the task on estimating the efficiency of implementing projects to modernize production capacities, methods of discounting monetary flows, investment analysis, theory of decisions taking and financial and economic analysis were applied (Troshin, Burdina, Moskvicheva, et al. 2016). In order to solve tasks of this research, system and cost approaches, and methods of economic analysis were used (Moskvicheva, Nikulina, Tarasova, et al. 2011; Nikulina, Tarasova, et al. 2009; Skrypnik 2016).

The research methodology includes the following:

1. Research of the current state and tendencies of the development of aircraft enterprises, revealing basic factors that prevent from improving the efficiency of managing the investment component of the industrial policy on the microlevel,
2. Studying the regulatory and methodological provision of the process of estimating the cost of credit resources, revealing and systematization of methodic approaches to managing investment processes at aircraft enterprises,
3. Analyzing ways to repay the principal and interests on credits and loans, formulating and proving the theorem of equivalence of ways to repay the principal of credit resources,
4. Developing tools to estimate expenses on attracting credit resources when implementing the investment component of the industrial policy of aircraft enterprises,
5. Developing the methodology to estimate the cost of credit resources taking into account the complexity of attracting them, stipulating the methodic approach to defining the factor of complexity forming the structure of resources of the investment component of the industrial policy of aircraft enterprises taking into account the complexity factor, and
6. Practical implementation of the methodology of estimating the cost of credit resources taking into account the complexity of attracting them at the aircraft enterprise.

The analysis of the practical situation shows that the decay in the Russian aircraft industry was caused by the insufficiently efficient industrial policy on the macro- and microlevel and the inaction of aircraft companies associated with it. In terms of companies of the sector, the indistinct system of taking decisions, maintaining unprofitable businesses and inefficient programs in the orders portfolio were observed. However, the main thing is that many enterprises still lack modern production complexes and technologies (Melik-Aslanova 2016). Weak role of competition caused the monopolization of suppliers and consumers, focus on the internal market, and lack of diversification to the associated (non-aircraft) markets. In this context, it is possible to observe investment attractiveness of aircraft enterprises, a high level of dependence on budgetary financing, and lagged positions on the world market of selling airplanes.

Due to the above reasons, many aircraft enterprises suffer a crisis. Technological lagging, out-of-date and inefficient technologies, the lack of the quality control, losses of the most fundamental competences in managing the technical progress, system integration, lack of qualified staff, i.e. inefficient industrial policy of enterprises prevent from solving the crisis. One of the main reasons of this state is the limited volume of own funds which does not enable aircraft companies to form and implement breakthrough projects in the relevant segment of aircraft construction.

To implement large-scale investment processes focused on modernizing production capacities of the leading enterprises of the aircraft industrial sector, the government developed federal target programs, including “Development of Aircraft Industry for 2013-2025” State Program of the Russian Federation (Development of Aircraft Industry for 2013-2015” State Program of the Russian Federation). The main resources of investments for modernizing the production base of enterprises include own and borrowed capital (Table 1). In the first variant it is necessary to single out the stock capital, accumulated depreciation, and unallocated profit. In the borrowed capital a special role is given to credits and loans in the form of corporate bonds. Every

resource of investments is related to specific expenses (Troshin, Burdina, Moskvicheva, et al. 2016; Troshin, et al. 2013; Burdina, 2007). It is the most advantageous way for the enterprise to obtain target budgetary funds on a non-repayable basis. However, such funds are limited. Besides, according to the researches, budgetary funds are spent for scientific researches and developments, and other resources are raised for implementing investment projects (Troshin, Burdina, Moskvicheva, Nikulina, Tarasova,. Rogulenko 2016; Nikulina and Tarasova 2014).

The analysis of the structure of long-term obligations of aircraft enterprises showed that 90% of enterprises used credits and loans of the United Aircraft Corporation for investment purposes. In practice it is more habitual for enterprises to use bank loans. The research showed that the volumes of debt obligations of enterprises on credits were growing (Melik-Aslanova 2016; Moskvicheva and Melik-Aslanova 2015).

Table 1. Peculiarities of Using Own and Borrowed capital at Aircraft Enterprises

	Advantages	Disadvantages
Own capital	Simple to raise	Limitation of the volume to raise
	Ability to generate profit in all areas of activity	Higher cost of attraction as compared to borrowed resources
	Providing financial stability, payment capacity	Lack of the growth of profitability of own capital due to attracting borrowed capital
Borrowed capital	Great opportunity for attracting	Decrease in the payment capacity and negative impact on the financial stability
	Possibility of the financial potential growth	Assets generate a lower profit
	Increase in the profitability of own capital	Dependence on fluctuations of the fund market
		Complexity of the raising procedure

3. Methodology

3.1. Formulating Theorem about Equivalence of Ways to Repay the Principal of Credits and Loans

Under the modern conditions, attracting credits and loans is extremely important for developing aircraft enterprises. Crediting process mediates the accelerated diversification of business, contributes to competitive struggle, taking on the sales market, etc. Thus, when attracting credits and loans, taking economically grounded decisions is an actual task that touches on many parties in interest. Mathematical apparatus and technology of payment mechanisms allow obtaining information required for taking a decision. However, due to the insufficiently accurate mathematical description of a number of important provisions on the fundamental level, the values that are not significant economically are built in the applied tasks when setting them. In some cases they are used as an objective function (for example, “minimum upcharge”, “without credit upcharge”, etc.). It disfigures the final conclusions. This article is devoted to one of such provisions related to selecting a method to repay the principal of credits and loans.

The schedule of payment on credits and loans, mainly, depends on the following conditions:

1. Term of provision,
2. Term of the privileged period,
3. Size and type of the interest rate,
4. Way of accruing and paying interests,
5. Way to repay the principal, and
6. Procedure of accruing and paying a commission fee (additional charges of the borrower).

Various combinations of the above conditions define various schemes of mutual settlements between the lender/creditor and the borrower. The annuity scheme, equal repaying, repayment of the principal at the end of the lending/crediting term, etc. are the most wide-spread schemes in practice. It is necessary to note that various schemes of mutual settlements have been widespread in practice due to a good theoretical base and mathematical apparatus for settlements.

Let's consider the case (hereinafter referred to as "Case A") where schemes of mutual settlements differ only by the way to repay the principal, and the other conditions are the same and look as follows:

1. Term of provision – any, final,
2. Privileged period – no,
3. The interest rate is constant during the whole term of the loan and is higher than zero, which is a required condition of the theory about the temporary value of money,
4. Moments of periodical accrual and payment of interests coincide, and
5. Additional commissions are not charged from the borrower.

When fulfilling the condition about the collectibility, ways of repaying the principal for Case A are equivalent in relation to the efficient rate on the credit and loan.

Basic definitions for the further mathematical record of the theorem and its accurate proving will be determined below.

n is final term of repaying the credit/loan. To simplify further reasoning and keeping the commonality, the periodicity of accruing and paying the interest is defined as n.

i is the interest rate on the credit/loan. To simplify further reasoning and keeping the commonality, the interest rate will be considered as determined for the selected interval of accruing and paying interests.

ir is efficient rate on the credit/loan for the selected interval of accruing and paying interests.

$i, ir > 0$ is the required condition of the existence of the theory about the temporary value of money,

S_0 is the sum of the principal. When making the plan of the monetary flow on the credit/loan, $S_0 < 0$,

S_j, I_j are amounts paid by the borrower for repaying the principal and interests, $\forall j \in [1, n]$. When making the plan of the monetary flow on the credit/loan, $S_j \geq 0$, $I_j > 0$, $\forall j \in [1, n]$, and $\sum_{j=1}^{n} S_j = -S_0$ is the condition of the credit/loan return.

The theorem "On Equivalence of Ways of Repaying the Principal of Credits and Loans" states that for the set conditions (Case A), $ir_1 = ir_2 = ir_3$.

Proof

□ In the general case the formula for defining the k payment on the credit/loan will be as follows (D_k).

$$D_k = S_k + i \cdot \sum_{j=k}^{n} S_j, \tag{1}$$

Then by convention the efficient rate for Case A is defined as the solution of equation (2) in relation to ir.

$$\sum_{j=1}^{n} \frac{S_j + i \cdot \sum_{k=j}^{n} S_k}{(1+ir)^j} + S_0 = 0, \tag{2}$$

Then let's reveal the formula under the integral sign with the double sum.

$$\sum_{j=1}^{n}\frac{i\cdot\sum_{k=j}^{n}S_k}{(1+ir)^j}=i\cdot\left(\frac{S_1+S_2+\ldots+S_n}{(1+ir)}+\frac{S_2+\ldots+S_n}{(1+ir)^2}+\ldots+\frac{S_n}{(1+ir)^n}\right)$$

The facients under every S_j make up a geometrical progression that has *j* elements, and the ratio from dividing two proximate elements is $q=\frac{1}{(1+ir)}$. According to the formula for the sum of *j* elements of the geometrical progression $\left[S=b_1\cdot\frac{q^j-1}{q-1},\ \text{where}\ b_1=\frac{S_j}{1+ir}\right]$, let's continue transforming the formula under the integral sign with the double sum.

$$i\cdot\left(\frac{S_1+S_2+\ldots+S_n}{(1+ir)}+\frac{S_2+\ldots+S_n}{(1+ir)^2}+\ldots+\frac{S_n}{(1+ir)^n}\right)=i\cdot\sum_{j=1}^{n}\frac{S_j}{(1+ir)}\cdot\frac{(1+ir)^{-j}-1}{(1+ir)^{-1}-1}=i\cdot\sum_{j=1}^{n}S_j\cdot\frac{(1+ir)^j-1}{(1+ir)^j\cdot ir}$$

Taking into account the transformations that were made, let's represent formula (2) as follows:

$$\sum_{j=1}^{n}\frac{S_j}{(1+ir)^j}+i\cdot\sum_{j=1}^{n}S_j\frac{(1+ir)^j-1}{(1+ir)^j\cdot ir}-\sum_{j=1}^{n}S_j=0, \qquad (3)$$

Let's transform the left part (3).

$$\sum_{j=1}^{n}\frac{S_j}{(1+ir)^j}+i\cdot\sum_{j=1}^{n}S_j\frac{(1+ir)^j-1}{(1+ir)^j\cdot ir}-\sum_{j=1}^{n}S_j=\sum_{j=1}^{n}\frac{S_j\cdot ir+i\cdot S_j\cdot[(1+ir)^j-1]-S_j\cdot(1+ir)^j\cdot ir}{(1+ir)^j\cdot ir}=$$

$$\sum_{j=1}^{n}S_j\cdot\frac{ir+i\cdot(1+ir)^j-i-(1+ir)^j\cdot ir}{(1+ir)^j\cdot ir}=\sum_{j=1}^{n}S_j\cdot\frac{(i-ir)\cdot[(1+ir)^j-1]}{(1+ir)^j\cdot ir}$$

After the transformations, the equation for defining the efficient rate will look as follows (4).

$$\sum_{j=1}^{n}S_j\cdot\frac{(i-ir)\cdot[(1+ir)^j-1]}{(1+ir)^j\cdot ir}=0, \quad (4)$$

Let's introduce the definition $\alpha_j=\frac{(i-ir)\cdot[(1+ir)^j-1]}{(1+ir)^j\cdot ir}$. Then let's consider the following cases:

1. For the interval $0<ir<i$, $\alpha_j>0$, consequently, $\sum_{j=1}^{n}S_j\cdot\alpha_j>0$, i.e. when fulfilling the condition of collectability, there is at least one payment within repaying the principal $S_j>0$. Consequently, any value ir from this interval is not the solution of equation (4).
2. For the interval $ir>i$, $\alpha_j<0$, consequently, $\sum_{j=1}^{n}S_j\cdot\alpha_j<0$, i.e. there is at least one payment within repaying the principal $S_j>0$. Consequently, any value ir from this interval is not the solution of equation (4).
3. For the value $ir=i$, $\alpha_j=0$, consequently, $\sum_{j=1}^{n}S_j\cdot\alpha_j=0$, for $\forall S_j$, i.e. any scheme of repaying the principal. Consequently, $ir=i$ is the only solution of equation (4).

The only solution of equation (4) was obtained for any ways to repay the principal (combination S_j), i.e. their equivalence was proved in relation to the efficient rate on the credit/loan. The theorem was proved. Consequences from the theorem:

1. In Case A, regardless of the way of repaying the principal, monetary funds on the granted credits/loans are allocated at the efficient rate that is equal to the interest rate.
2. Comparison of the schemes related to repaying the principal in terms of overpayment or minimization of interests payment has no economic sense.
3. Allocation during repaying the principal is mainly related to the indicators of the creditor's or borrower's liquidity, and the borrower's possibility to replace credits/loans by its own funds.
4. If the approach to accruing/paying the commission coincides with the algorithm of accruing/paying interests (extended Case A), the efficient rate is defined by using formula (5)

$$ir=i+ic, \quad (5)$$

where ic is the amount of the commission remuneration.

Mathematically accurately formulated and proved theorem "On Equivalence of Ways to Repay the Principal of Credits and Loans" supplements theoretical provisions of the fundamental level, and consequences following from it will enable industrial enterprises to practically take grounded financial decisions.

3.2. Methodology of Estimating the Cost of Credit Resources Taking into Account the Complexity of Attracting Them

Attracting credit resources for modernizing projects of aircraft enterprises is related to expenses. Expenses on attracting credits include interest payments, commission for various services, including the one for opening a credit line. The need in taking into account the factor of complexity when analyzing expenses on attracting capital is hypothesized:

$$Ex_{cr}^{attr.res.} = \sum_{j=1}^{N} \frac{D_j n_j + Ex_{cr_j}^{compl}}{(1+r_{cr})^j} \quad (6)$$

where $Ex_{cr}^{attr.res.}$ are expenses on the credit, RUB,

n_j is interest rate of the j period, in shares,

$_{Bj}$ is amount of the debt of the j period, RUB,

r_{cr} is rate of discounting taking into account the interest rate, in shares,

j is period of payments, and

$Ex_{cr_j}^{compl}$ are expenses related to the complexity of attracting credits, RUB.

However, it is important to reveal a number of peculiarities and reasons of the organizational nature that make it difficult to obtain the required volumes of investment resources. These reasons can be characterized as a factor of complexity to obtain funds. The quotient of complexity to obtain the i investment resource is defined by the scoring system. The higher is the value of the quotient of attracting funds of the i resource, the less possible is the share of the i resource in the volume of investments.

Every enterprise individually defines quotients of the complexity related to attracting financial resources. The structure of factors taken into account when forming values of complexity quotients is shown in Table 2.

It is offered to define the complexity of attracting various resources of capital as the growth of the price of a specific capital resource in interests R_j. Expenses related to the complexity of attracting various resources $Ex_{leas}^{attr.res.}$ $Ex_{obl}^{attr.res.}$ $Ex_{cr}^{attr.res.}$ $Ex_{equity}^{attr.res.}$ are defined taking into account R_j,

where $Ex_{leas}^{attr.res.}$ are expenses on the leasing, RUB;

$Ex_{obl}^{attr.res.}$ are expenses on the bonded loan, RUB;

$Ex_{cr}^{attr.res.}$ are expenses on the credit, RUB;

$Ex_{sh}^{attr.res.}$ are expenses on the credit, RUB.

The parameter of complexity related to attracting investment resources has an impact on the indicator of the comprehensive value of providing the project with investment resources. It is recommended to use this indicator that takes into account the factor of complexity of attracting investment resources when implementing the goals of the industrial policy on the microlevel.

The calculation model of the parameter related to the complexity of attracting resources is:

$$R_j = \sum_{i=1}^{n} B_{ji} R_{ji} \quad (7)$$

where *Rji* is the percent of complexity of attracting the *i* component of the *j* investment resource (it is defined by the expert method), in %,

Bji is the importance of every component of the complexity factor, in shares, and

n is number of components that characterize the complexity parameter.

The research offers methodic recommendations on defining the parameter of complexity related to attracting investment resources.

The percent of complexity related to attracting the *i* component of the *j* investment resource is defined by the expert method that takes into account the required conditions for attracting investment resources.

The table is made for every resource. It includes the relevant indicators that define the size of the complexity factor. The represented indicators are average in the aircraft sector (Melik-Aslanova 2016; Skrypnik, 2016).

The percent of complexity related to attracting the component is classified into three categories of complexity (low 1-3, medium 3-6, and high 6-10). Points are defined for every category of complexity. Depending on the result, the interval of the percent of the complexity related to attracting the component is defined (Table 2).

If the maximum number of points is 2.00, this complexity factor falls within the interval of the 1st complexity category (minimum). If the maximum number of points is 5.00, this complexity factor falls within the interval of the 2nd complexity category (medium), and if the maximum number of points is 8.00, this factor of complexity falls within the interval of the 3rd complexity category (maximum) (Burdina, and Melik-Aslanova 2015; Burdina and Soloveva 2013).

In accordance with the developed methodic tools, the price of the *j* investment is corrected in compliance with the complexity factor:

$$Pjcorr = Pj + Rj \quad (8)$$

where *Pj* is the price of the investment resource, %;

Rj is parameter (indicator) of complexity related to attracting the *j* investment resource, %.

Table 2 shows the tools to estimate expenses on attracting credit resources that take into account the complexity of attracting when implementing the investment component of the industrial policy pursued by aircraft enterprises taking into account the sectoral specificity (Burdina and Melik-Aslanova 2015).

Table 2. Defining the Parameter of Complexity to Attract the Investment Resource (Bank Loans)

Time of obtaining funds,%	Rt, loan					
		2,0		5,0		8,0
Time of waiting for obtaining monetary funds after collecting documents	< =10 days	2.0	(10;60]	5.0	> 60 days	8.0

Attraction probability	Rap, loan.					
		2,00		5,00		8,00
System of indicators of estimating structural components of the investment element (Block – indicators of the investment attractiveness estimation):						
Equity ratio	≥ 0.5	0.18	[0.1;0.5)	0.45	< 0.1	0.73
Quotient of the relation of the borrowed resources to the own ones	≤0.5	0.18	(0.5;1.0]	0.45	> 1.0	0.73
Profitability of the capital stock	≥ 0.25	0.18	[0.10;0.25)	0.45	< 0.10	0.73
Sales profitability	≥ 0.50	0.18	[0.40;0.50)	0.45	< 0.40	0.73
Profitability of own capital	≥ 0.25	0.18	[0.10;0.25)	0.45	< 0.10	0.73
Quotient of absolute liquidity	≥ 0.2	0.18	[0.08;0.2)	0.45	< 0.08	0.73
Quotient of intermediary liquidity	≥0.75	0.18	[0.50;0.75)	0.45	< 0.50	0.73
Quotient of current liquidity	≥2.50	0.18	[1.80;2.50)	0.45	< 1.80	0.73
System of indicators of estimating structural components of the investment element (Block – indicators of the investment attractiveness estimation):						
Term of the project re-payment, years	≤ 3	0.18	(3;6]	0.45	>6	0.73
Index of investments profitability, quotient	≥1.6	0.18	[1.1;1.6)	0.45	<1.1	0.73
Internal standard of profitability, quotient	≥0.25	0.18	[0.15;0.25)	0.45	<0.15	0.73

Security	Rs,y,loan					
		2,00		5,00		8,00
System of indicators of estimating structural components of the investment element (Block – indicators of the investment attractiveness estimation):						
Quotient of depreciation of fixed assets	≤ 0.5	0.18	(0.5;0.75]	0.45	>0.75	0.73
Quotient of suitability of fixed assets	≥0.5	0.18	[0.25;0.5)	0.45	<0.25	0.73
Quotient of update	≥ 0.5	0.18	[0.1;0.5)	0.45	<0.1	0.73
Including active fixed assets	≥ 0.5	0.18	[0.1;0.5)	0.45	<0.1	0.73
Retirement rate	≥ 0.2	0.18	[0.08;0.2)	0.45	<0.08	0.73
Including active fixed assets	≥ 0.2	0.18	[0.08;0.2)	0.45	<0.08	0.73
Quotient of real value of fixed assets in the organization’s property	≥ 0.5	0.18	[0.2;0.5)	0.45	<0.2	0.73
Level of technical equipment	≥ 0.3	0.18	[0.08;0.3)	0.45	<0.08	0.73
Returns on assets	≥1.5	0.18	[1.0;1.5)	0.45	<1.0	0.73
Return on production assets	≥0.2	0.18	[0.1;0.2)	0.45	<0.1	0.73
Counter-security	≥0.5	0.18	[0.2;0.5)	0.45	<0.2	0.73
Documents, registration	Rd,r, loan					
		2,00		5,00		8,00
Collection of						

financial documents (financial reports, certificates from tax authorities and funds, certificates about invoice turnovers), days	< =1	0.67	(1;5]	1.67	> 5	2.67
Preparing business-plan, business case, days	< =30	0.67	(30 -60]	1.67	> 60	2.67
Conclusion, prolongation of agreements, days	< =5	0.67	(5 -25]	1.67	> 25	2.67
Readiness of staff for work on attracting credit funds	Rr, loan					
		2.00		5.00		8.00
Quality of employees' financial education	High level	0.67	Medium level	1.67	Low level	2.67
Previous experience of attracting loans	Positive	0.67	partially	1.67	negative	2.67
Staff's experience, years	>=7	0.67	[3-7)	1.67	<3	2.67
Owners' consent	Roc,loan					
		2,00		5,00		8,00
Term of obtaining owners' consent, days	< =30	1.00	(30 -60]	2.50	> 60 days	4.00
Expenses for obtaining	< =0.1 % of the	1.00	(0.1;0.3]	2.50	> 0.3 % of the	4.00

owners' consent	amount				amount	
Defining the complexity parameter	Rt,loan.*Bt+Rвп,loan*Bap+Rs,y,loan*Bs,y+Rd,r,loan*Bd,r+Rr,loan*Br+ +Roc,loan*Boc					

4. Results And Discussion

The developed methodology of estimating the cost of credit resources taking into account the complexity of attracting them based on the equivalence theorem was tested at the Kazan Aircraft Plant. The Kazan Aircraft Plant is a modern enterprise with the high intellectual and technical potential. It is a unique aircraft complex in the Russian Federation. The main areas of its production policy include the batch manufacturing of the modernized TU-160, and works on mastering the manufacture of empennage for the Il-75-MD90A airplane. It pre-determines the investment strategy of the enterprise focused on the modernization of production capacities. The attraction of investment resources by the enterprise to modernize its production capacities is possible by bank loaning, issue of bonds, and leasing, the cost of which is shown in Table 3.

Table 3. Expenses Related to Attracting Investment Resources by the Kazan Aircraft Plant

Resources of investment resources	Payments	Resources estimation
Bank loans	Interest payments	15%
Bond-secured loan	Coupon payments	14%
Leasing	Leasing payments	17%

The enterprise management had estimated the cost of raising investment resources and chose the bank loan because the issue of bonds required a long-term procedure of preparing documents, and the leasing is the most expensive investment resource. At the same time, the estimation of the parameter related to the complexity of attracting and using of the bank loan can change the initial conclusions about the cost of these resources (Table 4).

Table 4. Calculation of the Parameter Related to Complexity of Attracting Investment Resources by Enterprise

Indicator	Credits	Leasing	Value
Time	5	2	0.3
Probability of attracting	7	7	0.2
Security, guarantees	8	2	0.2
Documents, registration	8	5	0.1
Readiness of staff for the work on attracting capital	2	2	0.1

Owners' consent	4	2	0.1
Total parameter of complexity factor, %	5.9	3.3	1
Price,%	15	17	
Price taking into account the complexity to attract capital, %	20.9	20.3	

Thus, calculations on the methodology of estimating the cost of credit resources taking into account the complexity of attracting them based on the equivalence theorem show that in this context the leasing was more advantageous than the credit.

5. Conclusion

The results of the research described in the article contain theoretical and methodical, and scientific and practical results on the issues related to analyzing the cost of credit resources taking into account the complexity of attracting them based on the equivalence theorem.

Studying the regulatory, methodological and methodic provisions and analyzing the current practice in Russia and abroad enabled the authors to make conclusions about the current state and tendencies of the development of aircraft enterprises, and to determine the main factors preventing the improvement of the efficiency of managing the investment component of industrial policy of enterprises.

The analysis of the practical situation revealed the reasons why aircraft enterprises raise insufficient volumes of investment funds to modernize production capacities, peculiarities and reasons of the organizational nature that made the raising of the required volumes of investments for implementing system-forming projects difficult. It is possible to show these reasons through the parameters of the factor related to the complexity of receiving funds.

The article states the methodology of estimating the cost of credit resources taking into account the complexity of attracting them based on the equivalence theorem. The latter makes it possible to quantitatively estimate the cost of credit resources taking into account attracting them to implement sectorial projects, to forecast changes in the resources structure, and as a consequence, to purposefully correct the system of projects management under various conditions of the economy state. The methodology of estimating the cost of credit resource taking into account the complexity of attracting them based on the equivalence theorem was practically implemented at the Kazan Aircraft Plant. The veracity of the results obtained by the authors is stipulated by using the data published in official periodicals of the Russian Federation, official reports of enterprises and organizations, and is confirmed by applying the materiality qualifiers.

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[Índice]