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MANAGEMENT OF FINANCIAL FLOWS

in the Supply Chain of Industrial Enterprises

Monograph

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It was outlined methodological basis first in monograph for the organization and management of working capital calculations in the payments step in the concept of supply chain management. Organizational and economic essence and role of payments in the supply chain of industrial enterprises were disclosed. The method and the original economic and mathematical model were given for determining the optimal values of the working capital in the payments step in close connection with the financial environment. It was proved the necessity and appropriateness of the "lean" management technology using in the organization and management of mutual settlements. The basic options of "lean" management of mutual settlements were developed on this basis, involving corporate and banking bills, warehouse certificates, and the pass-through shoulder method.

The monograph is intended for students and master students of economic specialties, MBA programs, professors, graduate students and experts engaged with working capital management, financial flows, mutual settlements, and logistics.

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CONTENTS

INTRODUCTION

Relevance of the research topic. Currently, current problems of industrial enterprises are widely discussed in the press and scientific publications. The variants of the development and improvement of economic relations between entities suggest capable of adapting them to the crisis conditions. However, an integrated approach to the organization and optimization of settlements in the supply chain of industrial enterprises is underutilized. At the same time, this approach allows to create the necessary adaptation effect and to create prerequisites for development of economic relations.

Analysis of the current state of the management of funds in circulation revealed that:

• theoretical and methodological framework of the working capital control in stage of calculations elaborated insufficiently;

• there is no systematic approach to the organization of settlements in most industrial enterprises requiring harmonization of all functional stages of capital turnover;

• no methodology of the mutual management in the SCM concept (Supply Chains Management), the most full reflecting modern integration processes in industry;

• "lean" management technology is not adapted to the calculations;

• the organization of mutual settlements and their impact on the final financial result of the company not developed.

The degree of a problem elaboration. Organization and working capital management of industrial enterprises considered in works of M.I. Bakanov, I.T. Balabanov, I.A. Blanc, Y.F. Brigham, J.K. Van Horn, L.A. Drobozina, V.V. Kovalev, M.N. Kreynina, A.A. Maksyutov, V.M. Rodionova, G.V. Savitskaya, R.S. Sayfulin, E.V. Semenkova, J.G. Siegel, V.A. Slepov, E.S. Stoyanova, N.D. Fasolyak, M.A. Fedotova, D. Khan, A.D. Sheremet, J. Shima, P.I. Shulyak and others. Various aspects of the working capital research studied by the Urals scientists V.P. Ivanjicki, O.B. Veretennikova, V.N. Smagin, A.G. Butrin, A.S. Tcherevko, E.V. Bashlykov, M. J. Khodorowsky, O.V. Zubkova and others. Questions of of supply chains organization are considered in scientific works of V.I. Sergeev, A.P. Garnov, J.G. Lebedev, V.S. Lukinskiy, D.T. Novikov. The main provisions of the working capital management revealed in these studies, and important methodological developments in the exploration and evaluation of the effectiveness of working capital management and supply chain management are presented. At the same time, how to optimize working capital in terms of settlements in the supply chain is not fully explored. Relevance and practical importance of this problem determined the choice of research topics, setting goals and objectives, and contents.

The purpose and objectives of the study. The purpose is to improve the methodological tools of organization and management of working capital in the payments stage in the supply chain of industrial enterprise. Achieving this goal required solving the following tasks:

- to reveal the organizational and economic nature and characteristics of working capital in the supply chain of industrial enterprises;

- to develop a method for optimizing the supply chain of industrial enterprise.

- to develop the economic and mathematical model for determining the optimal parameters of the supply chain of industrial enterprises;

- to propose a method for identifying and implementing of positive synergies by accelerating turnover of working capital arising from the interaction of supply chains of industrial enterprises;

- to form an algorithm of "lean" working capital management in mutual settlements stage in the supply chain of industrial enterprise.

Supply chain of industrial enterprise is the object of study. Organizational and economic relations arising in the process of the industrial enterprise's working capital formation in payments stage are subjects of research.

Scientific statements and conclusions based on the studying of domestic and foreign economic literature, thematic periodicals materials about the management of working capital were theoretical and methodological basis of the research. To solve the problems mathematical simulation methods were applied.

Laws and regulations, Internet materials, dissertation research, statistics made an information base of this work.

Scientific novelty of the research is to develop methodological principles of the optimal parameters of working capital formation in the calculation stage in the supply chain of industrial enterprise, and to obtain the following results.

1. Organizational and economic nature and characteristics of working capital are disclosed emerging at the stage mutual settlements in the supply chain of industrial enterprise. The necessity of applying the concept of supply chain management justified for the mutual settlements formation and control. Organizational and economic nature disclosed of a document of title as reflecting a bi-unity of material and financial subsystems of working capital, features of mutual settlements chains functioning disclosed. The concepts of "calculations chain in delayed finance mode", and "calculations chain in outpaced finance mode" first introduced.

2. Methods for mutual settlements optimization developed of industrial enterprise as the focus of the supply chain. Unlike existing methods, the proposed method is based on intersystem approach and allows determining the optimal mutual settlements parameters of supply chain participants.

3. Economic and mathematical model developed and tested for determining the optimum parameters of the industrial enterprise supply chain.

4. A method for determining and implementing positive synergies developed in the form of additional profit by accelerating the working capital turnover arising from the interaction of supply chains of industrial enterprise. Synergy basis is supply chains multiplication achieved by structuring of financial flows by documents of title.

5. An algorithm generated of "lean" working capital management in the settlement stage in the supply chain of industrial enterprise. The necessity and the possibility of "lean production" technology using grounded to manage the financial elements of working capital. Algorithm allowed for the first time identifying and implementing 14 options of funds in circulation organization in the chain "first-tier supplier – producer – first-tier consumer" to accelerate the turnover of capital, cost reduction, the release of monetary funds.

Validity and reliability of scientific statements, conclusions and recommendations in this monograph confirmed by:

• using a significant amount of factual material about enterprises in Russia and Chelyabinsk region, during the analysis of the industry conditions;

• correct use of modeling techniques, statistical analysis, expert assessments, and system analysis;

• approbation and convergence of theoretical conclusions, as well as models and methods based on these.

The practical significance of the work lies in the fact that the results allow to move from intuitive basis to scientific justification of the management decisions made by industrial enterprises management in the process of working capital control policy formation. Conclusions and methodological developments are of practical importance and can be used by managers and specialists of the economic departments of enterprises. The monograph contains a specific calculation forms and computer support of management decisions.

Key work provisions performed under the RF Ministry AVTSP "Development of Scientific Potential of Higher Education", and "Design, study and optimization of efficient supply chain of industrial enterprise» project (N 2.1.3/643).

The urgency of the research topic, the purpose and objectives, the subject and object of research, methodological and information base, the characteristic of scientific novelty and practical significance of the work presented in the introduction.

The peculiarities of modern industrial working capital disclosed in the first chapter "Working capital of industrial enterprise as a control object", also established a key role in ensuring the continuity of settlement circuit of the working capital. It has been concluded on the basis of analysis of scientific publications that there are shortcomings of the current stage of the organization and management of working capital under settlements, and as a consequence, the need for additional studies on the improvement of the mechanism determining the optimum parameters of working capital under calculations.

Organizational and economic characteristics and management principles of mutual settlements in the supply chain of an industrial enterprise disclosed in the second chapter, "Methodical bases of organization and management of mutual settlements in the supply chain of industrial enterprise". As well as it has been proved the necessity of applying the concept of supply chain management in the formation and management of

funds in circulation under mutual settlement. One has analyzed the mechanism of working capital formation of enterprises through the use of corporate, bank bills and warehouse certificates, and a method for optimizing the funds in circulation under calculations has been developed.

Economic and mathematical model allowing to determine the optimal parameters of the supply chain enterprise multiplying, proposed in the third chapter, "Economic and mathematical modeling of the mutual settlements". The algorithm developed of lean working capital management under settlements in the supply chain of industrial enterprise.

The results of scientific research summarized in conclusion, as well as formulated the basic conclusions.

CHAPTER 1. WORKING CAPITAL OF INDUSTRIAL ENTERPRISE AS A CONTROL OBJECT

1.1. Working capital of industrial enterprise: working capital consist, structure, circulation, management principles

The working capital of the enterprise in enterprise economic theory is treated as assets, renewable with some regularity to ensure ongoing activities, turnover period for investments in which is a year or one production cycle.

Working capital of the enterprise is characterized by the following features:

- working capital must be invested in advance, that is, to advance before income receiving;
- working capital advanced in the most liquid resources is not consumed and not consumed, but it must be constantly renewed in the economic circulation;
- the absolute need for working capital depends on the volume of economic activity, supply and marketing conditions and therefore this need is subject to regulation.

As is known, the working capital is divided by composition into two components: current assets and funds in circulation (Fig. 1.1). Integration of the funds in circulation and current assets into a single system of working capital follows from the continuity of the advanced value during three mentioned stages of their circuit.

Economic, organizational and production results from storing a particular type of current assets in a given volume is specific to this type of assets. For example, a large stock of finished goods associated with the expected volume of sales, reduces the possibility of products shortage in case of unexpectedly high demand. Similarly, large enough stock of raw materials saves the company from downtime or purchasing more expensive substitutes in case of a sudden lack of adequate stocks.

The amount of current assets in current production assets is determined, by primarily organizational and technical level of production and by duration of the production cycle of the products being manufactured.

An important component of working capital are funds in circulation, consisting of finished goods in sale, and enterprise's money funds, including receivables, a component having a special value. Its value is determined by such factors as type of the product, size of the market, the competition, market saturation of these products, accounting system adopted at the enterprise. Specific element of receivables are promissory notes receivable.

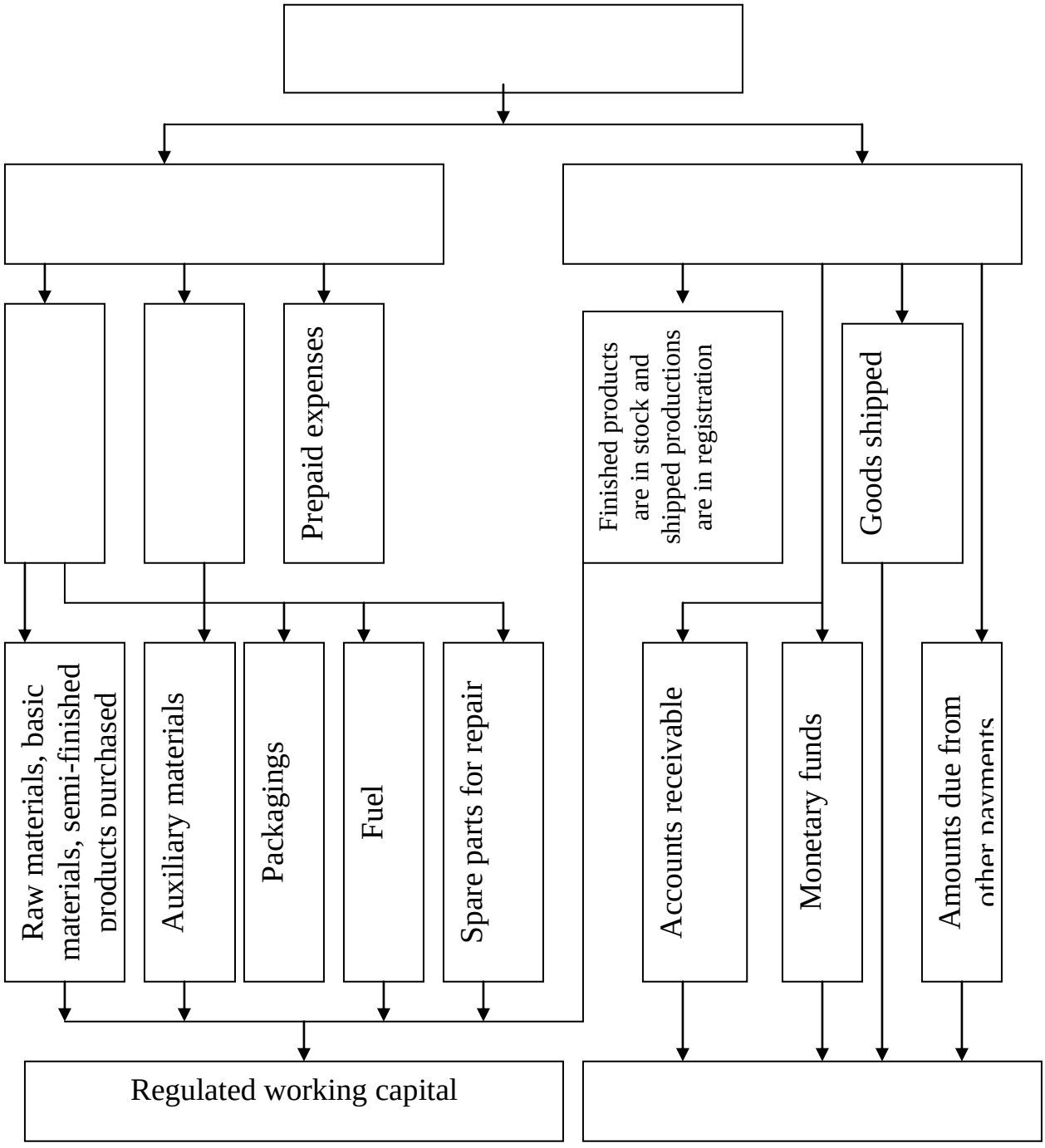

Fig. 1.1. Structure and deployment of the working capital

Money funds and securities are the most liquid part of the working capital. From the standpoint of investment theory money funds are a special case of investment in material assets. Therefore general requirements are applicable to them. First, a basic cash reserves is necessary to meet current payments. Second, some money funds require covering unforeseen expenses. Thirdly, it is advisable to have a certain amount of free money funds to enable possible or projected expansion. However money funds reserves

have an upper limit. The fact is that the liquidity price increases as the increasing cash reserves. If the share of money funds in the enterprise assets is low, a small additional cash inflow can be extremely useful; otherwise it will be not profitable.

Funds in circulation are not involved in the cost formation, but they are carriers of the cost already created. The main purpose of the funds in circulation is to provide rhythm of the circulation process by payment means. The volume of working capital involved in the funds in circulation depends on the sales conditions, goods movement system, the organization of marketing and sales.

The main characteristics of the working capital are its liquidity, volume and structure. Current assets have varying by degrees of liquidity, that is, their ability to be transformed into cash, possessing absolute liquidity. Monetary equivalents are most similar to the degree of liquidity to the money funds. Liquidity of receivables can already vary significantly. The least liquidity has inventories. Of these, the finished products are more liquid than raw materials. To analyze the composition and structure of working capital it is useful to classify them according to the following criteria (Figure 1.2). The ratio of individual components of working capital in their total value describes the structure of working capital. Structure of working capital depends on several factors and varies over time; it has significant differences in different industries and expresses the specific features of the production process, technology, production organization and sales conditions. The volume of working capital is determined not only the needs of the production process, but also by random factors.

Circuit of the company working capital has a cyclic nature (Fig. 1.3). Cycle of the capital movement corresponds to the logical sequence of production and financial cycle: from the purchase of raw materials to the sale of produced goods and receiving payment from buyers. Added value generated at the stage of product sales, which is a profit and it increases working capital.

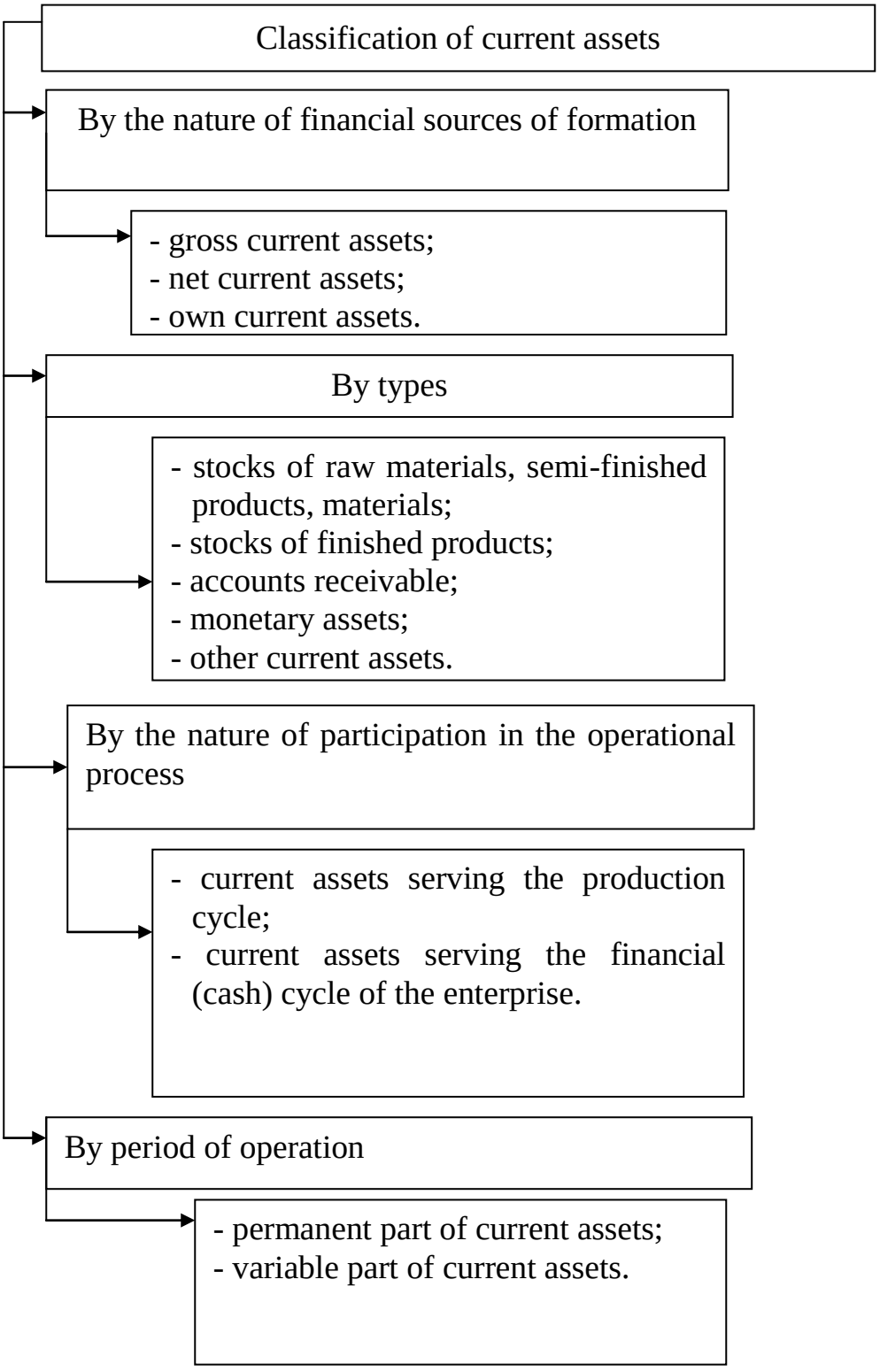

Fig. 1.2. Classification of current assets of the enterprise

Cyclic motion of the working capital is a significant factor in the analysis and management of working capital [6]. Working capital makes one operating cycle for the

full circuit. Operating cycle shows the time from the cash advance in stocks of raw materials to getting revenue from the consumer. Financial cycle shows the time between the cash outflow due to the implementation of current operations, and its inflow as a result of industrial and financial activity. Thus, production and technical part of the enterprise activity largely characterizes operating cycle and financial aspect characterizes financial cycle.

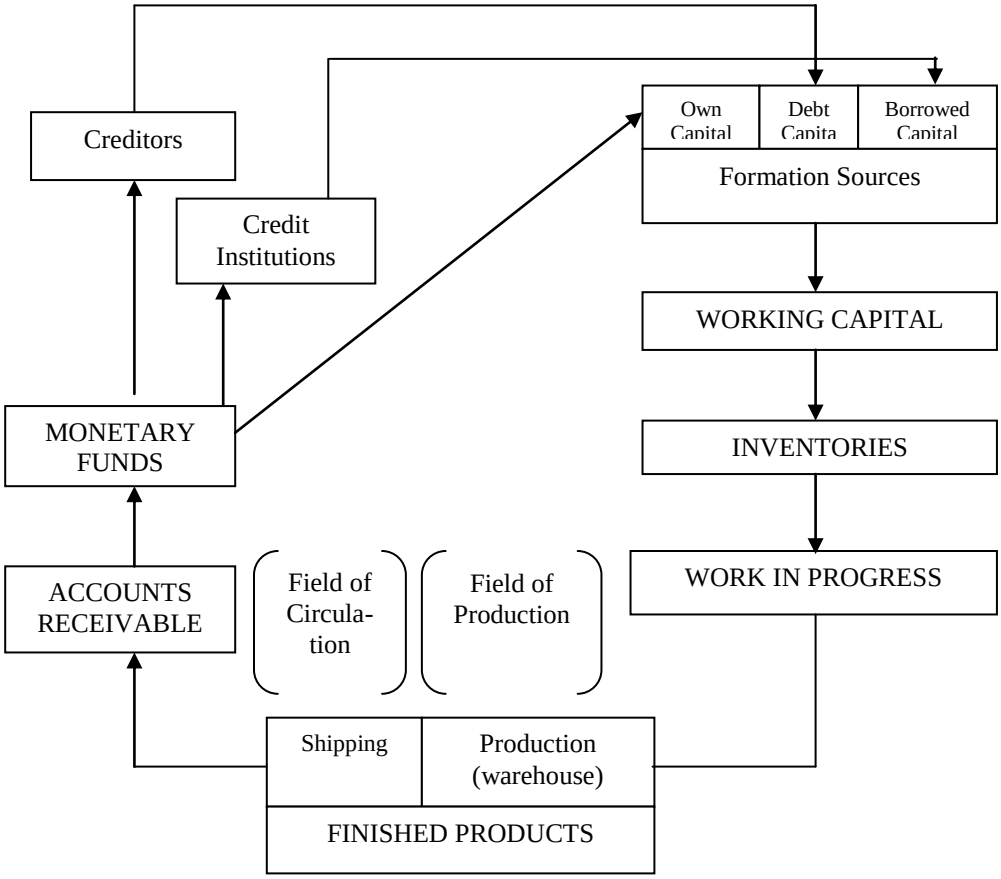

Fig. 1.3. Turnover of the working capital

An important task of working capital management is to define the scope and structure of current assets, the sources of their coverage and such a relation between them that would ensure efficient industrial and financial activity of the company. It is important to maintain the working capital in the volume optimizing management of current activities. Working capital management policy should to provide a search for compromise between liquidity loss risk and operational efficiency. This boils down to solving of two important problems: ensuring solvency, and acceptable amount of assets, their structure and profitability of assets.

Finding ways to reach a compromise between profit, liquidity loss risk and status of working capital; and sources of their coverage involves the analysis of various types of risks. Liquidity risk or reduced effectiveness risk due to changes in current assets,

referred to as left-sided. Similar risk, but due to changes in the commitments called as right-sided by analogy.

Let us distinguish phenomena potentially carrying a left-sided risk: lack of cash funds; failure of their own credit facilities, primarily in the growth of the receivables; lack of inventory; excessive volume of current assets.

Among the most important phenomena potentially carrying a right-sided risk are: a high level of accounts payable; non-optimal mix between short- and long-term borrowings sources; a high proportion of long-term debt capital.

Thus, in accordance with the stages of the working capital circuit can be divided three directions to accelerate their turnover.

1. On supply stage: inventory optimization, a systematic check of inventory; replacement of expensive types of materials by cheaper without compromising the quality of products; cooperation with reliable suppliers; introduction of "lean" technologies in manufacturing and logistics.

2. At the production stage: shortening of production cycle and ensuring it continuity; compliance with the rhythm of the enterprise; insurance losses from downtime, improving labor discipline; use of waste in reverse flows; introduction of "lean" production technology.

3. In the field of marketing: products sale accelerating, increase marketing efficiency; effective distribution channels building; inventory optimization, reduction in accounts receivables and payables by using discounts and factoring; improvement of mutual settlements through funds in circulation funds securitization – classical and modern calculation tools introduction into the economy.

It is particularly topical to focus efforts on a third direction in the current crisis conditions. The key practical problem is the organization of uninterrupted payments to contractors in the shortage of own money funds and poor accessibility of bank credit. Under these conditions, the main condition for continuity and high turnover rate of working capital is the development and implementation of an effective mechanism for securitization of circulation funds of industrial enterprises in close connection with the parameters of the financial environment, allowing "lean" options for working capital generating and implementing, aimed at scarce money funds releasing.

1.2. Role of mutual settlements in the industrial capital turnover

As you know, the products can be sold using the following main methods of payment: payment before delivery; payment and delivery to a day; delivery with a post-paid. The basis of this classification is the time of certificate of payment from the buyer in relation to the time of products shipment. To sell products on a prepayment would be most preferred for the enterprise, since there is no need for a working capital in the enterprise in this case. However, sales in such conditions are possible only in small

number of cases, when the company has a significant unmet demand for its products and consumers are willing to fund free the production process.

Sales of products for prepaid and postpaid are now widely used in the Russian economy. Limitations of many businesses in their own working capital, arduous access to cheap bank credit market does not allow to sell the entire volume of production only on a prepayment basis. Therefore, companies need to expand their sales by providing customers deferred payment for goods shipped, that is a commercial loan.

Commercial loan is a deferred payment for goods or services provided to the buyer by the supplier. Under the commercial loan one company associated with the manufacture or sale of goods and services sells to other company its products with deferred payment. Commercial loan is provided not according to an independent agreement but as fulfillment of the obligations of the sale of goods, performance of works or provision of services. Commercial loan can be provided by the buyer to the seller in the form of an advance, or pre-payment of goods, or in the form of deferring payment of goods purchased from the seller to the buyer. Standards apply as for a loan for commercial loan, unless otherwise provided by the rules of the contract, from which a corresponding obligation emerged, and it does not contradict the obligation essence. In the structure of working capital of industrial enterprises commercial loan is reflected in accounts receivable.

The role of commercial loan and its capabilities should be assessed according to the criteria of working capital management and supply chain characteristics of each of the participants in the supply chain. Due to the unequal length of production and circulation because of seasonality, technological features, territorial fragmentation and sales specificity the rate of individual funds circuits (rate of production and sales) of various industries is different and does not coincide in time. Therefore, the funds circuit is characterized by the release of finished products from some companies and the emergence of demand for it from other companies.

Contradiction of founds movement, reflected in the rate mismatch of individual circuits is permitted by improving the system of mutual settlements, in particular, through the commercial loan using, thus it is possible to accelerate the circulation of funds. The role of commercial loan in market conditions in the enterprises funds circulation is to create conditions for the completion of funds turnover of in the last stage (C-M') and the beginning of funds turnover in the first stage (M-C). Most businesses do not have money to pay for the purchased goods. This is reflected on their bank accounts in the cash gaps or in mismatch of the revenue amount with coming daily payments. The effect of stimulating the funds in circulation is achieved through credit transfer of goods from the seller to the buyer.

The role of commercial credit (loan) in market conditions in the circulation of funds is to promote the transition of the natural form of cost to monetary form. Commercial credit is the first step of credit relations. The second stage of the credit relations is formed with the help of a bank loan, directly related to commercial credit.

This relationship is reflected in the fact that the company-suppliers present the promissory notes belonging to them to serving banks and receive the money in exchange. Bills registration allows compensating commodity capital, falling out of economic circulation, and ensuring the reproduction of the necessary means of payment and establishes bank guarantees of a reliable business and stable cash turnover.

Loan as an economic category of commodity and money relations mediates all stages of reproduction, including production, distribution, consumption and accumulation. Like money loan stands as the most advanced category of commodity production and monetary relations. A loan distinguishing from the category system of the market economy is caused by the fact that it is an independent process of expanded reproduction. Contents of this process is that via the loan the distribution of material and money funds occurs, being released during circulation of funds and the social product transition from the commodity form into the form of money. In accordance with the requirements of reproduction distributed values should return to the starting point to ensure reproducibility of their motion. This means that the loan is based on the temporal distribution of values and has strictly a return character. In this it differs qualitatively from the finance related to free redistribution of wealth and national income.

Commodity and money advances of extended reproduction is inherent to loan. Commodity advancing of the assets turnover as the core of reproduction is carried out by means of mutual companies' credit. The highest form of money advances of funds circuit is a bank loan. It is ahead of own working capital of enterprises and stimulate the continuity of their movement at all stages of the circuit. This reflects the nature of the advance bank loan, it is necessary to move the natural value of the goods in the form of money. When the loan is ahead of own working capital, i.e. when payments from the company's account performed, loan is compensatory or recovering. In this situation, the loan simply restores some working capital and does not keep up with the money circulation in the first stage. Bank credit plays a significant role in balancing the natural-material and cost proportions of reproduction, since the issuance of loans means creating a means of payment in strict accordance with the needs of production and realization of the social product.

Displacement of a bank loan from the first "floor" of credit relations in the supply chain "supplier – producer – consumer" is of great importance for strengthening the money turnover, as banks stop a mechanical money issuing under the illiquid assets of enterprises and thus induce them to produce products and obtaining money proceeds. Introduction of commercial lending is aimed at creating market fund of products, providing cash in circulation.

The foregoing leads to the relevance of the problem of the working capital efficiency increasing through improved management of settlement and the need for additional research in this area.

1.3. Evolution and challenges of payments management of industrial enterprises

Obviously, the settlement crisis became one of the most significant facts in the Russian economy in the 90s. Its new "wave" covered industries at the end of 2008 amid the global economic and financial crisis. Numerous articles, monographs and dissertations of Russian scientists are subject to studying this phenomenon. For us, the most important are problems of organization and management of industrial enterprises' funds in circulation, in particular, an algorithm to adapt the company to defaults, taking into account the influence of external financial environment.

We distinguish four main stages of the payment crisis development. The first stage of payments crisis began after price liberalization in 1992. Instant impairment of the working capital of enterprises, the sharp rise in prices and the destruction of the former concessional bank lending led to the fact that the companies began to increase the volume of defaults to each other. The second stage of payments crisis (1993 – 1995) was associated with the fact that the companies have realized the impossibility of continuing the production process under the condition of non-payment of products shipped. Prepayment became use widespread in payments, contractors with poor financial situation and uncertain prospects stopped receiving an "automatic" support from other companies. Defaults in this period were generated mostly by unprofitable and idle plants. The third stage of payments crisis (1995 – 1999) was called by industries differentiation in financial position and manifested differently in different industries. Three groups of industries distinguished in which defaults performed fundamentally different functions:

- depressed industries, where the recession has reached a maximum level, defaults played the role of the missing income compensator. That is, in fact, losses of enterprises were covered by non-payment to creditors;
- prosperous industries (for example, the oil industry), who used non-payments to their creditors for compensation of their customers' arrears;
- gas and electricity, faced with mass non-payment of consumers (especially "budget" consumers and depressed industries).

The fourth stage of payments crisis (2008 – 2009) was caused by a sharp decline in lending activity of banks amid the global crisis.

In the period of 1991 – 1999 in the Russian economy nonmonetary methods of payment for delivered products were widely used. We accept kinds of used payment instruments during the classification of payment for monetary and non-monetary basis. The non-monetary payment methods are those types of payment transactions in which the role of a value equivalent either material goods or money substitutes operate: barter payments, promissory notes and other securities by the netting.

The most general definition of barter was proposed by V. Makarov and G. Kleiner. They propose understanding barter as kind of exchange of any rights for the goods

ownership or rights to receive services (works), in which the mutual transfer of these rights is a necessary part of exchange, regardless of whether they are paid by money or not.

We refer to payments by mutual transactions operations to offset mutual claims on goods supplies on the one hand and monetary claims on the other hand (for example, the local budget now has an obligation to the company to supply fabrics for budgetary organizations – obligations on supplies, and the company has tax debts – monetary liabilities); and multilateral netting.

First attempts to use mathematical modeling for funds in circulation research in terms of settlements with buyers of products were taken by V.A. Lindenbaum in 1969. Forecasting of the money inflow for goods shipped was done by the author in connection with the need to achieve the most accurate execution of the plan set for the sales of products, from which a system of economic incentives depended directly.

Further development of mathematical models describing the payment process with buyers of products was made by P.G. Bunich, V.L. Perlamutrov and L.H. Sokolowski, K.A. Bagrinovski. Scheduling problem of settlements with customers considered by the authors as part of the process of working capital management (determining the need for working capital diverted into the payments studied, as well as the choice of optimal forms of settlements with customers).

Researches in the field of mathematical modeling in settlements with buyers continued M.V. Lychagin. He viewed in detail problems of mathematical modeling of industrial enterprises' financial activity taking into account the scientific achievements of domestic and foreign scholars. M.V. Lychagin proposed a simulation model of the working capital movement, describing the motion of the working capital at the stages of production and circulation; models describing the credit and settlement mechanism in the industry.

The scientific works in the field of organization and management of funds in circulation in the market times can be structured along the following lines:

1) Monetary funds modeling.

In the work of St. Petersburg scientists [32] the role of financial resources defined in modern logistics, as well as the role of methodological framework development for solving a number of applications related to the management of material and financial flows:

- the terms "financial flow" and "financial margin" clarified for the logistics system; a classification of financial flow proposed, revealing the essence of finance and allowing maximum use of the properties of the financial flow, collateral to material flow;

- uses of logistic models and methods proposed for different types of financial flows; on the basis of "just in time" model the application of a uniform methodology justified for the flow control;

- the use of the financial component justified in logistic models and methods of logistics flows management, in particular, in the determining optimal order lot model, ABC method;

- methodical approach developed to solving multi-product problems, taking into account three main components of the total costs (the cost of purchasing, ordering and storage) in terms of restrictions on capital.

The author proved in his study conclusively that methodology of organization and management of material flows is applicable to financial flows, and this confirms their unity once again.

In the doctoral thesis [3] he studied fundamentally monetary flows. The research deals with the following:

- models systematized for calculating of the monetary reserves and similarities found between the optimization models of monetary reserves, and models of the order size in the supply chain in micrologistical system;

- sections and problems of financial flows management defined, thereby solving the problem of organizational and functional integrity of the resource management system in micrologistical system;

- a classification of material, financial and information flows proposed, taking into account the relationships and interactions of business processes in micrologistical systems;

- a classification of theoretical models developed, reflecting the interaction of material, financial and information flows and explaining behavior of aggregate flows taking into account their dynamics (repeated exposure);

- deterministic model improved to calculate the monetary reserve and the model of credit line also imorived subject to various conditions of financial planning;

- a methodology developed for the management of financial flows of the company, in which for the first time in domestic and foreign practice model of lending and financial investments developed subject to the limitation on the interest payments size; the monetary reserve replenishment model developed for leveraged; model of uniform money certificates developed and model of uniform money certificates considering lending on the basis of a systematic approach, financial management and logistics theory;

- methodology for calculating the parameters of multiproduct supply developed considering borrowing to replenish stocks, the opportunity cost of capital investment and limit of funds for the purchase of stocks, as well as an integration of material and associated financial flows in the logistics system;

2) Simulation of nonmonetary settlements.

To a greater extent than barter and netting, promissory notes payments are applied in modern Russian economy. A large number of national scientists' works dedicated to this topic. The deepest classification of the promissory notes used in payments are given in works by A. Vilensky, L.V. Petrova and E.V. Semenkova [78], A.G. Butrin [17, 18,

19, 20]. The first and most important for the practical application of the work in this direction is the monograph by A.G. Butrin [23].The main idea of the author is the widespread use of promissory notes in payments between enterprises. Acceleration of settlements with customers and suppliers assumed through an exchange of counterparties bills received for more liquid bills. Obviously, in the case of such an exchange, the company will incur losses, as the value of the bank bills in most cases higher than the industrial. In connection with this, the new indicator introduced - "bills conversion rate". The company can pay off creditors by bills received from the bank. Expected to have accounting bills received from counterparties in the bank. Currently, given the shortage of funds it is also necessary introducing bills that require adjustments of previously used and developed schemes and forming new schemes.

3) Receivables Management.

O.N. Mitrokhina [65] researched the mechanisms of commercial payments at the enterprises and their improvement necessary for sustainable development of Russian enterprises. Key findings include: a systematic approach proposed to improve commercial payments through external and internal mechanisms; the mechanism of optimization of financial flows proposed to use; the need to create business units proved, their budgeting and business planning.

In her work [31] the idea proposed and grounded that the company is stable if its material and financial flows correspond to each other at the stage of attracting resources and at the stage of sales. Temporary conformity in form of delay and outpacing flows is a key aspect of conformity. The minimum total costs and losses in the chain "supplier-producer-consumer" is the optimization criterion. In this paper:

- the necessity of improving the credit policy of industrial enterprise proved on the basis of the concept of logistics;
- organizational and economic features revealed of flow processes in an industrial enterprise;
- a methodical approach developed to optimizing credit policy parameters based on the concept of logistics;
- economic and mathematical model of the company’s credit policy built in the modes of payment deferment, prepayment and flows synchronization;
- a mechanism suggested for determining the price of products sales in terms of financial flows lag.

In the paper [37] the classic ABC, XYZ-analysis of material logistics has been adapted to the analysis of receivables and payables: they have been regularized in order of maturity and pairwise combinations of receivables and payables have been made corresponding to each other by the timing and amount. Reserves and accounts payable funding them that will provide the necessary stability of the firm have been analyzed too.

In accordance with the opinion of A.M. Zevakov [36] management of material funds and money funds should be subject to the same rules as material and money are

enterprise's working capital. Note, however, that liquidity degree of working capital may be different, but the money funds are the most liquid assets. In this paper he developed methodical maintenance of financial and working capital management, taking into account the liquidity of each asset type and changes in the value of assets over time, including influence of inflation in the economy.

4) Inventory Management.

A.V. Mishchenko and M.V. Mogilnitskaya proved the urgency of company's working capital management in order to ensure the most efficient structure of production resources stocks. They proposed a dynamic production model that specifies the sequence of production operations, the volume of production resources, and market demand for the final product. Thus the financial flow structuring allows working capital optimizing used to purchase material resources [66]. It should be noted insufficiently complete study of the financial and material flows integration in this work, including inventory management by limiting the size of the capital invested in stocks.

G.L. Brodetskij developed inventory control strategies using borrowed funds, developed multiproduct models of inventory control, taking into account the time value of money and the magnitude of leverage shoulder, as well as model restrictions accounting on the amount of capital. Payment options of the financial resources are researched on the prenumerando and postnumerando rent basis, as well as a model proposed including costs of storage payout in the middle of the time interval between deliveries.

In his fundamental work on reserves [60] he developed the theory and methodology of inventory management in the supply chain of the enterprise:

- an improved version proposed of the total logistics costs model (TLC), based on a systematic approach and principles of logistics management, taking into account the relationship and interaction between the individual components of cost, constraints and nonlinearity of parameters, modifications of options of the classical optimal order lot model;

- Harris-Wilson formula improved to calculate the optimal order lot, taking into account the different options in storage costs, lack of simultaneity of various products reception to the warehouse, features of discounts accounting and non-momentary of incoming shipments unloading;

- a fundamentally new approach developed to the analytical description of logistics networks in the form of simple logistics chains (SLC); for each SLC option derived formulas for calculating the quantity and value indicators. Distinction of the approach developed is that the decomposition of a real network as the SLC personifies the role of the each supply chain participant and takes into account the added value of logistics operations performed;

- the criteria clarified for minimum of the logistics network overall cost: under the proposed criteria for each SLC, formed on the basis of the economic order quantity

model EOQ, selected option with minimal cost; then these options are summarized for all SLC included in the analyzed (projected) logistics network;

- the algorithm developed of forming a system of inventory management in supply chains, which main elements are ABC-analysis and XYZ-analysis; the combined method developed of the performance estimating of stocks, the choice of management model (strategy) by low cost criterion, the use of active control methods developed using logistic concepts (fast response, "just-in-time", etc).

5) Logistisation of funds in circulation based on financial logistics unit. Financial logistics worked out deepest in the writings of scholars of St. Petersburg (St. Petersburg State Engineering and Economic University, St. Petersburg State University of Economics and Finance) and Chelyabinsk (South Ural State University) [20]. Thus, a leading scientist in the field of economic logistics professor V.V. Shcherbakov said financial logistics as part of the resource logistics, and notes that the financial logistics is currently the least studied section of resource logistics: some issues are not considered at all, and there are significantly differing viewpoints on other issues.

Analysis of existing works and publications on financial flows between enterprises and banks showed that currently there is a lack of enterprises' working capital financing mechanisms offered by banks. At the same time, used by companies sources of current financial needs funding which alternative to lending can be replaced with less expensive sources.

Development and widespread adoption of enterprises' working capital funding mechanisms by financial institutions, adequate to crisis conditions, will solve the current problems of industrial enterprises. There are factoring, promissory note loans, and the introduction of warehouse certificate among the promising schemes for optimizing the enterprise's working capital funding.

Acute struggle for buyers makes the enterprises to use more flexible ways of working with them. One of the main ways of keeping the customer base and attracting new customers is to grant deferred payment for counterparties for goods delivered or services rendered. However, providing customers more favorable conditions for the payment of goods shipped and services rendered inevitably leads to an increase of accounts receivable in the balance structure of the company, leads to a reduction in working capital and cash gaps, deterioration of the current liquidity and reduce financial stability, as well as an risk increases of debtors non-payment of debts and inflation risk increases. Furthermore, it is necessary to create a separate entity for effective management of accounts receivable, while the costs of establishing and maintaining of credit departments are constant regardless of the receivables volume.

Replenishment of working capital and cover of cash gaps can be achieved by conventional methods, bringing the loan or overdraft. However, this solution may further complicate the financial condition of the company, as the first, does not solve the problem of accounts receivable managing, that is credit, inflation and currency risks continued, and the cost of maintaining of credit management unit does not decrease;

secondly, besides interest on the loan additional costs appeared associated with its maintenance (discount, insurance of the collateral, loan and current accounts fees, etc.).

An effective way to solve problems associated with the receivables emergence is factoring. It allows for the borrower to replenish working capital, to "release" the balance of receivables by its assignment to a bank or specialized factoring company, reduce the fixed costs of the credit department and obtain current information on the status of accounts receivable.

You can use a paper credit to minimize the costs of the bank loan maintenance. Rates on paper credits can be substantially lower than the rates on term loans for the same period under similar collateral. In addition, you can receive additional economic benefits during company debt repayments to the counterparty by bank bills. Paper credit is made by providing money funds to the borrower for the purchase of creditor bank bills. Bills may be either interest-free or profitable, in the last case the rate on the loan is increased by the rate of return on the bill.

Circulation term of bills is not less than the term of loan. Bills can be in circulation in your contractors before the payment thereof; can be laid down as collateral for loans from other banks involved, can be early redeemed by the bank at a discount.

Another effective mechanism of the company's financial flows optimization are warehouse certificates, a document of title issued by the trade warehouse to commodity owners to confirm the fact of accept for storage of certain goods by such persons and lack of collateral encumbrance of the product, and – the right of the holder to receive this product personally or dispose of the goods specified in the certificate held in storage by dispose this document itself (the right to receive the goods) as its transfer.

Thus, currently there is an objective need to develop organizational, economic, financial, legal and other measures to improve the integration of banks and industrial enterprises that will contribute to their adaptation and competitiveness strengthening. So, analysis of the current state of the payment control revealed that:

• theoretical and methodological bases of payments control elaborated insufficiently;

• there is no systematic approach to the organization of settlements with counterparties at the majority of industrial enterprises, requiring coordination of all functional stages of capital turnover;

• there is no methodology of mutual settlements management in SCM concept (Supply Chain Management), most fully reflecting the modern integration processes in the industry;

• "lean" management technology is not adapted to the working capital;

• problems of mutual settlements organization are not worked out and their impact on the effectiveness of working capital and a entire enterprise.

Topical current objectives of mutual settlements control are:

- to reveal the organizational and economic nature and features of settlements arising in the supply chain of industrial enterprises;

- to develop a method for optimizing the mutual settlements of industrial enterprise;
- to develop economic and mathematical model for determining the optimum parameters of settlements in the supply chain of industrial enterprises;
- form an algorithm of "lean" working capital management in the stage of mutual settlements in the supply chain of industrial enterprise.

Conclusions of the first chapter

1. The key task of survival and further development of the majority of industrial enterprises is a more efficient use of working capital. Optimizing of mutual settlements and interaction with bank is a reserve here. Development and widespread adoption of new mechanisms for enterprises' working capital funding by counterparties and financial institutions will ensure the continuity of the capital circulation and cost reduction. Promising schemes for optimizing of enterprises' working capital funding include factoring, paper credit, introduction of warehouse certificate.

2. Analysis of the current state of the funds in circulation management revealed that:

• theoretical and methodological bases of payments control elaborated insufficiently;

• there is no systematic approach to the organization of settlements with counterparties at the majority of industrial enterprises, requiring coordination of all functional stages of capital turnover;

• there is no methodology of mutual settlements management in SCM concept (Supply Chain Management), most fully reflecting the modern integration processes in the industry;

• "lean" management technology is not adapted to the working capital;

• problems of mutual settlements organization are not worked out and their impact on the effectiveness of working capital and a entire enterprise.

Based on these topical current objectives of mutual settlements control are:

- to reveal the organizational and economic nature and features of settlements arising in the supply chain of industrial enterprises;
- to develop a method for optimizing the mutual settlements of industrial enterprise;
- to develop economic and mathematical model for determining the optimum parameters of settlements in the supply chain of industrial enterprises;
- form an algorithm of "lean" working capital management in the stage of mutual settlements in the supply chain of industrial enterprise.

CHAPTER 2. METHODICAL BASES OF ORGANIZATION AND MANAGEMENT OF MUTUAL SETTLEMENTS IN THE SUPPLY CHAIN OF INDUSTRIAL ENTERPRISE

2.1. Organizational and economic features and principles of mutual settlements management in the supply chain

In the early 21st century integrated management paradigm has spawned a new ideology of business management – Supply Chain Management (SCM). This paradigm reflects a new understanding of business: individual enterprises are viewed as units of the general supply chain, related directly or indirectly to a single (integrated) management process flow of all kinds of resources for the most complete and high-quality customer's satisfaction in accordance with their specific needs. The classical approach is limited to the considering of funds in the "narrow sense" – only within the same subject. Today, however, this is not enough objectively, and SCM is a natural extension, the development of an integrated approach beyond of the focus company in terms of cross-functional and inter-organizational co-ordination of different subjects. SCM is an integrated functional, including three or more participants involved in the flow of goods, services, finance, and information from the source to the consumer, as well as the bank as financial infrastructure of the chain [34].

Object decomposition of the supply chain in two modes of operation and place of payments are presented in Fig. 2.1, 2.2 [20]. Supply chain with delayed finance mode (Figure 2.1) – this is interconnected sequence of links by which the goods are delivered to the final consumer in the mode of payment deferral. Supply chain with the finance advance mode (Figure 2.2) – this is interconnected sequence of links by which the goods are delivered to the final consumer in the pre-payment mode. Comparison of two types of chains is shown in Table. 2.1.

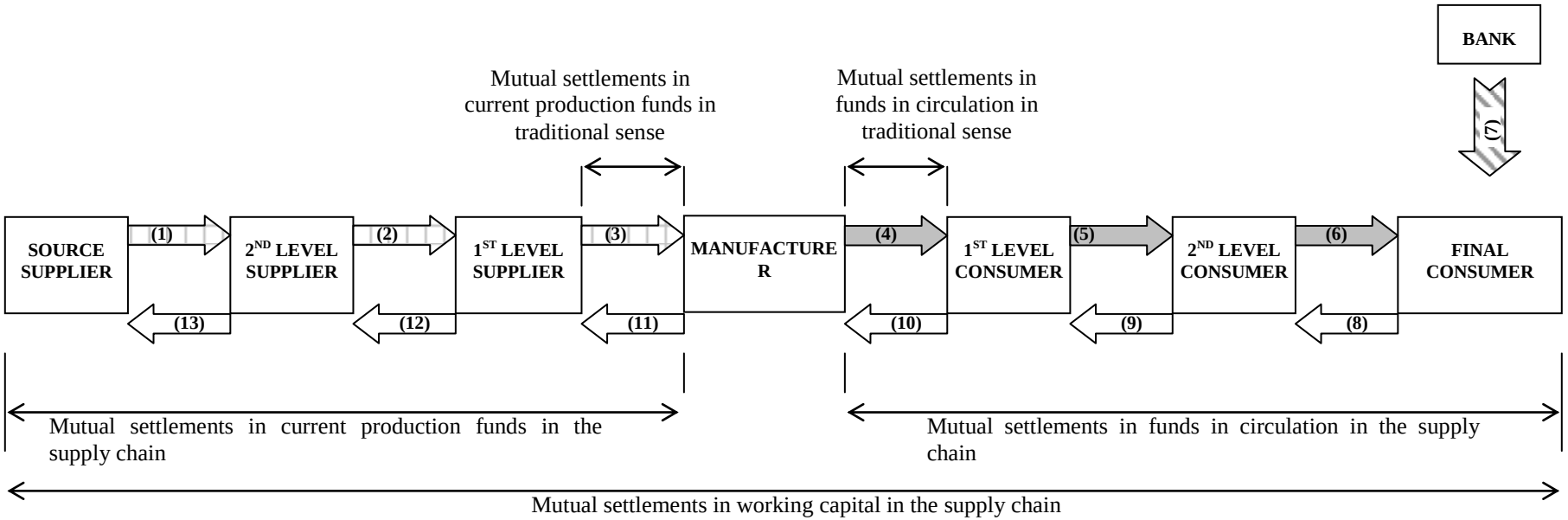

Fig. 2.1. Supply chain with the delayed finance mode: (1), (2), (3) – material resources; (4), (5), (6) – finished products; (7) – "injection" flow; (8), (9), (10), (11), (12), (13) – payments

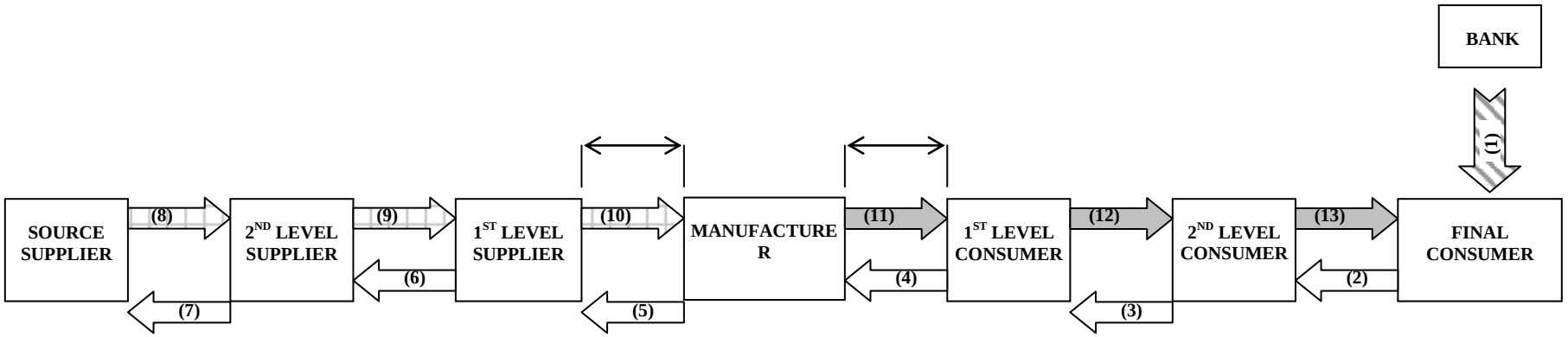

Fig. 2.2. Supply chain with the advanced finance mode: (1) – "injection" flow; (2), (3), (4), (5), (6), (7) – payments; (8), (9), (10) – material resources; (11), (12), (13) – finished products

Table 2.1

Features of settlements depending on the type of supply chain

Feature	Type 2 chain	Type 1 chain
Type of flow relationship	Pushing of Finance Resources	Pulling of Finance Resources
What a debt arises from the focus company	Accounts payable	Accounts receivable
What kind of flow is primary	Financial	Material
Stock availability	No	Yes
Specificity of circulating funds	Finished products predominate. Specificity of circulating funds of a higher chain member is determined by the specific of circulating funds of the member below	Receivables predominate. Specificity of circulating funds of a below chain member is determined by the specific of circulating funds of the higher member
Pricing regime	Discount	Markup
Type of risk	Failure to deliver on time	Non-payment of accounts receivable in the prescribed period
Narrow link	Primary source supplier	Final consumer
Place of entropy	The material part of the working capital	The financial part of the working capital
Bank role	Lender of prepayment	Grouting of narrow link
Tool of securitization	Bill	Bill, warehouse certificate, factoring
Speed of response to customer request	Low	High
Operating mode of circuit	Development	Stability

Comparison of classical organization of mutual settlements management and the one based on the supply chain allowed revealing several significant differences (Table 2.2) and complementing traditional classification of payments (Table 2.3).

Table 2.2

Comparative analysis of different approaches to the management of mutual settlements

Feature	Traditional approach	The concept of supply chain management
Goal	Optimality ensuring within one member	Optimality ensuring within the entire supply chain
Methodological basis	Systems approach	Intersystem approach

Object of control	Circulating funds in the distribution system of one member	Circulating funds in the "Sales" functional of the supply chain
Methods of control	Local methods within one member	Integrated methods within the whole chain
Openness	External factors such as given	High flexibility
Criteria of buyer selection	Increasing number of consumers	Reduction of customer base. Cooperation with a small amount of reliable buyers.
Source of funding	High cost	Low cost
Tools of securitization	No	Bill, warehouse certificate
Consistency with current production funds	Weak	High
Interaction with bank	Spontaneous	Optimal

Table 2.3

Classification of circulating funds in the payments stage

Number	Feature	Kind
1	According to location in the circuit	"Supply" functional and "Sales" functional
2	According to the type of supply chain	"Pulling" finance mode and "pushing" finance mode
3	According to the degree of members integration	Vertical integration and contractual relations
4	According to the degree of consistency with the flow higher or lower in the chain	Synchronized and autonomous

This allowed formulating the following principles of organization and management of funds in circulation in the payments stage of the supply chain:

- transition from focus on competition to focus on cooperation with consumers and suppliers;
- cooperation with a small amount of reliable products buyers and material resources suppliers;
- vertical integration with key customers and suppliers located at least at the first level in order to reduce risks;
- mutual control of material, financial and information flows;
- quick response to order and different forms of payment;
- presence of an established settlement system for the supplied resources;
- focus on reducing overall costs and losses;
- bank involvement as a supply chain infrastructure;

- decrease in entropy in the entire chain;
- providing a positive synergy effect.

2.2. Promissory note and warehouse certificate as instruments of working capital formation in the supply chain.

Today we have three basic tools for financial flows structuring: bill, warehouse certificate, the legal institution of persons change in liabilities (assignment of claims deal and debt transfer deal). The combination of these instruments depending on the economic situation will raise the profitability and efficiency of payment operations and efficiency of financial flows management. In the present economic crisis conditions, improving the system of settlements for goods, works and services through the implementation of payment tools in the form of promissory note and warehouse certificate is an important factor in enterprise adaptation to the environment. Currently bill is a popular tool, allowing companies to reduce their debts partly. However, promissory note using for this purpose comprises a number of risks. Firstly, the bill is a purely monetary obligation, and there is no guarantee that any of the noteholders chain will not require money on it, despite the agreement for the settlement of promissory note by products or services. Secondly, it is impossible to oblige the company absolutely take promissory notes in payment for their goods.

Let us consider organization and management of promissory notes circulation in the supply chain. Enterprises can attract external bills funding by using two schemes. The first involves direct lending through the issue of own bills, and the second – using of bank securities. In the first case it is customary to distinguish two subspecies of treasury bills issuance depending on the objectives pursued by the issuing company:

- if the loan is arranged for payments to suppliers of raw materials, goods or services – such promissory notes are called payment ones;
- if the promissory notes are placed on the open market – they are called financial ones.

Using of bank bills of exchange as an external funding source assumes the conclusion of the paper crediting agreement with the bank. In this case, the bank writes its own bills, by which it credits the company. Company in turn pays to its counterparties by means of these bills. Company partners can sell bank bills on the secondary market in order to get real money, or keep them till maturity and to present for payment at the bank. Upon expiration of these securities credited enterprise returns the funds to the bank in nominal amount in the case of discount promissory notes, or including interest in case of interest-bearing bill, and pays a commission. Thus, the company borrows a bill from the bank, not money.

Advantages of the bank bills using are following. Firstly, liquidity of this instrument is bigger compared to a company bill. Scale spread of the bank bills will be a

bigger among company's counterparties – a partner can refuse to accept for payment company's debenture, but bank bill can be sold on the secondary market or repay early in the same bank. Secondly, the interest rate on paper credits is much lower than on commercial loans. This is due to the fact that bank doesn't divert resources when issue a paper credit – it emits its debt obligations and should receive funds from the company at payment date to repay the bill to its holder.

The main disadvantage of external financing using paper credit is that the company does not generate its own credit history. This is one of the main reasons that many companies are looking for sources of current activities funding alternative to paper credit. Another disadvantage of bank paper crediting compared with company's own bill borrowing is secrecy of such transactions for the external market. In addition, these transactions are usually terminable and contain the possibility of early payment requirement for the loan with interest payments.

It is the issue of its own notes that has allowed many companies to demonstrate their creditworthiness on the debt market. Even after the implementation of bill programs these issuers got access to more long-term and low-cost type of funding – bonded loans. Therefore the promisers endeavor to support secondary market of their securities, engaging the services of specialized organizations that form a liquid secondary market; in order to the company has always been able to consider bills as a revolving tool. It also helps in dealing with banks in determining interest rates on bank loans.

From the bank's point of view, paper crediting is a target loan for the purchase of urgent bills of bank which provided the loan. Bank bill received the borrower can use to pay for goods delivered. Usually the following steps of interaction between the company and the bank precede to paper crediting:

- the bank evaluates the creditworthiness of the company and makes a decision on the issuance of credit;
- if a positive decision is taken to issue a credit, a special credit is given to the borrower for the purchase of bank bills;
- company buys bank bills for a credit issued;
- bills obtained by the borrower passed to suppliers by endorsement for payment of the goods received;
- by the due date on bills supplier presents them to maturity in the bank;
- the borrower pays to the bank the amount of the loan and the interest for credit. Since this is resource-free operation for the bank, the bank can reduce sharp the interest rate to the size of its margin in the range of 3-5% per annum.

The disadvantages of this financing method include the limited bills turnover: these instruments are less liquid compared to money funds, and the supplier does not always agree to take bill (even bank bill) from the buyer instead of the "real" money. Therefore, it would be better to obtain the supplier's consent before using of this kind of financing instrument.

Specificity of Russian bank paper credit is that its implementation involves mainly bills issued by banks, not commercial bills issued by business entities.

Development of commodity markets, means and methods of product demand meeting timely and fully, led to the need to optimize the material and financial flows through the improvement of their structuring tools. As a result of this class of documents of title replenished. Warehouse certificate in its economic nature is an instrument of transformation of material flow in the financial flow and back, therefore, it allows you to control the structure of working capital in order to increase its efficiency. Using the warehouse certificate enables the company to ensure the harmonization of material and financial working capital, thereby making it possible to free up a significant part of money resources from payments.

As is known, after the adoption of Part II of the Civil Code even two tools for structuring the financial flow in financial and economic turnover of enterprises got the right to exist – a simple warehouse certificate and double warehouse certificate (Art. 912 of the Civil Code).Warehouse certificate is issued in confirmation of the goods certificate for storage, and the certificate holder is entitled to dispose of the goods at a time when it is in storage. Only objects can be commodity content of the warehouse certificate – the material objects of economic turnover to be measured and have valuation. Besides of objects, works and services can also be commodity content of the bill.

By their nature, warehouse certificates have no signs of the issued security. When issuing a warehouse certificate there is no fact of alienation: the goods placed in storage do not become the property of the warehouse and the warehouse does not dispose of the goods accepted for storage. Nature of warehouse certificate follows from storage relations; it is not a debt instrument.

There is also a fundamental difference in terms of the nature of the instrument of financial flow forming. Unlike the note, requiring the real transfer of goods or money, warehouse certificates cannot be put into turnover if the real product was not put in storage. Besides, even if the origin of the note is real transaction, then later on the promiser will get money in the property and will be liable with this money for other his commitments. Therefore, the risk of non-payment of a bill consolidates risks of some other drawer transactions. In contrast to the bill, the obligation of the warehouse, fixed by warehouse certificate, contains mainly the risk of damage or loss of the storage subject and does not contain other business risks. This is due to the fact that the goods received for storage are not warehouse owned and they cannot be foreclosed on its own debts. Therefore, there is no sense to talk about its solvency in connection with the warehouse certificates. The question can only be considered of whether the keeper is able to be responsible with his property in case of damage or loss of the storage subject (Table 2.4).

We can suggest two options for companies which are going to release their warehouse certificates. In a first option storage allocated (separate legal entity), and all

keeper's rights for the required amount of goods transferred to this storage. The plant itself will be a bailor, legal warehouse will be a keeper. Physically goods will continue to be at the plant territory. Warehouse certificate issued by commodity warehouse and must be stamped and signed by director. The problem with this option has the financial basis: very few people believe the signature of small warehouse director, if storage products for millions will be transferred to him. Large plant, unlike small businesses, can be responsible for its own assets to the holder of a warehouse certificate in case of loss or damage of the storage object. The insurance company insuring property risk can come for help here.

In the second option, the enterprise (manufacturer of the goods) acts as a keeper itself. Need to find a formal bailor who should be entitled to dispose of the goods and write batch of warehouse certificates on his name for the entire amount of goods, which will serve as their content. Such formal bailor can be one of the small businesses that are engaged in the sale of the manufacturer's products. It is important to write correctly all necessary contracts in this regard, contracts, signing what the transferor will be entitled to dispose of the goods by order of dispose of certificates. First, the plant is the keeper itself, and that looks solid. Second, it is possible to organize the storage of goods with depersonalizing it when no specific goods passed previously in storage issued to the bailor at reclaiming, but an equal number of goods of the same name and quality that are in storage. This approach allows us to write warehouse certificates for the amount of minimum balance of plant products in stock that can be sold on the securities market or transferred to the bank to secure the loan. Third, there is no need to pay compensation for insurance company.

Table 2.4

Comparative characteristics of payment tools

Feature of comparison	Note		Warehouse certificate	
	Advantages	Disadvantages	Advantages	Disadvantages
1. Type of tool	Security		Security	
2. Ability to serve as a means of payment	Yes		Yes	
3. Ability to serve as a tool of commercial loan	Yes	Holder's claims not collateralized by pledge of debtors' property	Yes. Holder's claims collateralized by pledge of goods that improves his position in the line of creditors	

4. Ability to serve as a tool of low-costly working capital replenishment	Yes		Yes	
5. Ability to receive profit from operations	High		High	
6. Nature	Debt instrument		Storage relationships	
7. Redemption form		Money, goods, Services	Scheduled goods	
8. Occupancy	May not be		Always real	
9. Content subject	Goods, works, services		Goods	
10. The risk to the holder		High due to entrepreneurial risk of the issuer	Low due to no entrepreneurial risk of the warehouse	
11. The risk for the issuer	High, because can be presented for payment of money, that was not planned by the issuer		Low, because "redemption" comes by planned products	
12 Method of turnover	By endorsement (unilateral transaction)		Through indorsation of the assignment agreement (bilateral transaction)	
13. Degree of market development	High			Low
14. Adjustability	High			Low

Implementing a particular course of action, each company should determine for itself the uniform procedure for working with warehouse certificates. This procedure should establish rules for their issuance and turnover, as well as the rules under which the exercise of the rights of the certificates holders will be implemented in reclaiming goods from the warehouse or in the sale of goods due to its foreclosure in case of pledge.

Let’s analyze the mechanism of warehouse certificates turnover [23]. In accordance with Art. 915 of the Civil Code of the Russian Federation, warehouse certificate and the warrant can be transferred by endorsement together or separately. Everything is correctly relatively to transfer of rights on warehouse certificate, herewith the right of pledge on the goods remains in force – the pledge "follows" the good. However, relatively to transfer of rights to warrant you should be aware of the provisions of Art. 355 of the Civil Code, according to which the mortgagee's rights cession is valid if rights of claim to the debtor on the main (secured) obligation have been ceded for the same person. Thus, together with the making endorsement on warrants, new and

previous mortgagees must make a cession agreement for assignment of claims under the obligation secured by the warrant was issued. If such an agreement is not made, the endorsement on warrants is not valid. In favor of this view says that the right to pledge is not an absolute right and is accessory and exists inseparably from the obligation secured by pledge. Assignment of warrant follows the assignment of rights to the principal obligation, and not vice versa. So at first the assignment of claims contract is made, and then assignment of the warrant.

As has been said before, whereas a simple warehouse certificate is a security to bearer, the assignment of rights certified by it shall be effected by mere delivery of this security to other person. Assignment of double warehouse certificate will be provided by endorsements and cession agreement. In contrast to the warehouse certificate, handling of bills is going through endorsements, without making an assignment agreement.

Using of warehouse certificates in schemes of defaults decoupling eliminates two major drawbacks of using bills. First, during the application of bills someone of the chain members would want to get the money on the bill that increases systemic risk. Second, the holder of the warehouse certificate receives straight the products he had planned ahead. At the base of mechanism of defaults decoupling with warehouse certificates there are transactions under Art. 409 of the Civil Code (digression): existing requirement is terminated by agreement in return of execution of the securities – a warehouse certificate. After the warehouse certificates were made, they are transferred from the debtor to the creditor until they reach the consumer of the goods stored, and then the goods will be demanded from the warehouse.

We will consider the status of the financial flows subsystem, structured by warehouse certificates, on hypothetical example (Figure 2.3). Let us look at the sequence of the presented scheme participants' actions.

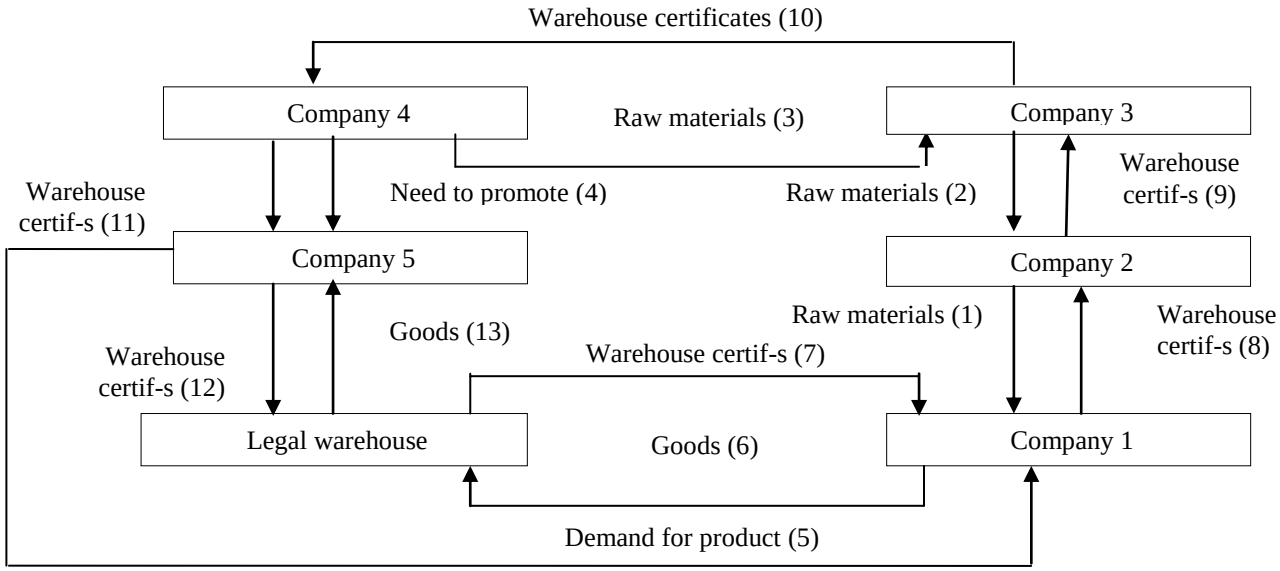

Fig. 2.3. Payment scheme using warehouse certificates

1. Company 1 organizes legal warehouse and stores products in the range and quantity which is necessary for Company 5 (6).

2. Warehouse issues warehouse certificates to Company 1 (7).

3. Company 2 agrees to take warehouse certificates from Company 1 (8) instead of paying the money for raw materials pursuant to a digression agreement between the Companies 2 and 1. Thus debt for raw is terminated in part equal to the contractual valuation of the certificates package.

4. Similarly operations are realized reflected by connections 8 and 10.

5. Company 4 exchanges purchased package of certificates for necessary products manufactured by Company 5 (11).

6. Company 5 reclaims on warehouse certificates necessary products from stock (12, 13).

Counterparties of the transaction, which result is the transfer of warehouse certificate and repayment of counterclaim, can take their profits operating by differences in valuation of the warehouse certificate as securities and valuation of goods – securities' content.

Let us analyze the algorithm of core financial flows using the warehouse certificate as a tool of commercial lending. As you know, a commercial loan can be granted both in the form of pre-payment for goods and defer of payment. Let us view the first case (Fig. 2.4, 2.5).

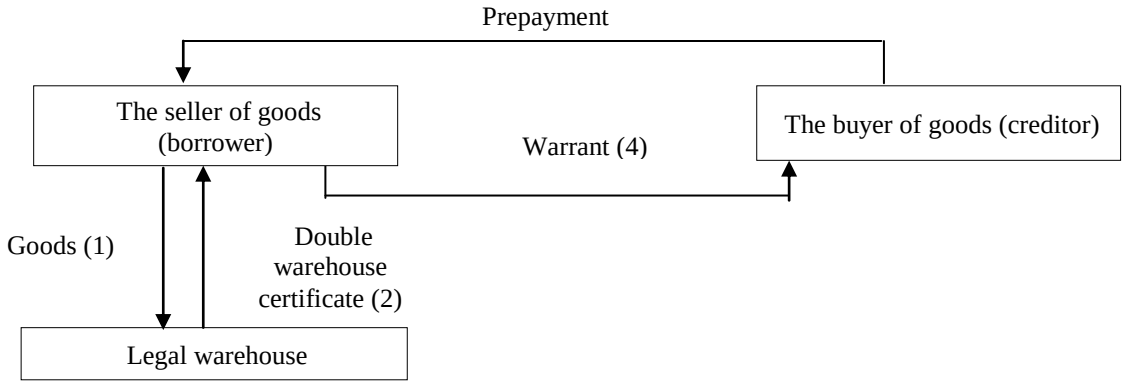

Fig. 2.4. Using a warehouse certificate for pre-payment for goods

Loan period is the time from the payment of money until the buyer's entry into full ownership for the goods. Assume that prepayment was 40% of the total value of the goods. Seller is obliged to give to the buyer the second part of the double warehouse certificate upon expiry of the credit, claiming money for remaining 60% of the total value of the goods; or to return prepayment amount to the buyer.

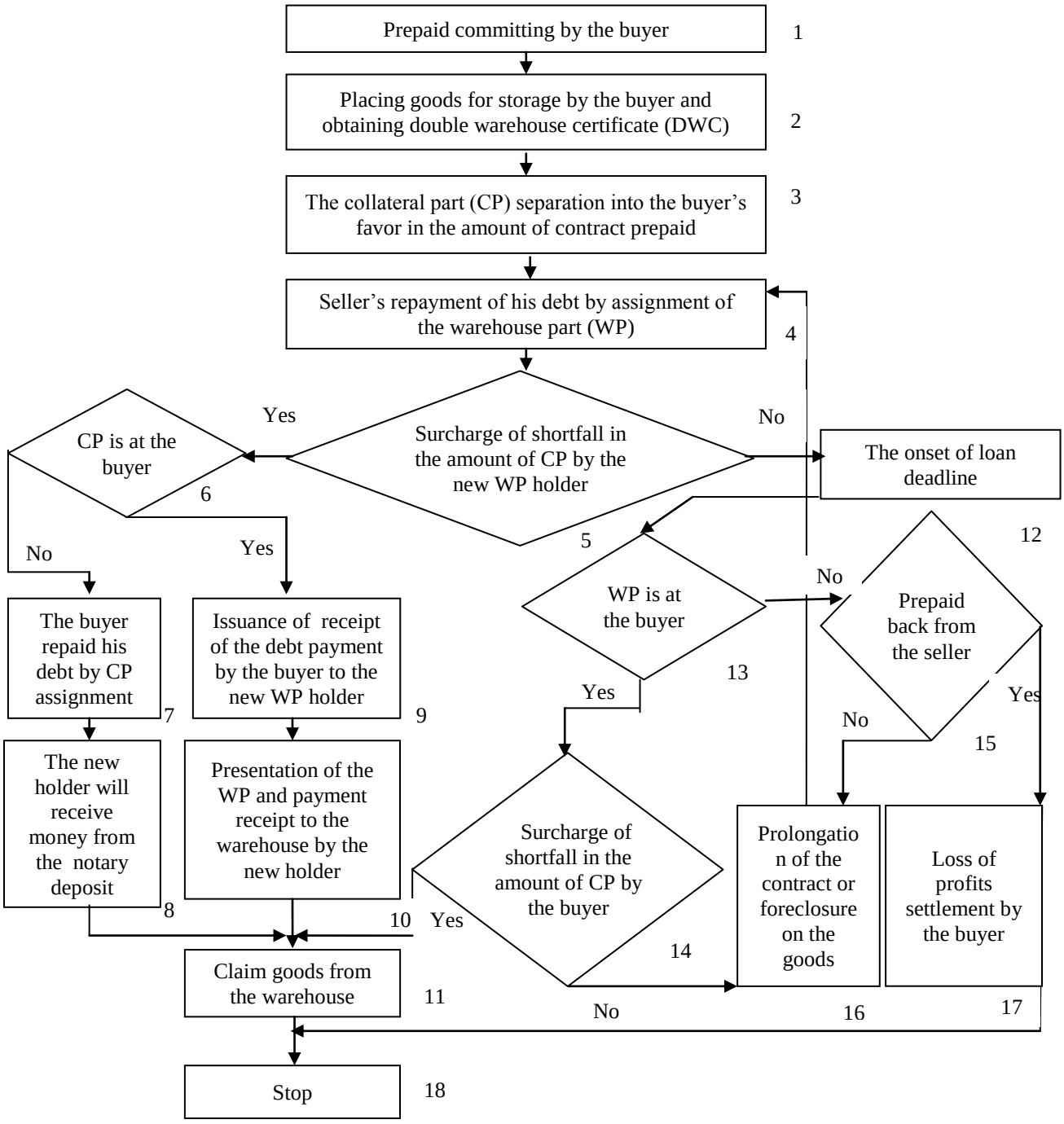

Fig. 2.5. Mechanism to use the warehouse certificate for commercial lending in the form of pre-payment

How to exclude simultaneously possibility for the seller to dispose of the goods until the expiry of the loan term and to give a guarantee to the buyer that at the end of this time, he will be able to get the goods after the additional payment of the remaining 60% of the amount? With double warehouse certificate it can be done as follows. First

goods is placed in storage (1), and the seller receives the double warehouse certificate (2). Then – after the conclusion of agreement for purchase and sale of goods and obtaining of prepayment (3) (for example, 40% of the value of goods) – the seller will operate not with the goods itself, but with double warehouse certificate "filled" with this goods.

The buyer will acquire not the goods itself, but double warehouse certificate (first warrant, then warehouse part), and will be able to get the goods in its use by presenting both sides to the warehouse. Seller – holder of the double warehouse certificate – separates a warrant from it and sends it to the buyer (4) by means of endorsement affixing. The seller will retain warehouse part and further will have the right to dispose of it at his own discretion. When separating warrant, seller of goods makes a mark on the warehouse part about the amount of the secured obligation (equal to the amount prepaid) and interest thereon.

Thus, the seller's obligation is to convey warrant to the buyer, and then to send warehouse part to him at the end of the loan term – claiming money from him for the remaining 60%. When it is impossible to convey to the buyer "complete" warehouse part, the seller is obliged to return to the buyer the amount of received prepayment of 40%, and the buyer should return warrant to the seller. At first it may seem that this turnover does not make economic sense: the seller, although he remains the owner of the goods holding warehouse part, cannot claim this product from a warehouse and use it without a warrant. What makes sense to keep the product if you still cannot use it? First, the risk of the buyer reduces through this scheme, because his claims are collateralized by the goods and the buyer gets into another line of creditors compared with other (Article 64 of the Civil Code). Second, during the commercial loan seller can "scroll" free warehouse part by the chain for the repayment of his debts to suppliers. Valuation of the warehouse part is equal to the difference between the full valuation of the goods and the amount received as a prepayment. However, in practice, during "scrolling" the warehouse part, for example, to repay his debts, it negotiated valuation can differ from the theoretical value. Here is a possibility of making a profit or loss by chain members. Turning, warehouse part should return to the seller of goods, so that he could sell it to the buyer for the remaining 60% of the value of the goods to the time of the expiry of a commercial loan. We emphasize that the turnover period of the warehouse part must meet the credit period. If this does not happen for any reason, it can be interpreted as failure of the seller’s obligations; the buyer can show him the warrant and claim him to return the payment. If the seller fails to return prepay, then it is necessary to foreclose on the goods, sell it at auction and to satisfy the claims for the prepaid amount being returnable from the amounts received. One of the reasons may be the next. At any stage of turnover, any holder of the warehouse part is entitled by law to deposit the sum – equivalent to the mark on the warehouse part, and claim all the goods from the warehouse, presenting a receipt for payment of this amount and warehouse part. To prevent this, as the warrant holder made a prepayment for goods and expects to get it

himself. Chain, along which the storage part goes, can be realized only under the control of the certificates issuer.

Now let's consider the second option of the commercial loan – payment deferment (Fig. 2.6, 2.7).

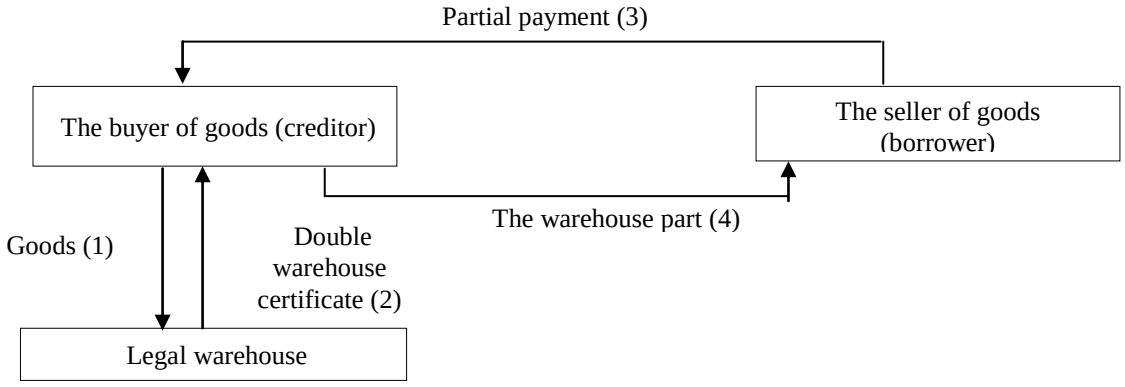

Fig. 2.6. Using a warehouse certificate for commercial lending in the form of payment deferment

Assume that the buyer could pay only 60% of the total value of the goods (3), the remaining 40% undertook to pay at the end of loan period. In this case, the warehouse part should be passed to the borrower (4). The collateral part should remain at the seller with the condition that it will be passed to the holder of the warehouse part only after the payment of money. Seller must return the warrant to the buyer so that he could claim the goods from the warehouse, presenting both sides. It may seem again that the scheme does not make sense, because the meaning of payment deferment for the buyer is to get goods in his hands, to sell it, to "scroll" the received money and then to pay to the seller. In fact, besides the possibility for the buyer to "scroll" with the warehouse part, the scheme will provide additional guarantees for seller and the opportunity, without waiting for payment, to assign permissions rights to the buyer, provided that those rights are liquid absolutely by the theoretical price of 40% of the total value of goods.

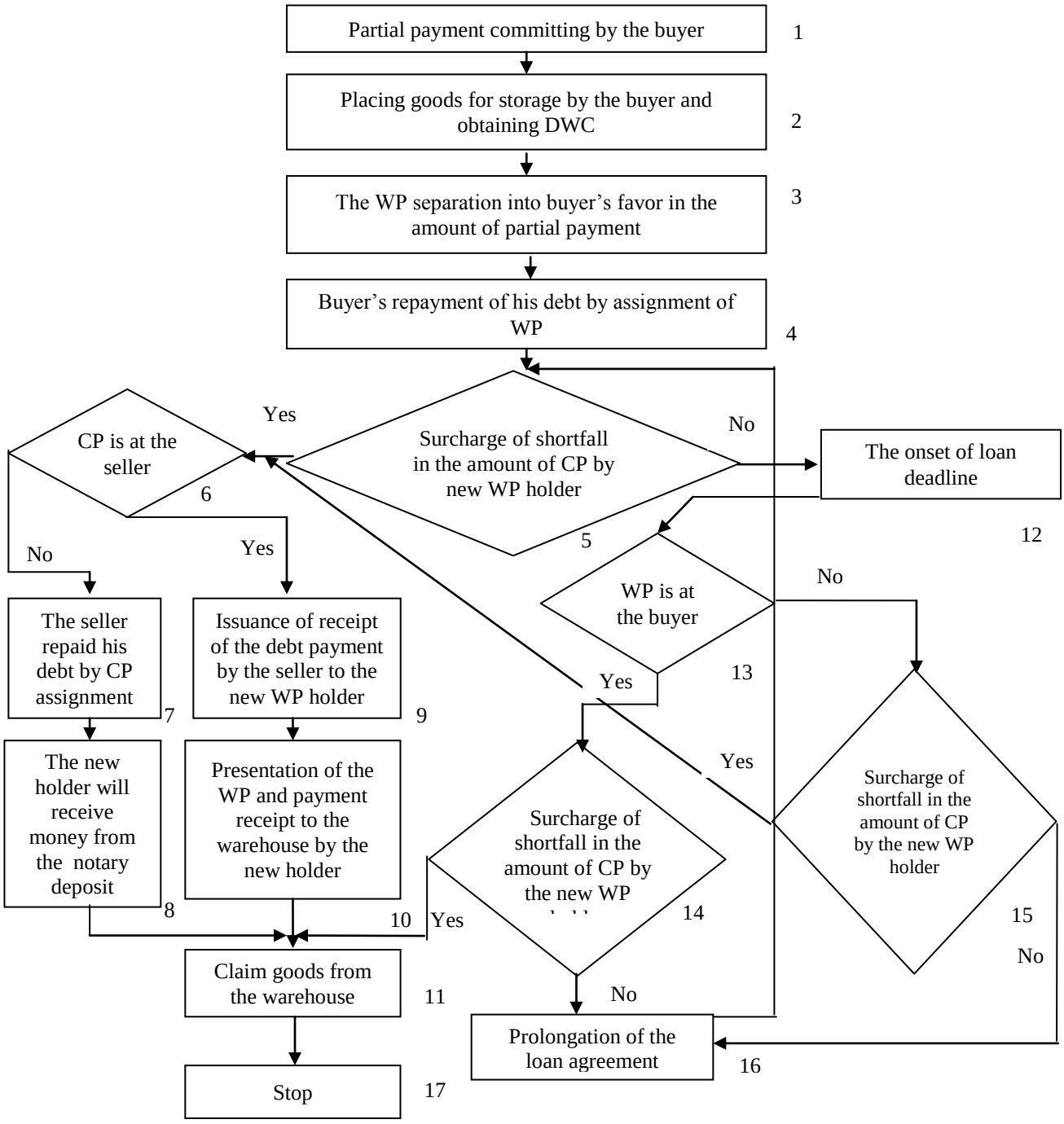

Fig. 2.7. Mechanism of the warehouse certificate use for commercial lending in the form of payment deferment

2.3. Payments optimization in the supply chain of industrial enterprise

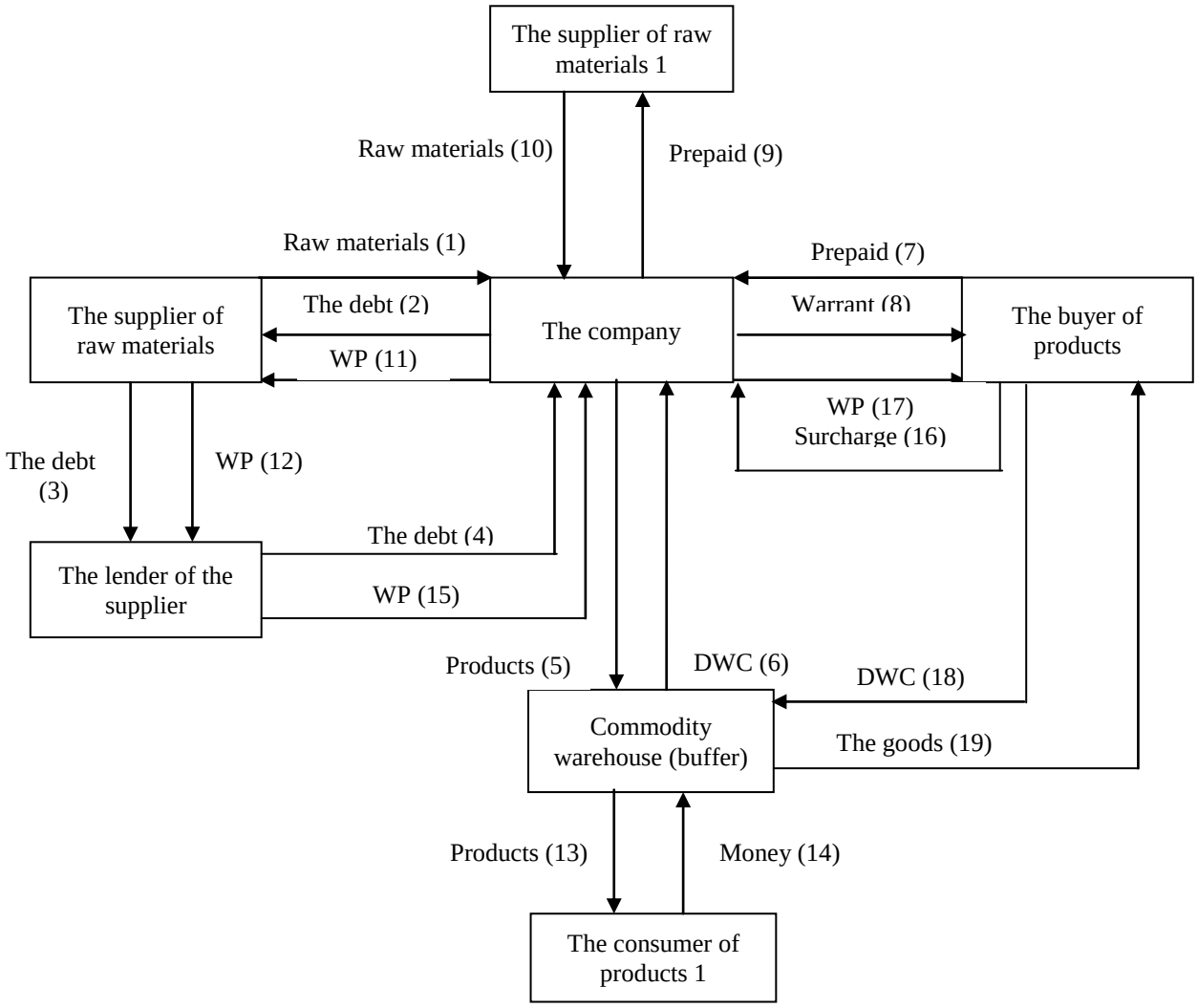

Fig. 2.8. Algorithm for the supply chains multiplication

Multiplication is to change the trajectories of the following flows of basic ("horizontal") supply chain SC_1:

- Financial flow in the form of prepayment (link 7). Its following route as a prepayment (link 9) forms the "superstructure" ("vertical") chain SC_2;

- Material flow in the stage of raw material (link 1). Its following route as a buffer filling (secondary material flow reflected by link 5) and sale to new user (link 13) forms a SC_2 chain.

In this scheme, the key role of the material flow is the formation of secondary material flow which generates supply chains. The regulatory role of the financial flow is reflected by connections 8 and 17, when the management subject was able to convert outbound material flow for the financial flow in the base chain, as a prerequisite for the material resources release for the multiply chain organization. Multiplication of the

supply chain enables a synergistic effect is to increase sales, and as a consequence, profits of the enterprise. If multiplication working capital is accelerated simultaneously on two directions: within the "horizontal" chain movement of the financial part of the working capital is accelerating (flows represented by linkages 11, 12 and 15), within the "vertical" chain – movement of the material part of the working capital is accelerating (sale of inventories from warehouse (13) avoids the "freezing" of capital, and to reduce costs).

Note that in case of failure to return the prepayment (financial "bottleneck link" - flow 7) revenue getting is a regulating flow in the new chain (flow 14); in failing to release the goods due to insufficient buffer capacity when claimed (material "bottleneck link" – flow 19) getting of raw materials by the company in the new chain for subsequent production of a needed product to the buyer is now regulating flow.

The subject of optimization is the delay between prepaid and delivery of products to consumers. Delay optimization criteria are integral costs (Figure 2.9).

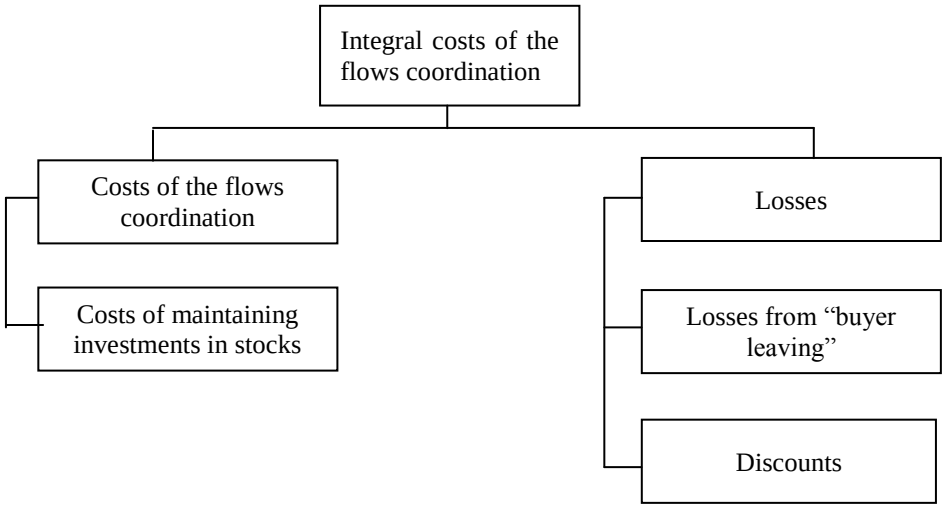

Fig. 2.9. Costs components in the basic supply chain

The costs of the flows coordination are costs of keeping investments in stocks. We use a dynamic theory of the firm by J. Forrester [86] to determine their functional dependence on the delay of orders. As is known, finished products are shipped to the consumer from the warehouse and from manufacturing. Delay of orders made from stocks consists of delay ordering by the company and delaying shipment of products from the warehouse. Orders are sent to production units, besides registration delay also have delay in the order book and production delay:

$$x = x_1 + jx_2 + (1 - j) \cdot (x_3 + x_4). \qquad (2.1)$$

where x – delay in ordering execution by the company, days; x_1 - delay in orders registration at the factory; j – part of the requirements (demand, claim) is met by stocks

of finished products, dimensionless; x_2 - delay in shipment of goods from the warehouse; x_3 - production delay; x_4 - delay in the normal order portfolio.

J is a variable associated with an aggregated flow of orders for all kinds of products produced by the company. Obviously, as destocking most of all order flow is directed to the production, instead of being made from stocks. One of the possible dependences between the size of *j* and the level of stocks *g/Q* presented in [86].

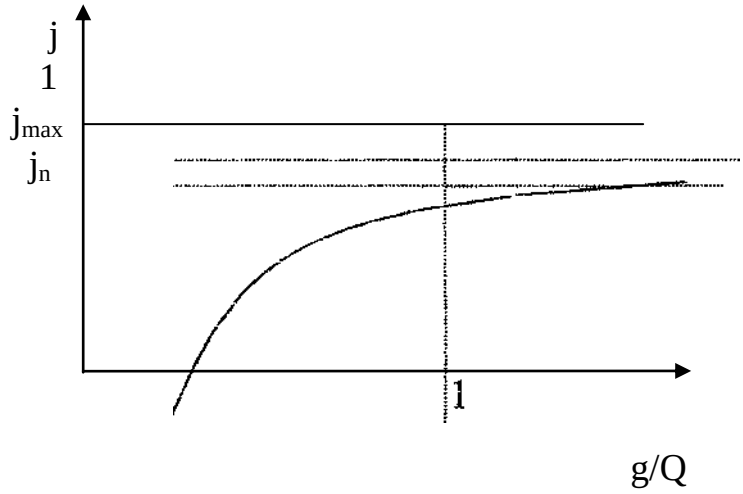

Figure 2.10. Requirements satisfied from stocks

This dependence is determined by the following considerations. Some products are so specific that they are never made in stock. Therefore, there should be an upper limit J_{max} of the part of orders met by stocks. The next characteristic is a part of orders J_n, which can be satisfied through the normal *Q* size of stocks under normal conditions. "Normal size of stocks" category ("eligible size of stocks") results from the average level of business activity, which should serve as an indicator of what stocks size is "enough." Not the actual stocks size is used in [86] as a measure of stock, but its relation to such size of stocks, which would be sufficient or appropriate.

On Fig. 2.7 on the abscissa the dimensionless ratio of the *g* actual size of the stocks to its *Q* eligible size is shown, which corresponds to the "normal" separation of the requirements flow on parts satisfied by the stocks and production. As the total aggregate stocks size increases part of *j* requirements increases slowly, getting closer to the limit value of J_{max}, this reflects the requirements for the products available in stock. While reducing stocks, *j* first decreases slowly and then faster and faster, as stocks size get closer to zero. When a stocks size is equal to zero, all the requirements will be directed to production.

The curve in Figure 2.7 can be approximated by the following analytical dependence

$$j = j_{\max} \cdot (1 - e^{-c_1 \cdot (q/Q)}) \qquad (2.2)$$

where c_1 and *Q* are constants selected depending on the initial state of the system.

Constant c_1 should be chosen so that the curve passes through the point corresponding to the J_n value, when stocks size is equal to the given Q value:

$$c_1 = -\ln \frac{j_{\max} - j_n}{j_{\max}} \tag{2.3}$$

"Normal" stocks Q size is determined by

$$Q = \mathrm{v} \cdot R_p, \tag{2.4}$$

where v is the coefficient of relative stocks size at the factory, which connects the eligible size of a goods stocks with an average sales rate for the year, dimensionless; R_p - prepaid revenues, dollar/year.

Knowing J, J_{max}, C_1 and Q, from (2.2) you can determine the actual finished goods stocks size at the plant by means of the logarithm:

$$g = -\frac{v \cdot R_p}{c_1} \cdot \ln \frac{j_{\max} - j}{j_{\max}}. \tag{2.5}$$

Then the cost of capital immobilization in real stocks

$$y_1 = g \cdot R_r \tag{2.6}$$

where y_1 is the cost of capital immobilization in stocks, dollars; R_r is the rate of revenue of the enterprise, dimensionless; g is the real size of the annual stocks, dollars.

Taking into account (2.5) we have

$$y_1 = -\frac{v \cdot M_n}{c_1} \cdot \ln\left(\frac{j_{\max} - j}{j_{\max}}\right) \cdot R_r. \tag{2.7}$$

Variable parameter is the part of the total number of claims j, is met by finished goods stocks.

Denoting

$$\frac{v \cdot R_r}{c_1} \equiv C,$$

We obtain

$$y_1 = -C_1 \cdot R_p \cdot \ln \frac{j_{\max} - j}{j_{\max}}. \tag{2.8}$$

It is obvious that with delay increasing the cost of forming of finished products stocks reduces, ensuring coordination of material and financial flows of the industrial enterprise.

Losses also consist of discounts and the "buyers leaving" effect. Discounts necessity is stipulated by to the need for immobilization of buyer's capital for the amount of prepayment, and the buyer is trying to offset his implicit costs and risks by low price purchase. While the maximum discount size k_{max} is limited by specific gravity of costs in 1 dollar of revenues. It is obvious that with increasing of delay period discounts should increase (Figure 2.11):

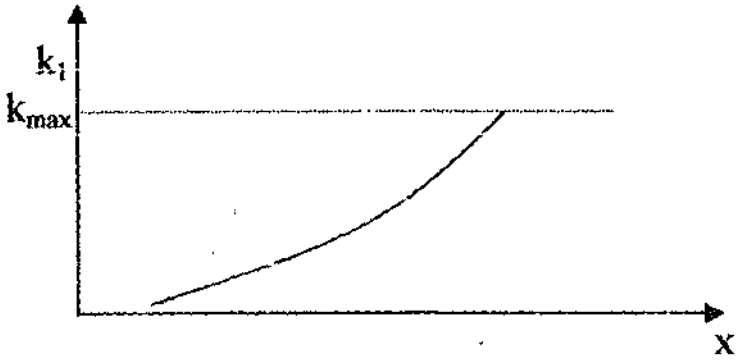

Fig. 2.11. Dependence of the discount on the delay of finished products delivery

Losses from discounts represent lost profits:

$$y_{21} = R_p \cdot R_r \cdot k_1 \tag{2.9}$$

Denoting $R_r \equiv C_2$, taking into account (2.34), we obtain

$$y_{21} \equiv C_2 R_p (e^{\varepsilon(x-c)} - 1). \tag{2.10}$$

The next element of losses is "buyers leaving" effect – it is a function of the number of buyers who left. We suggest allocate three reasons (three groups respectively) of the buyers leaving. The first reason is a significant lag of supply, due to the necessity of purchasing materials and production to the customer order. In this case the delay of delivery includes the time of stocks control in the sales link; ordering delay in sales link; postal delay; delay of materials delivery; delay of transportation; enterprise ordering delay; production delay; time of controlling the information flow. Buyer can go to another seller, which sells products from existing stocks.

It is obvious that an increase in the number of delay the numbers of unserved buyers should increase (Figure 2.12).

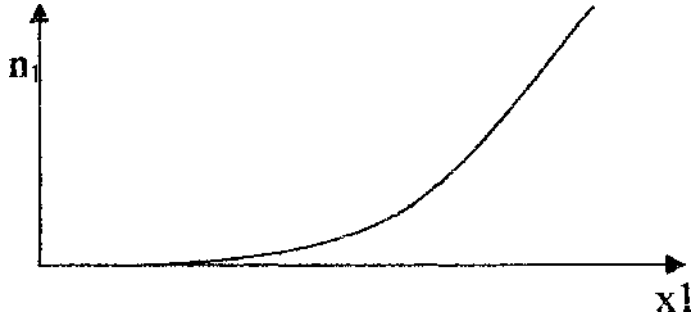

Figure 2.12. Dependence of the number of buyers who left on delay delivery

The statistical analysis allowed assuming the existence of an exponential function describing the dependence of the number of buyers who left on delay delivery:

$$n_1 = e^{(x-c)} - 1, \tag{2.11}$$

where n_1 is the number of buyers who left due to a significant delay of delivery; x is the value of the delay in products delivery.

The second reason is a settlements policy inadequate to market needs, when the company insists on the high prepayment. In the competitive environment conditions, the higher the down payment, the more buyers who left (Fig. 2.13).

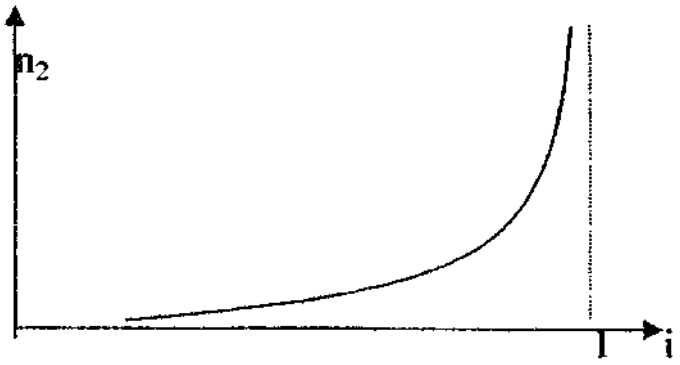

Fig. 2.13. Dependence of the number of buyers who left on prepaid

Analysis allowed suggesting the presence of an exponential function of the form

$$n_2 = e^{\delta_1 (i - a_2)} - l, \qquad (2.12)$$

where n_2 is the number of buyers who left because of the high first payment; δ is a parameter reflecting the competitive environment of the enterprise; i - the share of the first payment in the cost of production, $a_2 \leq I \leq 1$; a_2 are function parameters reflecting the competitive environment.

The third group of "buyers who left" is those who were not able to buy out fully the finished product. The risk of loss of these buyers increases with prepaid amount decreasing (Fig. 2.14).

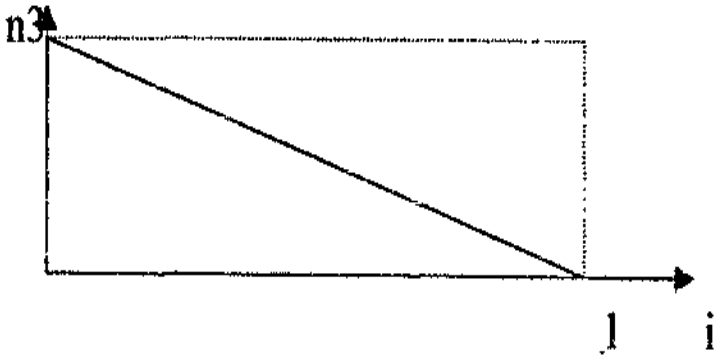

Fig. 2.14. Dependence of the number of buyers who left on prepaid amount

Analysis allowed suggesting the presence of a linear function of the form

$$n_3 = в - ki, \qquad (2.13)$$

where *n3* is the number of "lost" buyers due to the low first payment; *i* - the share of the first payment in the cost of production; *в*, k - function parameters reflecting the competitive environment of the enterprise.

Note that the "loss" of buyers occurs with a certain delay relatively to the "leaving" of the second group of buyers. Dependencies of number of buyers who left on the specific gravity of the first payment are opposite in nature, necessitating the prepayment optimization.

Thus, the total number of buyers who left is

$$n_y = n_1 + n_2 + n_3 \tag{2.14}$$

The effect of "buyer leaving" can be written as

$$y_{22} = m \cdot R_r n_y \tag{2.15}$$

Where y_{22} – annual loss of the enterprise, dollar; R_r – the rate of profit of the enterprise, dimensionless; m – the average annual sales per buyer by prepayment, rub./buyer; n_y – the number of buyers who left for the year, buyers.

Denoting $m^* R_r \equiv C_3$, taking into account (2.12), (2.13), (2.14), we obtain

$$y_{22} = C_3(e^{\delta(x-c)} + e^{\delta_1(i-a_2)} - 2 + в - k_i). \tag{2.16}$$

The total loss will be:

$$y_2 = y_{21} + y_{22}.$$

$$y_2 = C_2 R_p(e^{\varepsilon(x-c)} - l) + C_3 \cdot (e^{\delta(x-c)} + e^{\delta_1(i-a2)} - 2 = в - kl). \tag{2.17}$$

With increasing of delivery delay ceteris paribus the cost of flows coordination reduces and losses increase. Integral costs in the streaming system of businesses have optimum characterizing the minimum level of integrated cost of the enterprise (y*). It corresponds to the minimum loss (y_2*), the costs of compliance ensuring (y_1*) and the optimal flows delay (xl*).

Thus, we have the following optimization problem: to find a delay between the prepayment and delivery of finished products, ensuring optimum of the target function – criterion of the enterprise functioning:

$$y = (y_1 + y_2) \to \min.$$

Taking into account (2.8) and (2.17) we obtain the objective function

$$y = (-C \cdot R_p \cdot \ln(\frac{j_{\max} - j}{j_{\max}}) + C_2 R_p(e^{\varepsilon(x-c)} - l) + C_3(e^{\delta(x-c)} + e^{\delta_1(i-a)} + \\ + C_4 - kl)) \leftarrow \min. \tag{2.18}$$

Let us improve this technique as applied to our object. Optimal integral costs correspond to the optimum delay (Figure 2.15). It is necessary to allocate costs and loss in the basic and multiply chains. The decisive condition for balanced chains is equality of flow processes delays in both chains. Flows of basic chain are characterized by a delay in delivery under prepaid (which is equal to turnover term of the double warehouse certificate) flows of multiply chain are characterized by delay delivery of

products with immediate payment. To ensure this condition it is necessary to determine the optimal balance to meet the demand due to stocks and production in each chain.

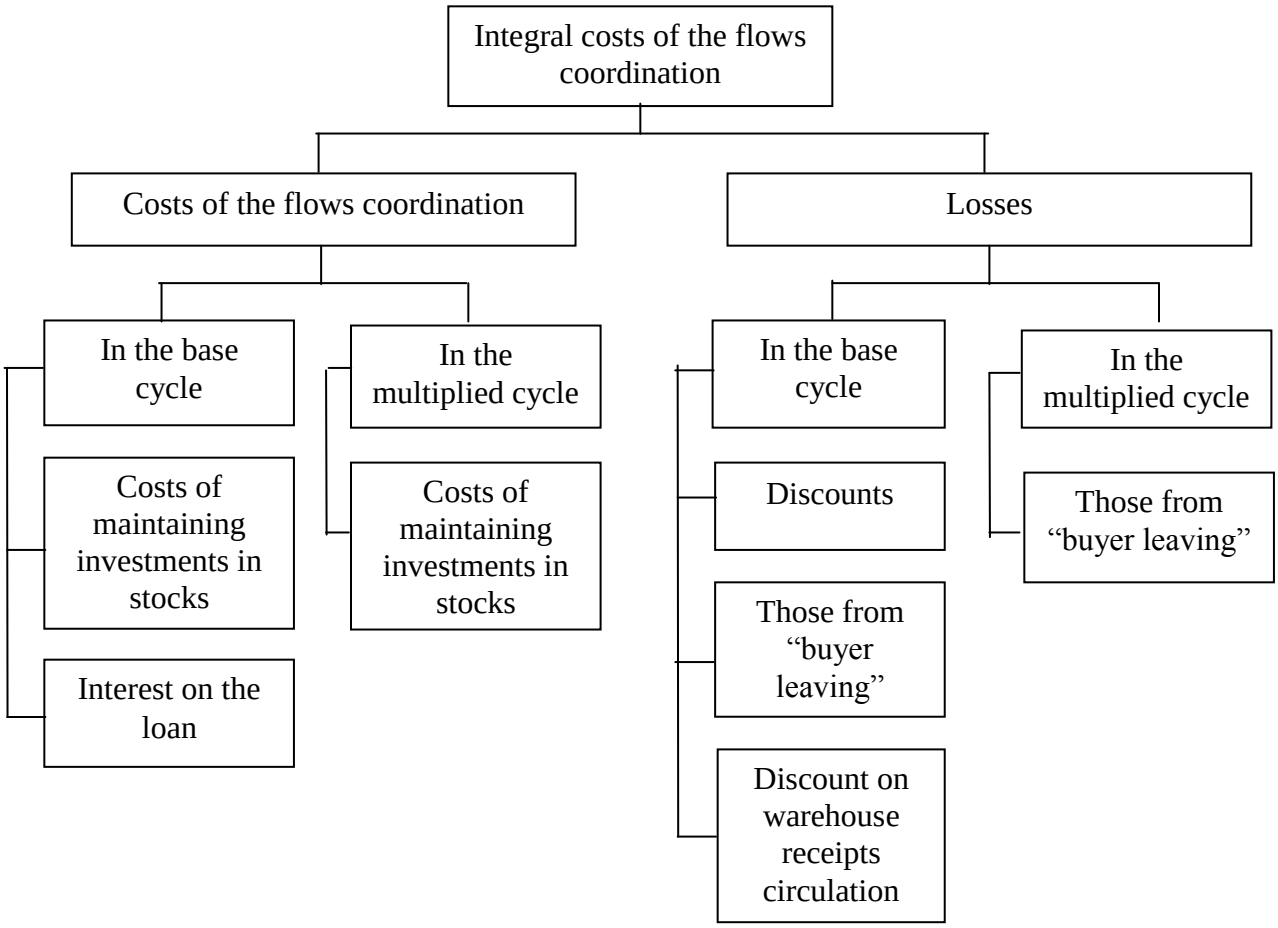

Fig. 2.15. Composition of costs in the supply chains

Delay of flows in Fig. 2.12 can be described as

$$x = x_1 + (j_1 + j_2)\, x_2 + (2 - j_1 - j_2)*(x_3 + x_4), \qquad (2.19)$$

where x – delay of orders fulfillment by the company, days; x_1 – delay of order registration on the factory, days; j_1 and j_2 – part of the total number of requirements met by stocks of finished products in the basic (actual stocks size q^{DC1}, "normal" stocks size Q^{DC1}) and multiply (q^{DC2} and Q^{DC2}) chains respectively, dimensionless; x_2 - delay in shipment of goods from the warehouse, days; x_3 – production delay, days; x_4 – delay in the normal order book, days.

The cost of stocks maintaining in the basic chain is

$$y_{11}^{DC1} = -\frac{\nu * R_{p1}}{c_1} * \ln\left(\frac{j_{max1} - j1}{j_{max1}}\right) * R_r, \qquad (2.20)$$

where y_{11}^{DC1} – cost for the actual stocks maintaining in the basic chain; ν - coefficient of relative stocks size at the factory, which connects the eligible size of a stocks of goods with an average revenue per year, dimensionless; R_{p1} – prepaid revenues in the basic chain, dollars per year; j_1 – share of orders in the basic chain, performed at the expense of stocks, dimensionless ($0 \le j1 \le 0{,}4$).

Similarly, the cost of stocks maintaining in the multiply chain

$$y_{12}^{DC2} = -\frac{\nu * M_2}{c_1} * ln\left(\frac{j_{max2} - j_2}{j_{max2}}\right) * R_r, \quad (2.21)$$

where y_{12}^{DC2}- the cost of the actual stocks maintaining in the multiply cycle; ν – the coefficient of relative stocks size at the factory, which connects the eligible level of size of stocks of goods with revenues for the year, dimensionless; M_2 – revenue with immediate payment in the multiply chain, dol. per year; j_2 – share of orders in the multiply chain performed at the expense of stocks, dimensionless ($0 \le j2 \le 0{,}4$).

Feature of the proposed multiplication scheme is that revenue in the multiply chain is a function of the revenue in the basic chain:

$$M_2 = i * R_{p1}. \quad (2.22)$$

Economic need for the introducing costs in the model in form of interest on the loan – the second element of the costs – is as follows. In the classical delay scheme the manufacturer sends received prepayment to the material resources supplier. In our scheme received prepayment starts a new chain DC_2 and payable in the initial chain DC_1 is repaid by transfer of a document of title (link 11). Obviously, the higher the prepayment, the higher the intensity of flows in the DC_2, however, the intensity of the flow 11 is lower; and there is a need to borrow funds to meet own "old" obligations and to pay interest:

$$y_{12}^{SC1} = \frac{(i - i_c) * R_{p1} * IR * x}{365}, \quad (2.23)$$

where i_c - share of material costs in sales, dimensionless; $\overline{i}$ – share of prepaid in the revenue; IR – interest rate for loans, dimensionless; x – delay of full payment receive, due to which the loan is repaid, days.

Thus, the costs of flows corresponding in the basic cycle are

$$y_1^{SC1} = y_{11}^{SC1} + y_{12}^{SC1}, \quad (2.24)$$

Full costs

$$y_1 = y_{11}^{SC1} + y_{12}^{SC1} + y_1^{SC2} = -R_r * \frac{\nu * R_{p1}}{c_1} \ln\left(\frac{j_{max1} - j_1}{j_{max1}}\right) + \frac{(i - i_c) * R_p * IR * X}{365}$$

$$- R_r * \frac{\nu * i * M_{п1}}{c_1} \ln\left(\frac{j_{max2} - j_2}{j_{max2}}\right). \quad (2.25)$$

Losses from discounts in the basic chain are lost profits

$$y_{21}^{SC1} = R_{p1} * R_r * (e^{\varepsilon 1(x-c)} - 1), \quad (2.26)$$

где y_{21}^{SC1} – lost profit, rub.; ε_1– rate of loss from discounts in the basic circuit, dimensionless; c – the minimum delay of shipment, days.

Losses of "buyer leaving" in the basic chain are loss of profit, which can be defined as:

$$y_{22}^{SC1} = C_3 * (e^{\delta(x-c)} + e^{\delta 1(i-a2)} - 2 + в - ki), \quad (2.27)$$

where C_3, в, a_2, c – constants of the model; δ, δ_1 and k – rate of losses from significant delay of supply and high prepayment respectively.

Losses from "buyer leave" in the multiply chain

$$y_2^{SC2} = C_3 * e^{\delta 2\,(x-c)} \quad (2.28)$$

where δ_2 - rate of losses from a significant delay delivery.

The final element of losses in the basic chain is the discount at warehouse certificates turnover. It arises at repayment of payables by concession the warehouse part to the lender (due 1,2,11). The emergence of discount is due usually to change of the market price of the goods, filling a warehouse certificate:

$$y_{23}^{SC1} = d * Nwp \quad (2.29)$$

where d – discount rate, dimensionless; Nwp – par value of the warehouse part, rub.

Considering, first, that the par value of the warehouse part is equal to par value of the double warehouse certificate minus par value of the warrant (which is equal to prepaid); second, par value of the double warehouse certificate is equal to "normal" stocks size Q, we obtain

$$Nwp = (1 - i) * \nu * R_{p1} \quad (2.30)$$

Considering (2.30) we have

$$y_{23}^{SC1} = d * (1 - i) * \nu * R_{p1} \quad (2.31)$$

Thus, the losses in the basic chain

$$y_2^{SC1} = y_{21}^{SC1} + y_{22}^{SC1} + y_{23}^{SC1} \quad (2.32)$$

total losses

$$y_2 = y_{21}^{SC1} + y_{22}^{SC1} + y_{23}^{SC1} + y_2^{SC2} =$$
$$= R_{p1} * R_r * (e^{\varepsilon 1(x-c)} - 1) + C_3 * (e^{\delta(x-c)} + e^{\delta 1(i-a2)} - 2 + в - ki) +$$
$$d * (1 - i) * \nu * R_{p1} + C_3 * e^{\delta 2\,(x-c)} \qquad (2.33)$$

Thus, we have the following optimization problem: find the delay, providing optimum of the target function – criterion of the supply chains functioning:

$$y = (y_1 + y_2) \rightarrow \min$$

The solution of this problem allows us to determine the following parameters of the industrial enterprise's supply chain:

- optimal multiplier *i**, providing synergies in the form of additional profits of the enterprise;

- optimal stability as a minor deviation from the optimal delay simultaneously in the basic and multiply chains *x**. It is provided by the formation of optimal reserves in each chain g^{SC1} and g^{SC2}; optimal regime of the "warehouse-production" material flow in each cycle j_1* and j_2*; approximation to the optimal level of customer service.

2.4 Definition of the freight charges for international shipments of bulk cargo

Due to the geographical remoteness of the Republic of Kazakhstan from sales markets, a significant share of the domestic production cost accounts for its transportation. Reducing of transport costs will reduce the price of goods and, as a consequence, will increase the competitiveness of Kazakhstan's exports. [53]

Improvement of the tariff policy, fees and payments for services in railway transport will promote the efficiency and quality of rail transportation, balancing of its cost for producers in the final price of products. The following study and the proposed method of calculation are described in the work carried out by scientists of the Industrial transport Department of KSTU [54-55].

One of the problems hindering development of rail transportation is the method of determining the transportation cost. In connection with the appearance of the new sovereign independent states on the world political map, and new national currencies, in railway transportation has come so called tariff gap. The essence of the tariff gap is that freight charge is determined by rail to the border stations in national currencies converted into Swiss francs.

We will define the tariff freight for international transportation with tariff gap (Fig. 2.13). The cargo transported is coal.

Fig. 2.16. Logistics scheme of the route Karaganda – Giurgiulești

Transportation of bulk cargo through the territory of the Republic of Kazakhstan:

Karaganda --- Tobol - 896 km.

The total length of the route is 4545 km, of which:

Across Kazakhstan – 896 km; across Russia – 2317 km; across Ukraine – 1048 km; across Moldova – 284 km.

Freight charge ratios for the transportation of 60 tons of coal in the Russian Federation for a distance of 2317 km (on the territory of Ukraine – 1048 km, on the territory of Moldova – 284), excluding (P) coefficient, will be equal to 6264 CHF (2632,8 USD and 1829.4 CHF respectively). When calculating the total freight rates should also take into account the correction coefficients. To calculate the cost of transportation of 60 tons of coal in the Russian Federation we use the formula [43]:

$$P = (a \times p) \times b \qquad (2.34)$$

where *P* - freight charge for 60 tons of cargo excluding coefficients (6264 CHF);

a - correction coefficient (0.55);

b - index for transportation of goods not listed separately.

We calculate the freight rates for the transportation of coal in the Russian Federation:

$$P = (0{,}55 \times 6264) \times 1 = 3445{,}2 \text{ CHF}$$

For cargo transportation on the territory of Ukraine considered only coefficient for coal transportation (k = 1), so the total freight charge will be 2632,8 USD.

When calculating the total freight charges for the freight transportation in Moldova will be considered: correction coefficient (a=0.55) and the coefficient for transit cargo transportation in Moldova (a=0.7):

$$P = (0{,}55 \times 1829{,}4) \times 0{,}7 = 704{,}4 \text{ CHF}$$

The results obtained we place in table 2.5. for comparison.

Table 2.5

Table for the freight charge calculating

Country	Distance, km	Freight charge	for 1 t. of freight charge	Extra fees	Currency
Kazakhstan	896	99411.00	1656.85	0	KZT
Russia	2317	3445.20	57.42	8.16	CHF
Ukraine	1048	2632.80	43.88	8.50	USD
Moldova	284	704.40	11.74	0	CHF
	4545	99411.00	1656.85	0	KZT
		4149.60	69.16	8.16	CHF
		2632.80	43.88	8.50	USD

We convert the table data into one currency, the Swiss franc, and obtain:

99411tg/170.24 = 583.94 CHF;

2632.8 USD × 153.78 = 404871.9 tg./153.78 = 2632.79 CHF

To calculate the total cost of transportation of 60 tons of coal from the Karaganda-Coal station to Giurgiuleşti station (exp. CFR), we sum the obtained values of the freight charges:

$$C_{tot} = C_{KZ} + C_{RF} + C_{UKR} + C_{MD} \quad (2.35)$$

where C_{KZ} – freight charge for transporting 60 tons of coal through the territory of the Republic of Kazakhstan [81];

C_{RF} – freight charge for transporting 60 tons of coal in the territory of the Russian Federation;

C_{UKR} – freight charge for transporting 60 tons of coal in the territory of Ukraine;

C_{MD} – freight charge for transporting 60 tons of coal in the territory of the Republic of Moldova.

$$C_{tot} = 621.98 + 3445.2 + 2480.6 + 704.4 = 7252.18 \text{ CHF}$$

For the transportation of 60 tons of coal in the Russian Federation for a distance of 2317 km (in the territory of Ukraine – 1048km, in the territory of Moldova – 284), freight charge excluding coefficients (P) will be equal to 6264 CHF (1210.8 USD and 704.4 CHF respectively). All data transferred to tenge. Market exchange rates as of October 23, 2013 amounted to:

1 USD = 153.78 KZT;

1 CHF = 170.24 KZT.

Thus, we obtain:

6264 CHF × 170.24 = 1066383.36 KZT;

1210.8 USD × 153.78 = 186196.8 KZT;

704.4 CHF × 170.24 = 119917.05 KZT.

When calculating the total freight charge one should also take into account the correction coefficients. To calculate the cost of transportation of 60 tons of coal in the Russian Federation we use the formula:

$$P = (a \times p) \times b \quad (2.36)$$

where P – freight charge excluding coefficients for 60 tons of cargo (1,066,383.36 KZT);

a – correction coefficient (a = 0.55);

b - the index for transportation of cargo not listed separately (b = 1).

We calculate the cost for transportation of coal in the Russian Federation territory:

$$P = (0{,}55 \times 1066383.36) \times 1 = 586{,}510.8 \text{ KZT}.$$

For cargo transportation in the territory of Ukraine considered only coefficient for coal transportation (k = 1), so the total freight charges will be equal to 186196.8 KZT.

When calculating the total freight charge for the freight transportation in Moldova will be considered: correction coefficient (a = 0.55) and the coefficient for transit of cargo in Moldova (b = 0.7), and the p indicator = 303,479.17 KZT:

$$P = (0{,}55 \times 303479.17) \times 0.7 = 116852.92 \text{ KZT}$$

To calculate the total cost of transportation of 60 tons coal from the Karaganda-Coal station to station Giurgiuleşti (exp. CFR), summarize the resulting data:

$$C_{tot} = C_{KZ} + C_{RF} + C_{UKR} + C_{MD} \quad (2.37)$$

C_{tot} = 99411+586510.8 +186196.8+116852.92 = 988971.5 KZT

In this transportation under the tariff calculation scheme with the tariff gap, when the distance reset (zeroed) on the border stations, the total amount of freight rates in international rail transport is 988,971.5 KZT.

We now calculate the freight charge from Karaganda-Coal station to Giurgiuleşti station (exp.CFR with through-shoulder scheme). We use the total distance for this that remains unchanged and is equal to 4545 km.

Freight charge for a distance of 4545 km is calculated by the formula:

$$R = R_{cfw}*K_1+R_{lt}*K_2+R_{cu}*K_3+R_{irn}*K_4 \quad (2.38)$$

where R_{cfw} - rates for services of commercial freight work for transportation by carload shipments;

R_{lt} - rates for locomotive traction using for transportation by carload shipments;

R_{cu} - rates for boxcars using for transportation by carload shipments;

R_{irn} - rates for services of international rail network for transportation by carload shipments [53];

K_1, K_2, K_3, K_4 - conversion coefficients of railway transport (K_1 = 700, K_2 = 393, K_3 = 518, K_4 = 285) [81]

R = 10.028*700+412.39*393+159.41*518+330.74*285 = 345924.15 KZT

We convert obtained result into Swiss Franc at the exchange rate: 345924.15 / 170.24 = 2031.9 CHF

We will calculate in Swiss Francs freight charges for the territory of each country by calculating the percentage ratio of the distances of each country to the general distance using the formula:

$$C = (S / S_{tot})* T \quad (2.39)$$

Where S - distance across the country participating (S_{KZ} - distance across Kazakhstan – 896 km; S_{RF} - distance across Russia – 2317 km; S_{UKR} - distance across Ukraine – 1048 km; S_{MD} - Moldova distance – 284 km).

S_{tot} – total distance traveled by the load from the departure station to the destination station;

T - total freight charge in Swiss Francs.

Thus, the freight charge by the through-shoulder scheme across the territory of the Republic of Kazakhstan will be equal to:

C_{KZ} = (896/4545)*345,924.15 = 68197.3 KZT

For Russia:

C_{RF} = (2317/4545)*2031.9 = 176,357.66 KZT

For Ukraine:

C_{UKR} = (1048/4545)*2031.9 = 79759.91 KZT

For Moldova:

C_{MD} = (284/4545)*2031.9 = 21598.88 KZT

Now we make a comparison of methods for determining the freight charges on railway transport.

Table 2.6 shows a comparison of determining the freight charges with the tariff gap scheme and a shoulder-through scheme for bulk cargo.

We calculate the annual savings for coal transportation when calculate the freight charges by the through-shoulder scheme by the formula:

$$\Delta C = \Delta C \times n_{day} \times 365 \quad (2.40)$$

where ΔC - the differences of the freight charges on the tariff gap scheme and through-shoulder scheme;

n_{day} - number of cars, loaded in one day (80cars/day);

365 - number of days in the year.

$$\Delta C = C_{tg}^{fc} - C_{ts}^{fc} \quad (2.41)$$

where C_{tg}^{fc} - freight charge on the tariff gap scheme;

C_{ts}^{fc} - freight charge on the through-shoulder scheme.

Table 2.6

Comparison of two methods for determining the freight charges for carload shipping

#	Country	Stations participating in the transportation process	Rate distance, km.	Freight charge	
				tariff gap scheme	through-shoulder scheme
1	Kazakhstan	Karaganda-Coal – Tobol	896 km	99,411 KZT	68,197.3 KZT
2	Russia	Tobol (exp.) – Solovey (exp.)	2317 km	586,510.8 KZT	176,357.66 KZT
3	Ukraine	(Topoli (exp) – Kuchurgan (exp.); st.p. Petrostal (exp) – st.p. 121 km (exp); Bolhrad (exp. p.t. 208 km) – Bolhrad (eksp. Grecheny; Frikatsey (exp) – Renee (exp))	1048 km	186,196.8 KZT	79,759.91 KZT
3	Moldova	Novosavitskaia (exp.) – Chimishliya (exp); Basarabească (exp) – p.t. 208km (exp); Grechen (exp) - Etulia (exp); Giurgiuleşti (exp.URW) – Giurgiuleşti (exp.CFR)	284 km	116,852.92 KZT	21,598.88 KZT
	Total		4545 km	988,971.5 KZT	345,913.75 KZT

Symbols: st.p. – stopping point; exp. – export; p.t. – passing track.

$\Delta C = 792765,17 – 345913,75 = 446851,42$ KZT

(for 1 car)

$\Delta C = 446851,42 * 80 * 365 = 13048061464$ KZT

(Per year throughout entire traffic volume)

So, in this section freight charge offered on the shoulder-through scheme, where they take the total distance from the departure station to the destination station regardless of the number of borders crossed. Thus, the freight charge for transporting 60 tons of coal from "Karaganda-Coal" station to "Giurgiuleşti" station (exp.CFR) on tariff gap scheme is 988,971.5 KZT, and on the through-shoulder scheme for the same distance – 345,913.5 KZT. The proposed method of the freight charge calculating is also suitable for other cargo. With a decrease in the overcharged unreasonably freight charges for the cargo transportation more favorable conditions created to reduce the final price of the transported product and it becomes more competitive on foreign markets.

The annual savings in operating costs due to implementation of the proposed methodology for calculating the freight charges for cargo transportation, amount to 13,048,061,464 KZT or 78,654,580.0 CHF.

Conclusions of the second chapter

1. At the beginning of the 21st century integrated management paradigm has spawned a new ideology of business management – Supply Chain Management (SCM). This paradigm reflects a new understanding of business: particular enterprises are considered as units of the general supply chain, combined directly or indirectly into a single (integrated) process of controlling flow of all kinds of resources for the most complete and high-quality customers satisfaction in accordance with their specific needs. The classical approach is limited to the considering funds in circulation in the "narrow sense" - only within the same subject. Today, however, this is not enough objectively, and supply chain management (SCM) is a natural extension, the development of an integrated approach. SCM is an integrated functional comprising three or more participants involved in the flow of goods, services, finance, and information from the source to the consumer, as well as the bank as financial infrastructure of the chain. We propose concepts: first, the supply chain in the delayed finance mode – an interconnected sequence of links for which the goods are delivered to the final consumer in the mode of delayed payment; second, the supply chain with the advanced finance mode – an interconnected sequence of links for which the goods are delivered to the final consumer in the pre-payment mode.

2. Principles of organization and control of the mutual settlements in the concept of the supply chain are as follows:

- transition from competition to focus on cooperation with consumers and suppliers;
- cooperation with a small amount of reliable buyers of products;
- vertical integration with key customers and suppliers located at least at the first level in order to reduce risks;
- joint control of material, financial and information flows;
- quick response to order and different forms of payment;
- presence of an established settlement system for the supplied resources;
- focus on reducing overall costs and losses;
- bank involvement as a supply chain infrastructure;
- decrease in entropy in the entire chain;
- providing a positive synergy effect.

3. Authors' method for optimization of funds in circulation (working capital) of industrial enterprise allowed us to determine the synergies arising from the supply chain multiplication, where financial flows are structured with modern settlement instruments.

4. Cost (value) of goods depends on many factors, including their quality, pricing policy of the company, and, lately, more and more of their transportation costs. One of the main problems for manufacturers and entrepreneurs today is the problem of calculating the cost of transporting goods by rail. We propose to reduce the cost of cargo transportation, thereby increasing the speed (turnover) of raw materials sold. Methods of

determining the cost of transportation by the through-shoulder scheme fits logically into the concept of the supply chain. It is not to use unreasonable zeroing of cargo transported distance at border stations (which are intermediate stages of the through route), but to take into account only distance from the departure station to the final destination station.

CHAPTER 3. ECONOMIC AND MATHEMATICAL MODELING OF THE MUTUAL SETTLEMENTS

3.1. Economic and mathematical model of the mutual settlements functioning

We construct a model of the industrial enterprise's funds in circulation turnover. Each of the components of income and expenses of the enterprise, arising from the involvement of bank financing, can be expressed by mathematical expressions, the general form of which is given in Table. 3.1.

Table 3.1.

Parameters and constants of the basic and multiply chains

Symbol	Name	Value	Unit of measure
v	Coefficient of the relative stocks at the company	0.2	Dimensionless
R_r	Company's rate of return	0.1	Dimensionless
B1	Revenue from prepaid in the basic chain	100 000 000	Rubles
B2	Revenue from immediate payment	Depends on the variable ***i***	Rubles
m	Revenue from prepaid average per 1 buyer	500,000	Rubles
x_1	Ordering time at the factory	5	Days
x_2	Time of shipment from the warehouse	5	Days
x_3	Production delay	60	Days
x_4	Delay in the normal order book	10	Days
J_{max1}	Upper orders limit in the basic chain met by stocks of finished products	0.4	Dimensionless
J_{max2}	Upper orders limit in multiply chain met by stocks of finished products	0.4	Dimensionless
j_{n1}	Share of orders met by "normal" stocks size in the basic chain	0.35	Dimensionless
j_{n1}	Share of orders met by "normal" stocks size in the multiply chain	0.35	Dimensionless
J_1	Share of total number of requirements in the basic chain met by stocks	0-0.4	Dimensionless
J_2	Share of total number of requirements in the multiply chain met by stocks	0-0.4	Dimensionless
C_1	Constant for selecting a share of the total number of requirements met by stocks of finished products	Initial conditions	Dimensionless
c	Time of the company ordering and products shipment from the warehouse	x1 + x2	Dimensionless

<table>
<tr><td>δ</td><td>Parameter of depending number of buyers who left on the delay of products delivery</td><td>Determined on the basis of initial conditions</td><td>Dimensionless</td></tr>
<tr><td>$\delta_{1,в,k}$</td><td>Parameter of depending number of buyers who left on the amount of the first payment</td><td>Determined on the basis of initial conditions</td><td>Dimensionless</td></tr>
<tr><td>i</td><td>Share of prepayment in the total revenue</td><td>0.5-0.9</td><td>Dimensionless</td></tr>
<tr><td>i_c</td><td>Share of material costs in the total revenue</td><td>0.5</td><td>Dimensionless</td></tr>
<tr><td>IR</td><td>Interest rate for credit resources</td><td>0.15</td><td>Dimensionless</td></tr>
<tr><td>a_2</td><td>Minimum proportion of the prepayment</td><td>0.5</td><td>Dimensionless</td></tr>
<tr><td>d</td><td>Discount rate at warehouse certificates turnover</td><td>10% per year</td><td>% per year</td></tr>
<tr><td>l</td><td>Average value of shipments for non-monetary resources per one counterparty</td><td>34,666</td><td>Rub/Day</td></tr>
<tr><td></td><td>Features of magnitude of losses from suppliers departure
$L_y=(в_1+\alpha_1 \cdot x)$</td><td>$в_1$ = -0.7368;
α_1 = 0.2456.
Calculated by identifying the coefficients of the curve for approximation of the original data in a table:<table><tr><td>x</td><td>L_y, per 1 day</td></tr><tr><td>3 days</td><td>0</td></tr><tr><td>60 days</td><td>14</td></tr></table></td><td>Dimensionless</td></tr>
<tr><td>δ_2</td><td>Parameter in the dependence of the number of buyers who left in the multiply chain</td><td>Determined on the basis of initial conditions
0.025</td><td>Dimensionless</td></tr>
</table>

Requirements met by stocks in the basic and multiply chains

Fig. 3.1 shows dependence of the proportion of the total number of requirements *j*, met by stocks of finished products, on the full aggregate reserve g/Q in the basic and multiply chains.

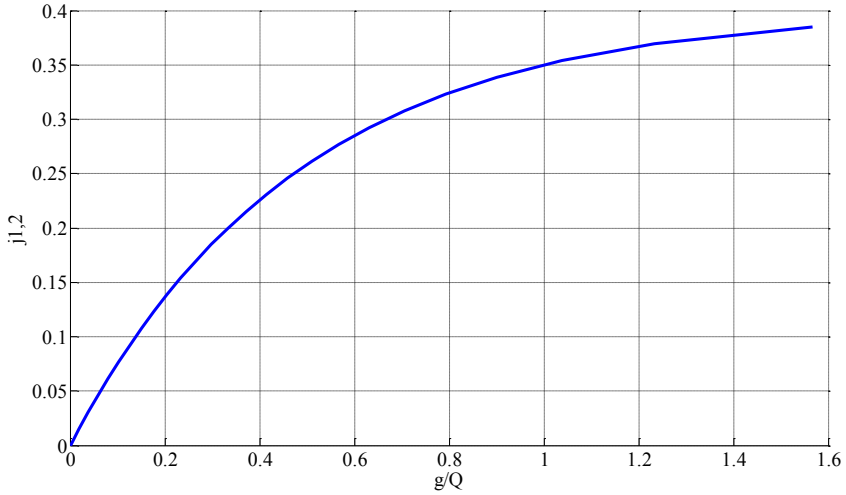

Fig. 3.1. Requirements met by stocks in the basic and multiply chains

Analytical representation of share of the general requirements magnitude in the basic chain SC1 met by stocks of finished products:

$$j_1 = j_{\max 1}(1 - e^{-2{,}0794(g/Q)}), \tag{3.1}$$

$$\text{constant } c_1 = \ln\left(\frac{j_{\max 1} - j_{n1}}{j_{\max 1}}\right) = 2{,}0794\,. \tag{3.2}$$

Analytical representation of share of the general requirements magnitude in the multiply chain SC2 met by stocks of finished products:

$$j_2 = j_{\max 2}(1 - e^{-2{,}0794(g/Q)}), \tag{3.3}$$

$$\text{constant } c_1 = \ln\left(\frac{j_{\max 2} - j_{n2}}{j_{\max 2}}\right) = 2{,}0794\,. \tag{3.4}$$

Costs of flows coordination, excluding loan interest

Thus, cost of the actual stocks maintenance (Figure 3.2), excluding loan interest for the basic chain represented analytically as:

$$y_{11}^{SC1} = -\frac{v \cdot B_1}{c_1} \cdot \ln\left(\frac{j_{\max 1} - j_1}{j_{\max 1}}\right) \tag{3.5}$$

or

$$y_{11}^{SC1} = -0{,}0096 \cdot B_1 \cdot \ln\left(\frac{j_{\max 1} - j_1}{j_{\max 1}}\right). \tag{3.6}$$

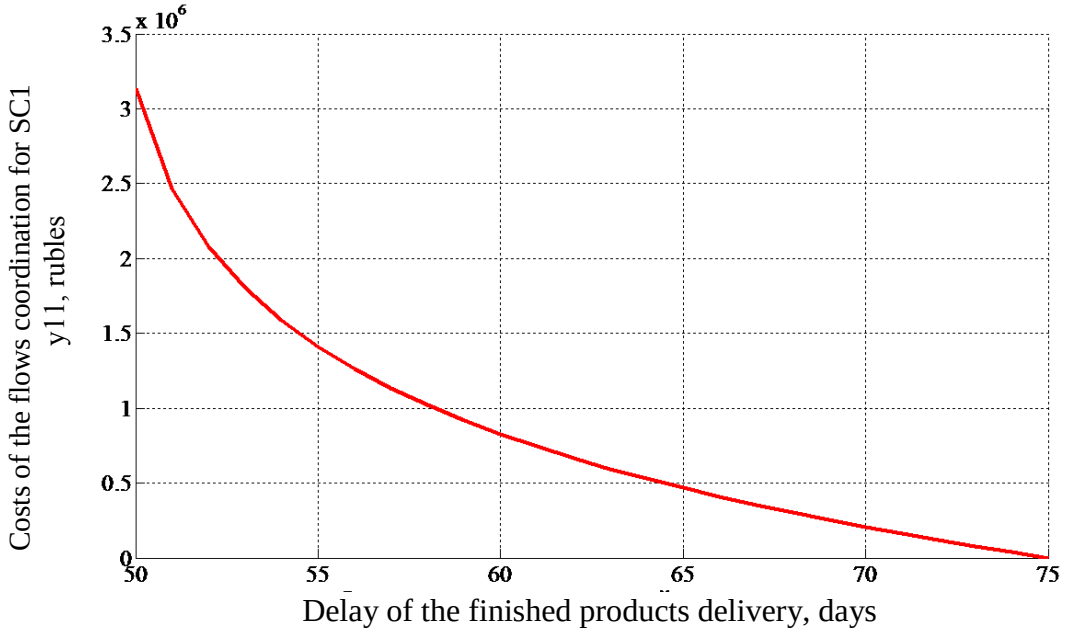

Fig. 3.2. Costs of flows coordination in the basic chain

Costs of actual stocks maintenance in the multiply chain depends on the proportion of prepayment and taking into account $B_2 = i \cdot B_1$ represented analytically in the form:

$$y_1^{SC2} = -\frac{v \cdot B_1 \cdot i}{c_1} \cdot \ln\left(\frac{j_{\max 2} - j_2}{j_{\max 2}}\right) \tag{3.7}$$

or

$$y_1^{SC2} = -0{,}0096 \cdot i \cdot B_1 \cdot \ln\left(\frac{j_{\max 2} - j_2}{j_{\max 2}}\right). \tag{3.8}$$

Results of the costs simulation for prepayment in the amount of 50% (curve 1), 60% (curve 2), 70% (curve 3), 80% (curve 4), 90% (curve 5) are shown in Fig.3.3.

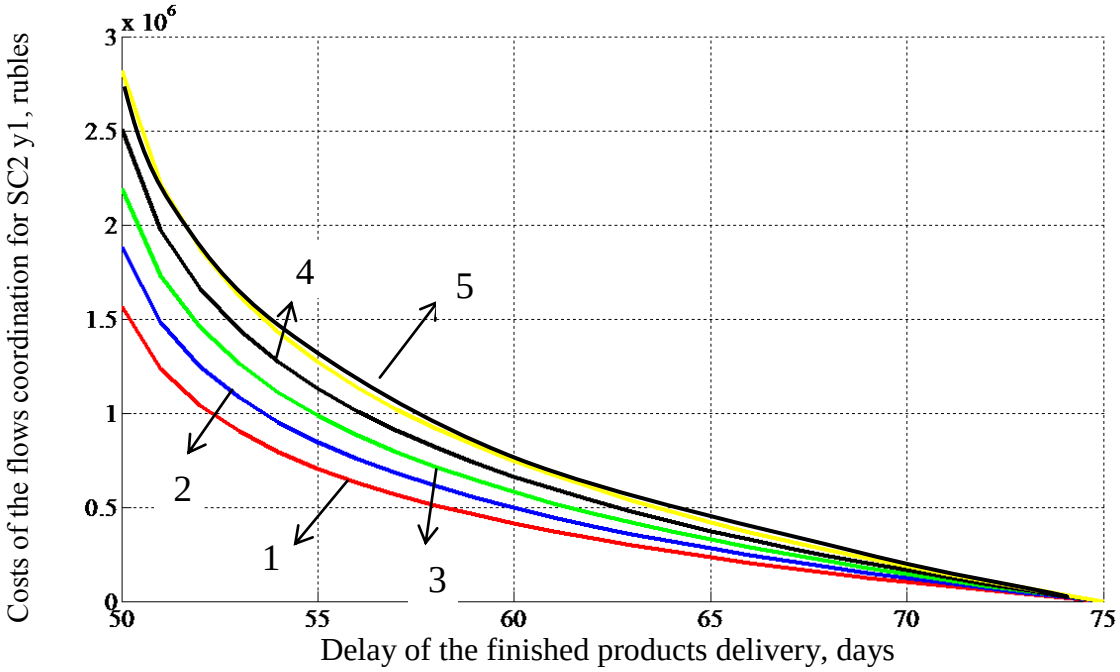

Fig. 3.3. Costs of the flows coordination in the multiply chain y_1^{SC2}

Costs associated with the payment of interest on the loan in the basic chain

Costs associated with the payment of interest on the loan in the basic chain represented analytically in the form:

$$y_{12}^{SC1} = \frac{(i - i_c) \cdot B_1 \cdot IR \cdot x}{365} \tag{3.9}$$

where i_c – share of material costs in the revenue; IR – cost of credit resources in the form of interest rates.

Results of modeling the costs associated with payment of interest on the loan in the basic chain for prepayment in amount of 50% (curve 1), 60% (curve 2), 70% (curve 3), 80% (curve 4), 90% (curve 5) are shown in Fig. 3.4.

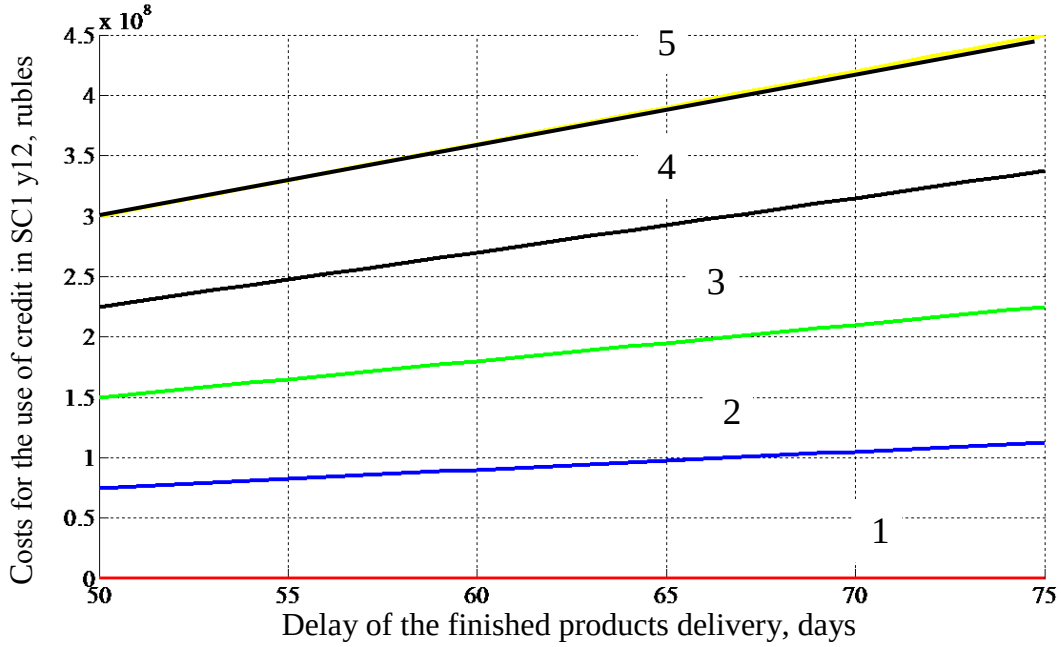

Fig. 3.4. Costs associated with payment of interest on the loan in the basic chain

Thus, the total costs of flows coordination in the basic chain, taking into account the cost of the loan payment, are as follows:

$$y_1^{SC1} = -0{,}0096 \cdot B_1 \cdot \ln\left(\frac{j_{\max 1} - j_1}{j_{\max 1}}\right) + \frac{(i - i_c) \cdot B_1 \cdot IR \cdot x}{365} \quad . \tag{3.10}$$

The simulation results of total costs for the flows coordination, taking into account the payment of the loan, in the basic chain for prepayment in amount of 50% (curve 1), 60% (curve 2), 70% (curve 3), 80% (curve 4), 90% (curve 5) are shown in Fig. 3.5.

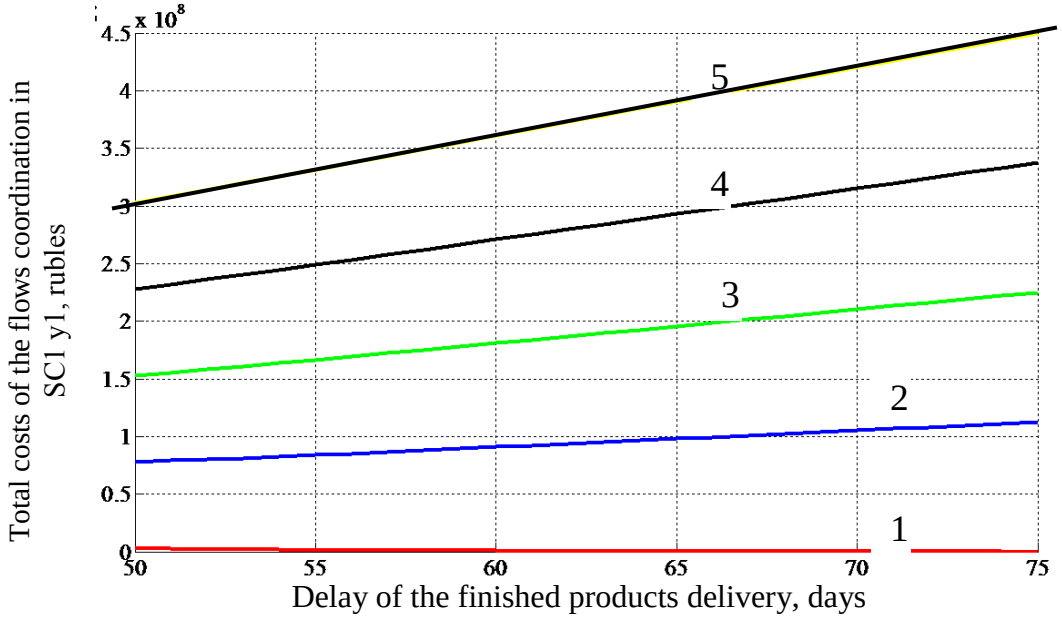

Fig. 3.5. The total costs for flows coordination in the basic chain

Total aggregate costs of the two chains

Thus, total aggregate costs of the flows coordination in both chains are:

$$y_1 = -0{,}0096 \cdot B_1 \cdot \ln\left(\frac{j_{\max 1} - j_1}{j_{\max 1}}\right) + \frac{(i - i_c) \cdot B_1 \cdot IR \cdot x}{365} - \\ - 0{,}0096 \cdot i \cdot B_1 \cdot \ln\left(\frac{j_{\max 2} - j_2}{j_{\max 2}}\right) \tag{3.11}$$

The simulation results of total aggregate costs for the flows coordination in both chains (sum of the basic and multiply chains) for prepayment in amount of 50% (curve 1), 60% (curve 2), 70% (curve 3), 80% (curve 4), 90% (curve 5) are shown in Fig. 3.6.

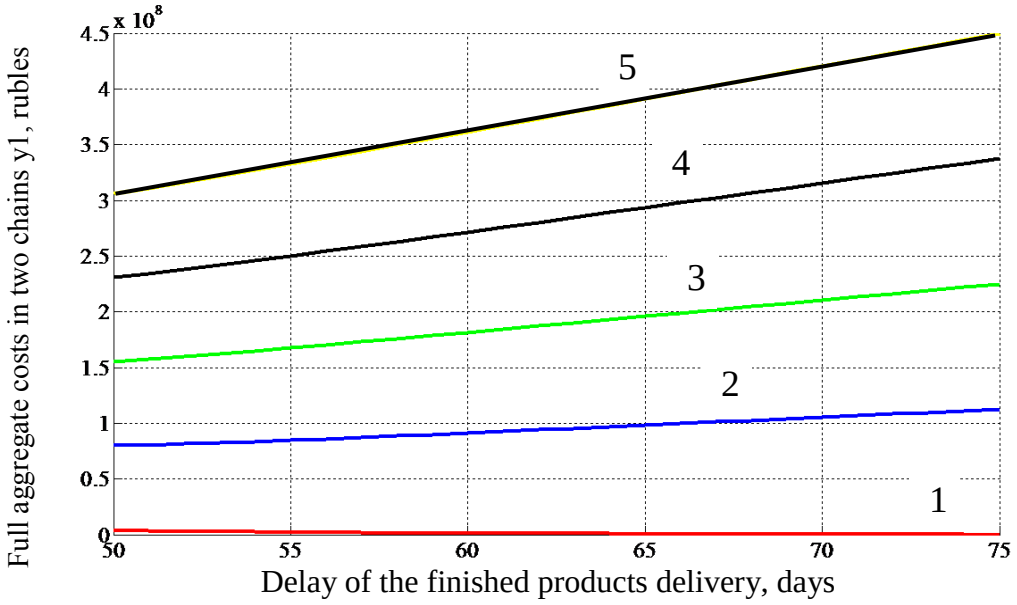

Fig. 3.6. Total aggregate costs for the flows coordination in the system

Company's losses from discounts in the basic chain

Company's losses in the basic chain are the element of delivery delay model. They consist of discounts and the "buyer leave" effect. Graphical representation of the dependence of discounts amount k_1 on delay of products delivery in the basic chain is shown in Fig. 3.7

Graphical representation of the dependence of losses from discounts in the basic chain y_{21}^{SC1} on delay of products delivery is shown in Fig. 3.8

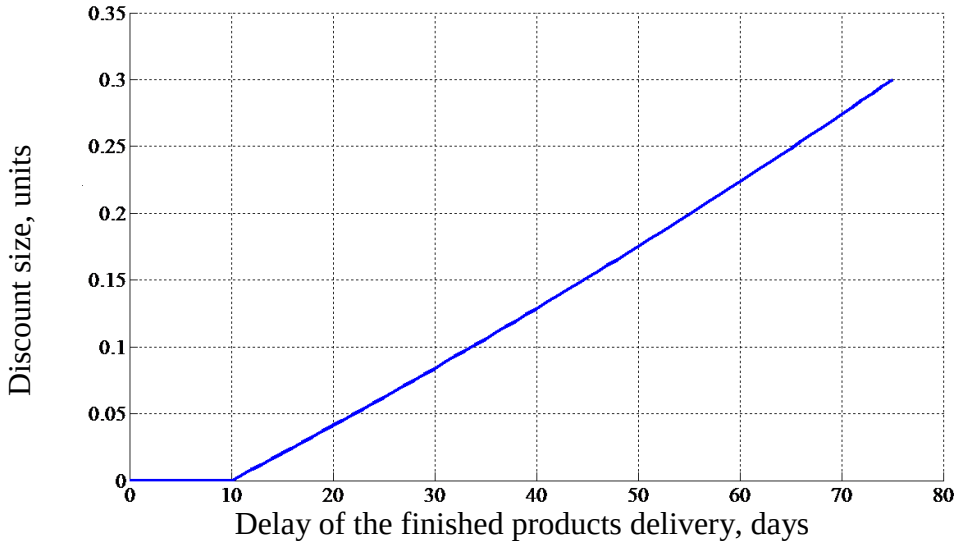

Fig. 3.7. Dependence of discounts amount k_1 on delay of products delivery in the basic chain

The analytical form of the exponential function of the dependence of discounts amount on delay of delivery in the basic chain

$$k_1 = e^{0,004(x-10)} - 1. \tag{3.12}$$

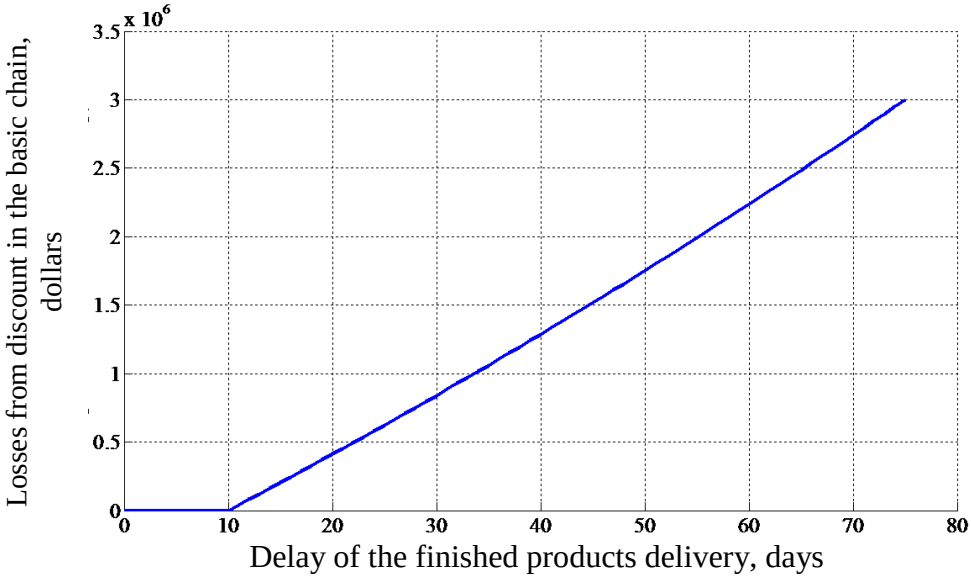

Fig. 3.8. Dependence of losses from discounts in the basic chain on delay of products delivery

Analytical form of losses from discounts in the basic chain:

$$y_{21}^{SC1} = B_1 \cdot Rr \cdot k_1 \tag{3.13}$$

Company's losses from buyers leaving in the basic chain

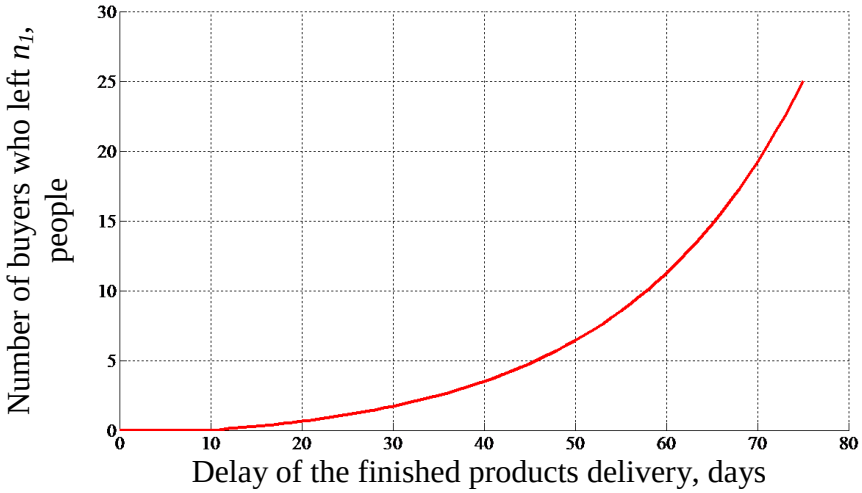

Fig. 3.9. Dependence of the number of buyers who left n_1 on delivery delay in the basic chain

Analytical form of dependence of the number of buyers who left in the basic chain

$$n_1 = e^{0,0501(x-10)} - 1. \quad (3.14)$$

Second component of the "buyer leaving" effect in the basic chain caused by buyers n_2 who are not satisfied with high prepayment (Fig. 3.10).

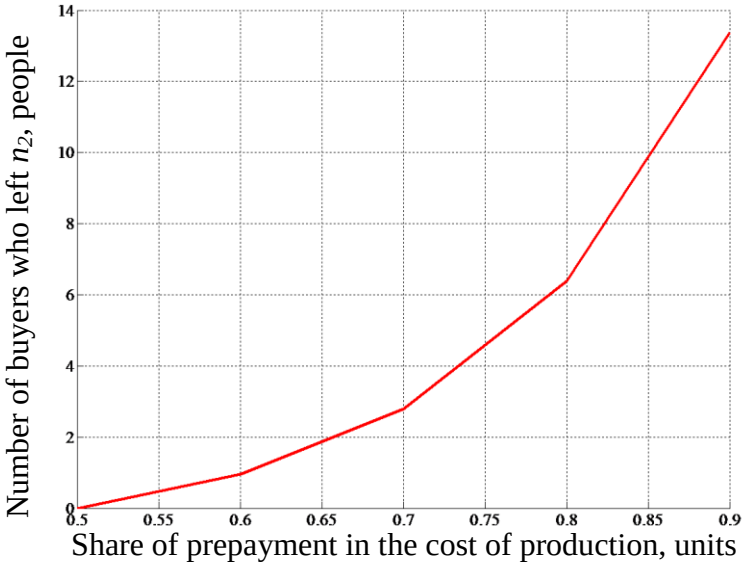

Fig. 3.10. Dependence of the number of buyers who left n_2 on prepayment in the basic chain

Analytical form of dependence of the number of buyers who left in the basic chain

$$n_2 = e^{6,6644(i-0,5)} - 1. \quad (3.15)$$

Third losses component caused by the effect of leaving buyers n_3, who could not redeem production at the basic chain (Fig. 3.11).

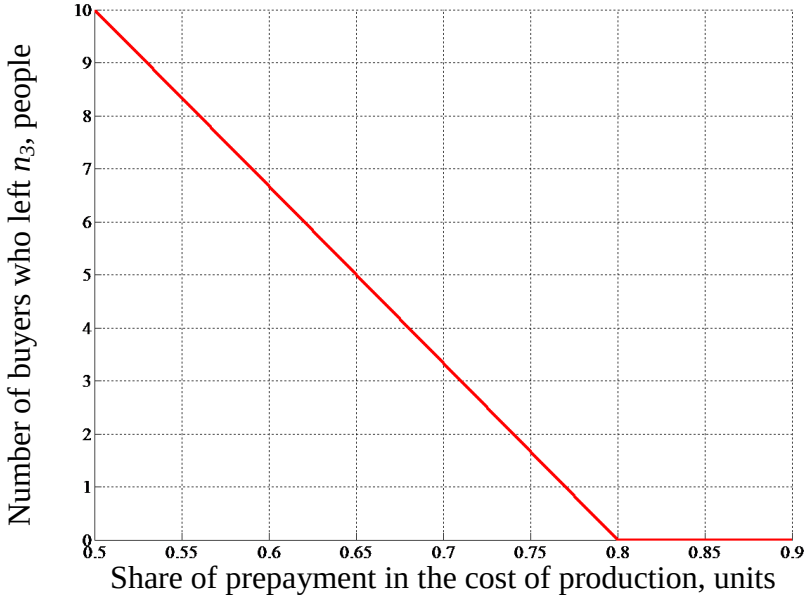

Fig. 3.11. Dependence of the number of "lost" buyers n_3 on prepayment share in the basic chain

Analytical form of dependence in the basic chain:

$$n_3 = \left(\frac{-100}{3}\right) \cdot i + \frac{80}{3}. \qquad (3.16)$$

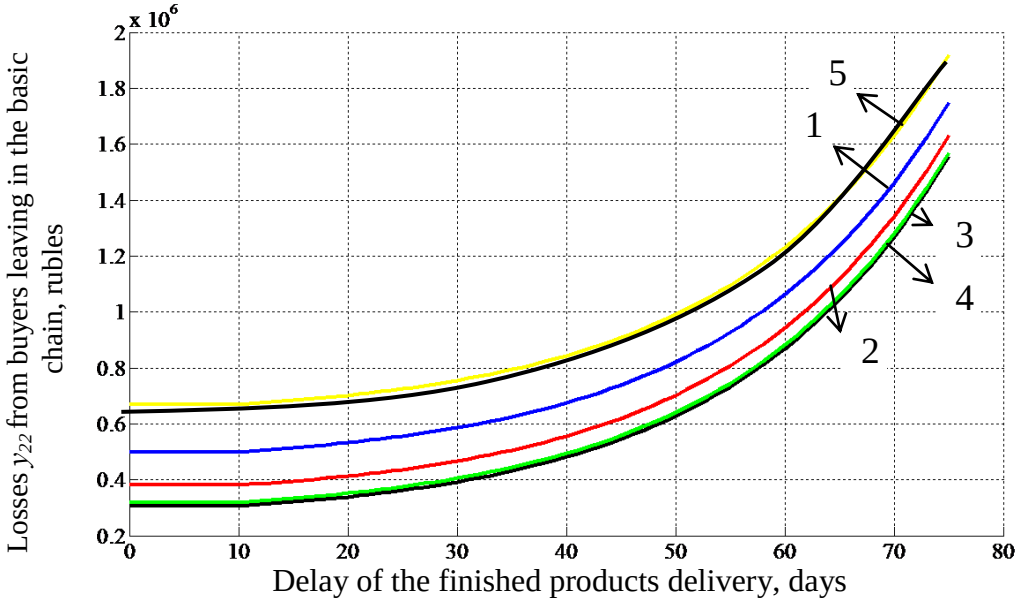

Fig. 3.12. Dependence of the losses from buyers leaving y_{22}^{SC1} on delay of products delivery in the basic chain (blue curve 1 – i=0.5; red curve 2 – i=0.6; black curve 3 – i=0.7; green curve 4 – i=0.8; yellow curve 5 – i=0.9)

Analytical form of dependence of the buyers leaving in the basic chain:

$$y_{22}^{SC1} = R_r \cdot m \cdot \left(e^{0{,}0501(x-10)} - 1 + e^{6{,}6644(-0{,}5)} - 1 + \left(\frac{-100}{3} \right) \cdot i + \frac{80}{3} \right). \quad (3.17)$$

Company's losses from discount on warehouse certificates turnover in the basic chain

Analytical form of dependence of the company's losses from discount on warehouse certificates turnover on delay of delivery in the basic chain

$$y_{23}^{SC1} = d \cdot (1-i) \cdot v \cdot B_1 \cdot \frac{x}{365} \quad (3.18)$$

where d – discount rate on warehouse certificates turnover.

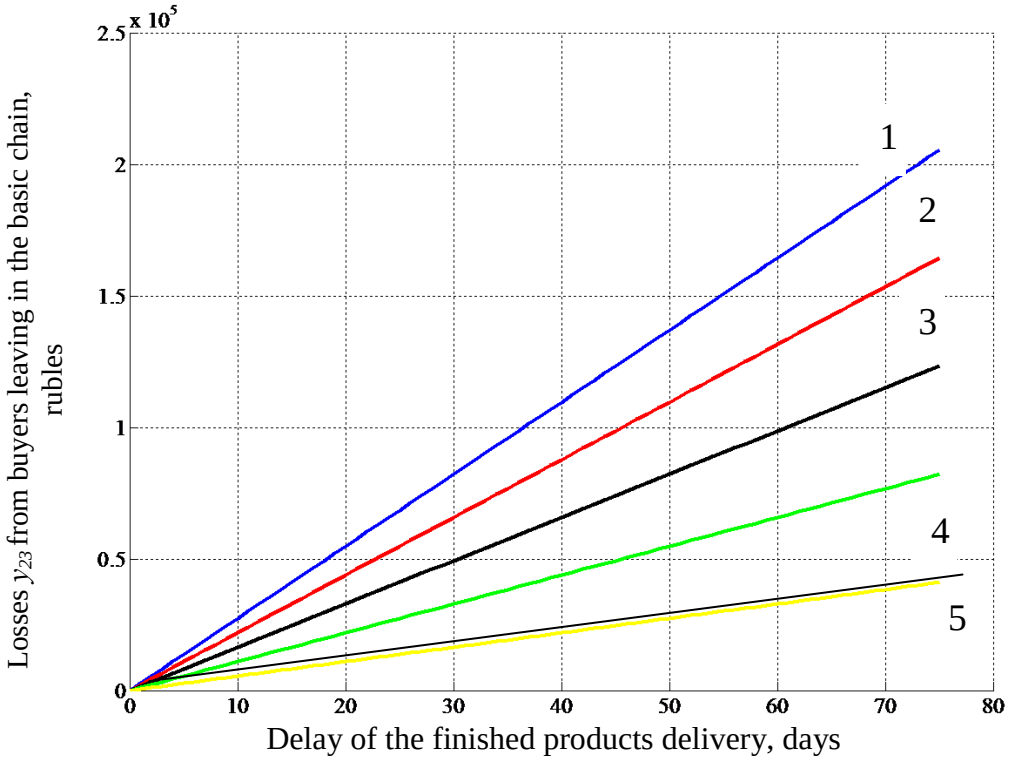

Fig. 3.13. Dependence of company's losses y_{23}^{SC1} from discount on warehouse certificates turnover on delay of delivery in the basic chain (curve 1 – i=0.5; curve 2 – i=0.6; curve 3 – i=0.7; curve 4 – i=0.8; curve 5 – i=0.9)

Loss of suppliers leaving in the basic chain dissatisfied with non-cash form of payment

Other losses will be the losses of "supplier leaving". "Supplier leaving effect" is the amount of lost profits. Suppliers, dissatisfied with non-cash payments, "leave" first; then the others are forced to appoint a discount, so the market value of the goods may deviate from the nominal value of the securities. As an analytical record of losses from leaving

of suppliers who are dissatisfied with the non-cash form of payment in the basic chain the following formula proposed:

$$y_{24}^{SC1} = R_r \cdot l \cdot L_y \tag{3.19}$$

where y_{24}^{SC1} - losses from leaving of suppliers who are dissatisfied with the non-cash form of payment in the basic chain, l - the average volume of resources deliveries for non-monetary form of payment per one counterparty; L_y - the number of counterparties who left dissatisfied with non-cash form of payment in the basic chain.

Obviously, the number of suppliers who left will be the more, the longer will be time of delay x. Based on the assumption of L_y linearity the formula for finding these losses from suppliers leaving is as follows:

$$y_{24}^{SC1} = R_r \cdot l \cdot (в_1 + \alpha_1 \cdot x) \tag{3.20}$$

where $в_1$, α_1 – function parameters reflecting the competitive environment of the company.

Then as a result of numerical identification of these parameters the final form of the loss function determined:

$$y_{24}^{SC1} = 34666 \cdot 0.1 \cdot (-0.7368 + 0.2456 \cdot x) \tag{3.21}$$

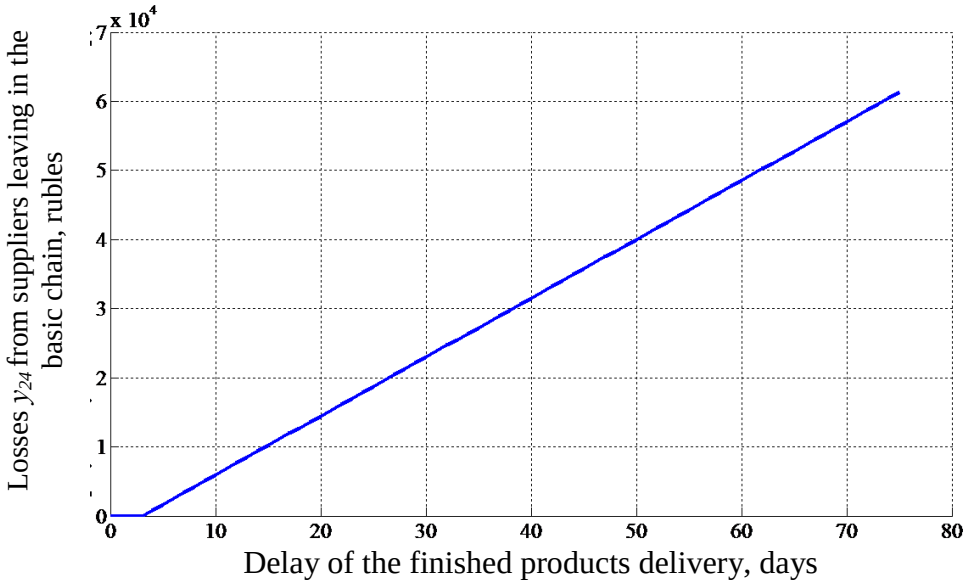

Fig. 3.14. Dependence of losses from leaving of providers who are dissatisfied with non-cash form of payment on time delay in the basic chain

Aggregate losses in the basic chain

Aggregate losses in the basic chain represented analytically as:

$$y_2^{SC1} = B_1 \cdot R_r \cdot k_1 +$$
$$+ R_r \cdot m \cdot \left(e^{0{,}0501(x-10)} - 1 + e^{6{,}6644(-0{,}5)} - 1 + \left(\frac{-100}{3} \right) \cdot i + \frac{80}{3} \right) + \quad (3.\ 22)$$
$$+ d \cdot (1-i) \cdot v \cdot B_1 \cdot \frac{x}{365} +$$
$$+ 34666 \cdot 0.1 \cdot (-0.7368 + 0.2456 \cdot x).$$

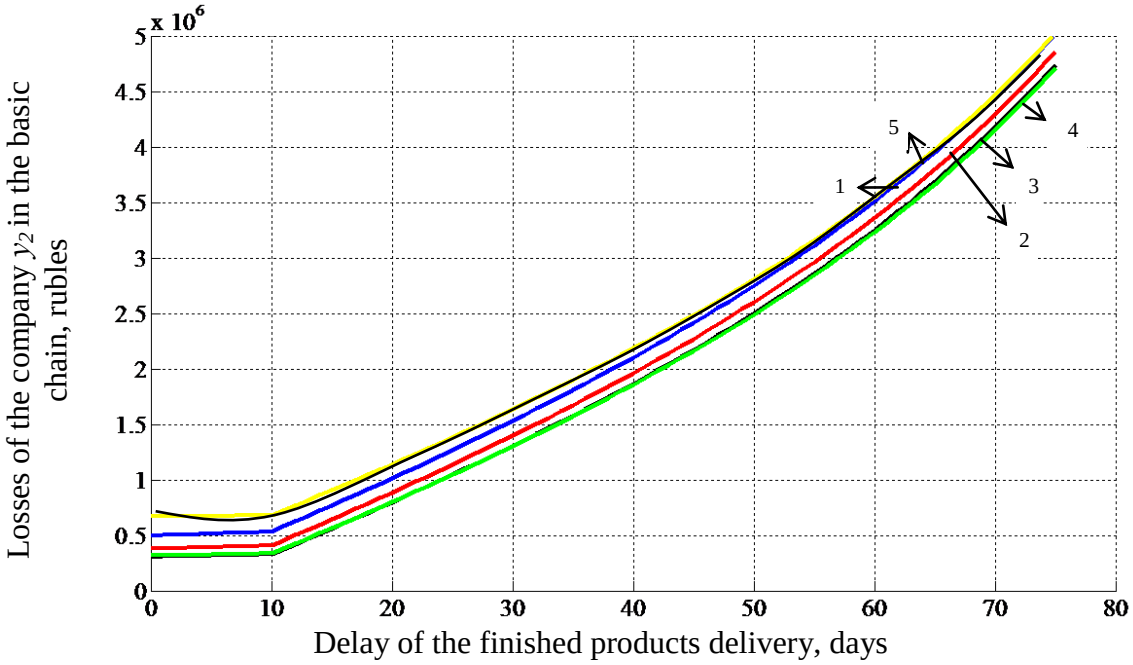

Fig. 3.15. Dependence of the aggregate losses in the basic chain y_2^{SC1} on time of delay of the finished product delivery (curve 1 – i=0.5; curve 2 – i=0.6; curve 3 – i=0.7; curve 4 – i=0.8; curve 5 – i=0.9)

Losses from buyers leaving in the multiply chain

Analytical dependence of losses from buyers leaving (Fig. 3.16) in the multiply chain

$$y_2^{SC2} = R_r \cdot m \cdot \left(e^{\delta_2 (x-10)} \right) \quad (3.23)$$

where δ_2 reflects new buyers leaving who are dissatisfied with tight credit policy, i.e. no deferral of payment.

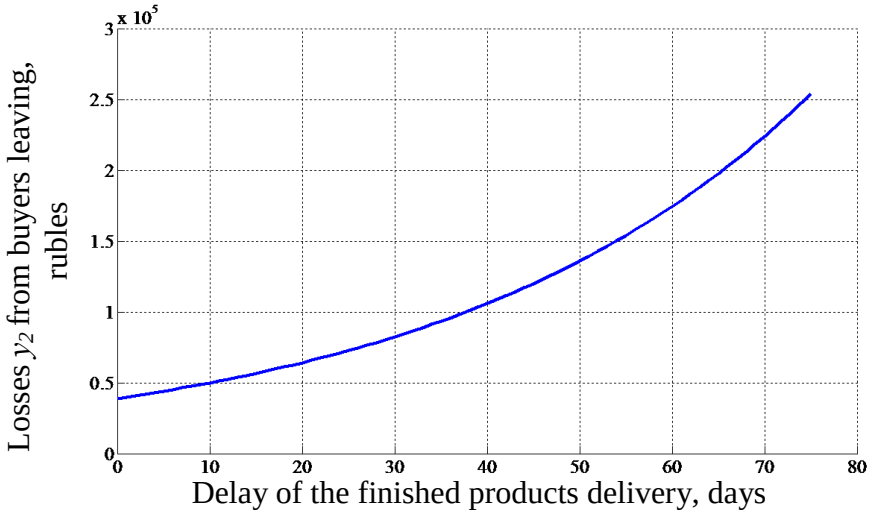

Fig. 3.16. Dependence of the buyers leaving in the multiplied chain y_2^{SC2} on delay of products delivery

Total company losses in the system

Thus, total losses y_2 in the system (Figure 3.17) can be represented analytically as:

$$y_2 = B_1 \cdot R_r \cdot k_1 + R_r \cdot m \cdot \left(e^{0{,}0501(x-10)} - 1 + e^{6{,}6644(-0{,}5)} - 1 + \left(\frac{-100}{3} \right) \cdot i + \frac{80}{3} \right) + \\ + d \cdot (1-i) \cdot v \cdot B_1 \cdot \frac{x}{365} + R_r \cdot m \cdot \left(e^{\delta_2 (x-10)} \right) + 34666 \cdot 0.1 \cdot (-0.7368 + 0.2456 \cdot x). \quad (3.24)$$

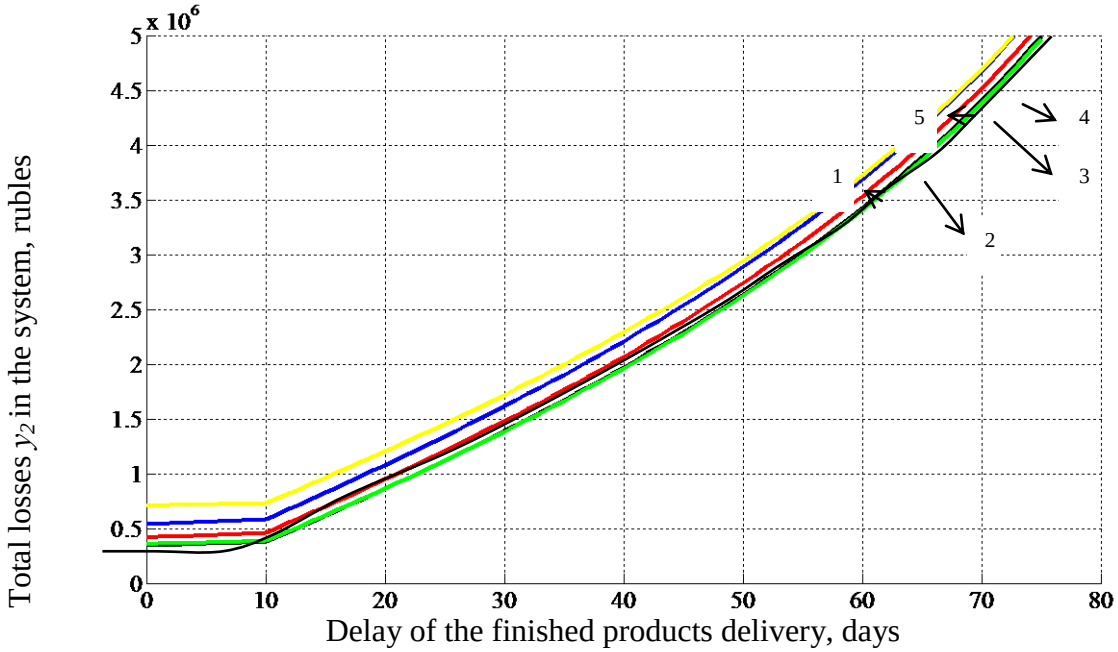

Fig. 3.17. Dependence of the total losses from delay of time of the finished products delivery (curve 1 – *i*=0.5; curve 2 – *i*=0.6; curve 3 – *i*=0.7; curve 4 – *i*=0.8; curve 5 – *i*=0.9)

Company total aggregate costs and losses in the system

Thus, total aggregate costs and losses y in the system (Fig. 3.18-3.23) are represented analytically as:

$$y = B_1 \cdot R_r \cdot k_1 + R_r \cdot m \cdot \left(e^{0{,}0501(x-10)} - 1 + e^{6{,}6644(-0{,}5)} - 1 + \left(\frac{-100}{3} \right) \cdot i + \frac{80}{3} \right) +$$

$$+ d \cdot (1-i) \cdot v \cdot B_1 \cdot \frac{x}{365} + 34666 \cdot 0.1 \cdot (-0.7368 + 0.2456 \cdot x) + R_r \cdot m \cdot \left(e^{\delta_2 (x-10)} \right) + \qquad (3.25)$$

$$- 0{,}0096 \cdot B_1 \cdot \ln \left(\frac{j_{\max 1} - j_1}{j_{\max 1}} \right) + \frac{(i - i_c) \cdot B_1 \cdot IR \cdot x}{365} - 0{,}0096 \cdot i \cdot B_1 \cdot \ln \left(\frac{j_{\max 2} - j_2}{j_{\max 2}} \right).$$

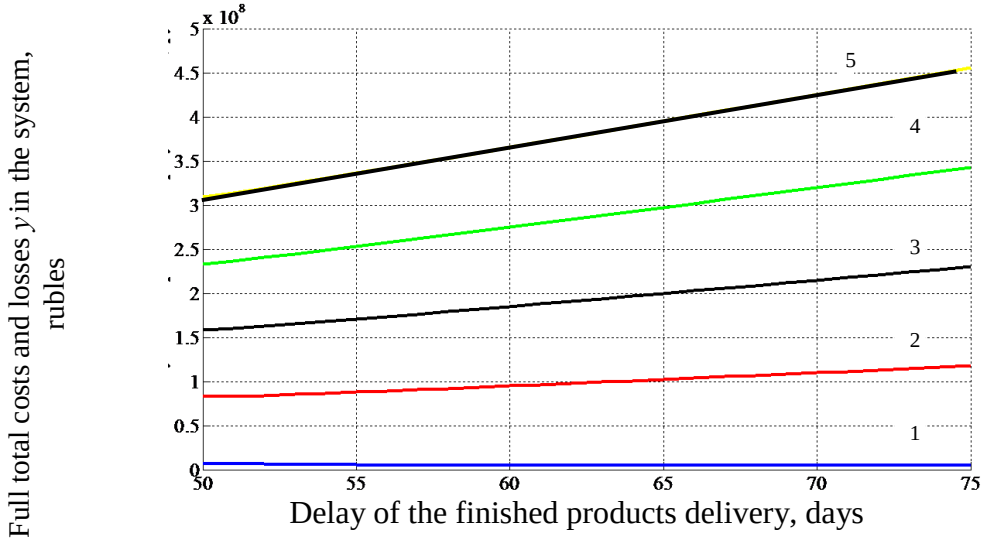

Fig. 3.18. Dependence of integrated costs in the system y on delay delivery of the finished product (curve 1 – i=0.5; curve 2 – i=0.6; curve 3 – i=0.7; curve 4 – i=0.8; curve 5 – i=0.9)

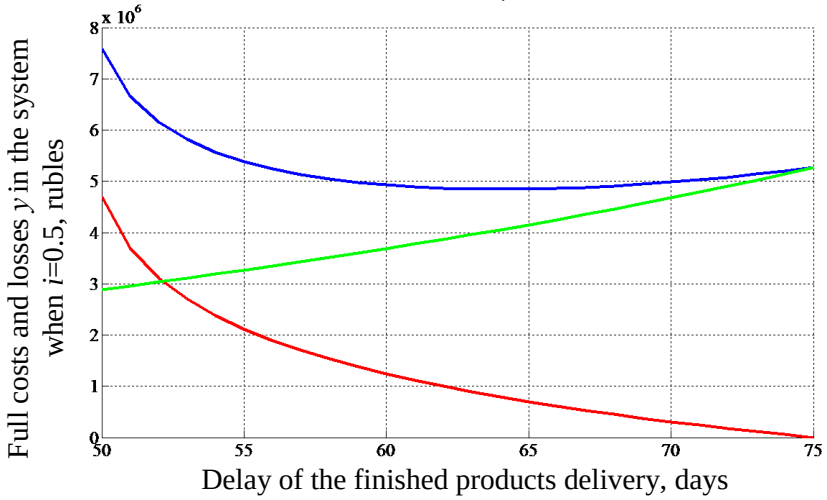

Fig. 3.19. Dependence of the integral costs y on time of delay delivery of finished products when i=0.5 (y curve 1; y_1 curve 2; y_2 curve 3)

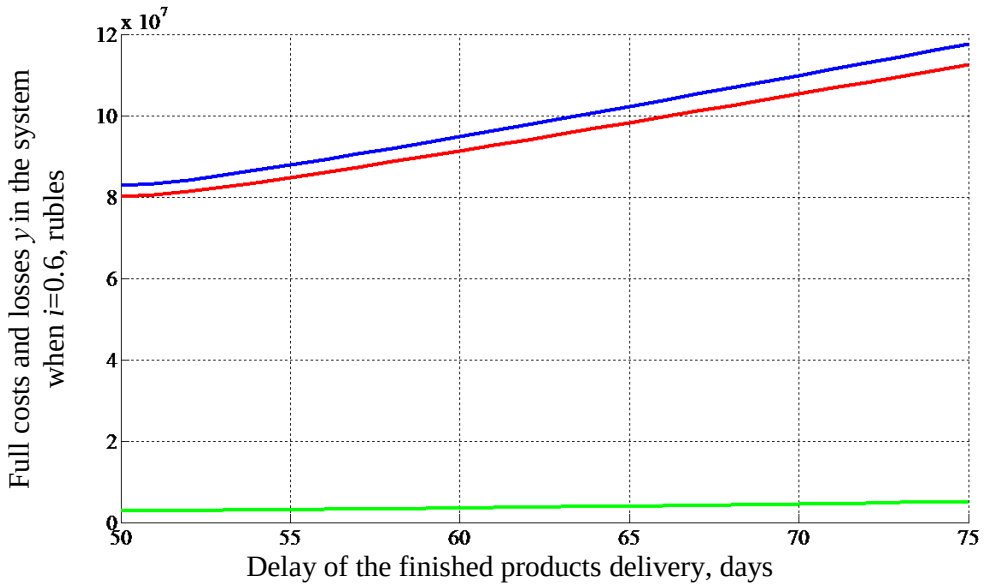

Fig. 3.20. Dependence of the integral costs y on delay delivery of the finished product when i=0.6 (y curve 1; y_1 curve 2; y_2 curve 3)

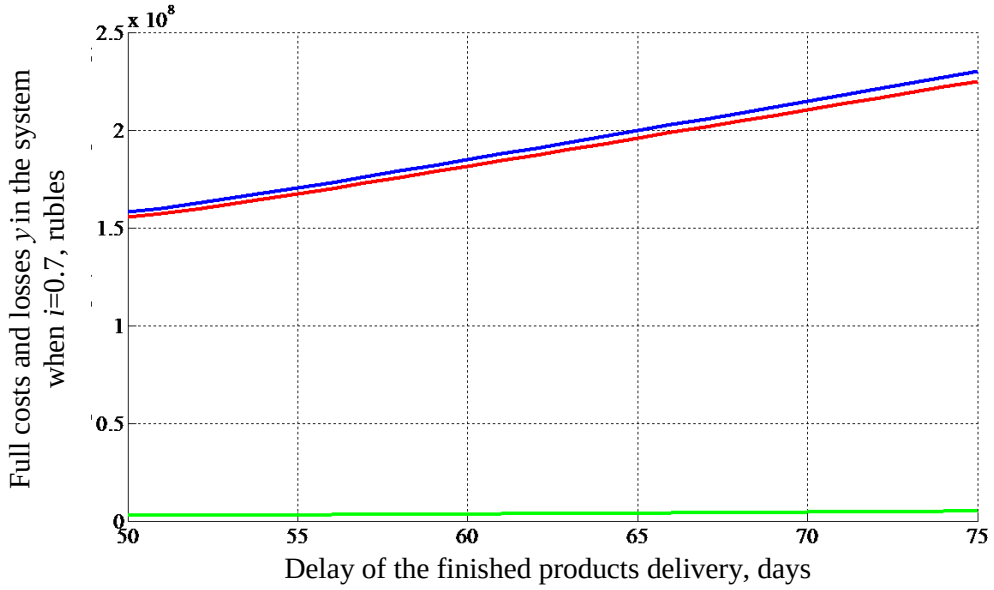

Fig. 3.21. Dependence of the integral costs y on the time of delay delivery of finished products when i=0.7 (y curve 1; y_1 curve 2; y_2 curve 3)

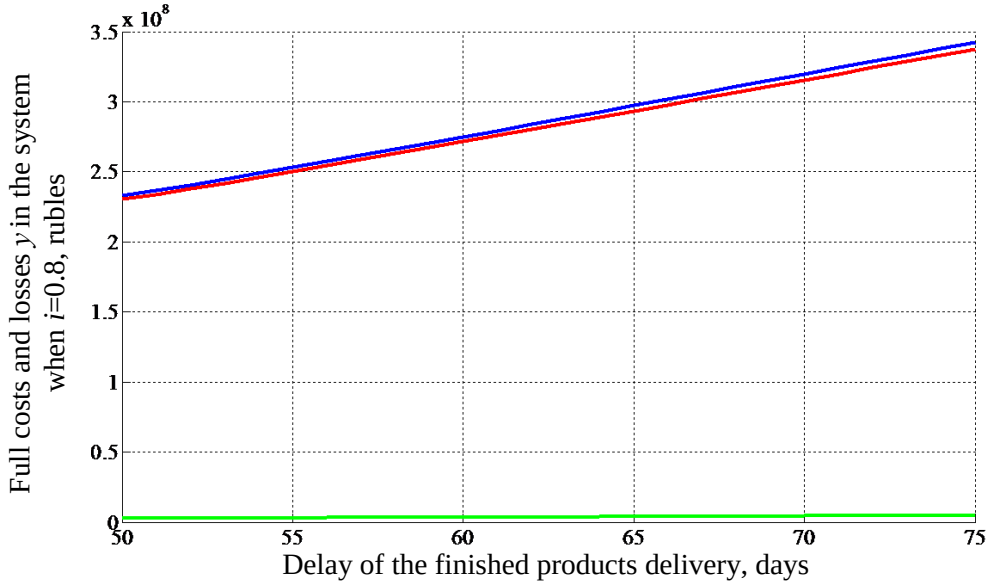

Fig. 3.22. Dependence of the integral costs y on delay delivery of the finished product when i=0.8 (y curve 1; y_1 curve 2; y_2 curve 3)

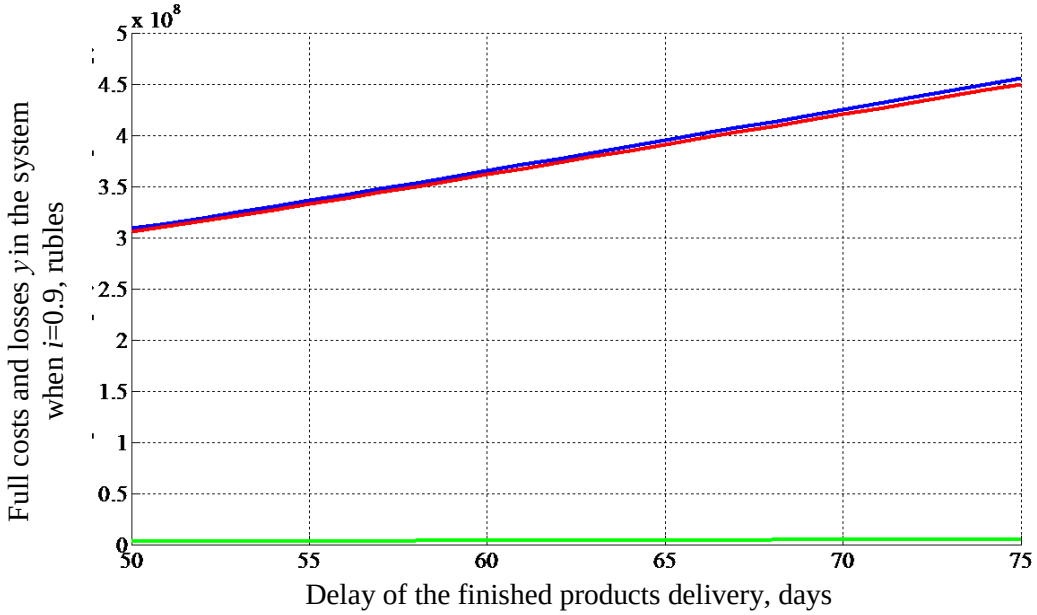

Fig. 3.23. Dependence of the integral costs y on delay delivery of the finished product when i=0.9 (y curve 1; y_1 curve 2; y_2 curve 3)

Table 3.2.

The optimal parameters

Share of prepaid i, %	Optimal delay time x^*, days	y^*, mln dol.	y_1^*, mln dol.	y_2^*, mln dol.
50	**64**	**4.8481**	**0.7935**	**4.0546**
60	50	82.754	80.014	2.740
70	50	157.97	155.33	2.640
80	50	233.26	230.64	2.620
90	50	308.90	305.95	2.950

Thus, the minimum value of the integral costs y^* achieved at the value of prepaid i=50% (lever of multiplication) and optimal delay delivery for payment 64 days (see Table. 3.2-3.6).

Table 3.3

Calculation of the economic reserve

Share of prepaid i, %	Optimal delay time x^*, days	y^*, mln dol.	K_C, rate of flows correspondence	x fact at a module c+	x fact at a module c	Economic reserve, tsd. dol.	
						$x^* < x$ fact	$x^* > x$ fact
50	64	4.8481	1	64	64	0	0
			0.9	70	58	135	196.5
			0.8	77	51	578.3	1812.4
			0.7	83	45	1188.5	-
			0.6	90	38	2203.5	-
			0.5	96	32	3393.8	-
			0.4	102	26	4965.3	-
			0.3	109	19	7436.9	-
			0.2	115	13	10289.9	-
			0.1	122	6	14796.8	-

Rate of flows correspondence $K_C = 1 - \frac{|x - x^*|}{x^*}$: Where x - actual lag between the financial and material flows, days; x^* - optimal lag between the financial and material flows, days; $|x - x^*|$ - mismatch of flow processes, days. "

Under the economic reserve means the value of deviations from optimal integrated costs in dollars, which arises at the appropriate K_C level .

Note: when the delay x is less than 50 days, the argument of the natural logarithm becomes negative, and the value of the logarithm itself moves from the field of real numbers to the imaginary. And when the argument is equal to 0 (corresponding to x = 49 days), the logarithm is equal to $-\infty$ (Asymptote). Similarly, it was in A.G.'s work, was only asymptote at x = 23, because $j_{\max}$ value was another ($j_{\max}$ = 0.8).

The resulting tables of parameter values after the optimum has been achieved

Table 3.4.

Basic chain options for the optimum

i, %	x, days	j_1	g, mln. dol.	y_{11}^{SC1} mln. dol.	y_{12}^{SC1} mln. dol.	y_1^{SC1} mln. dol.	k_1 %	y_{21}^{SC1} mln. dol.	n_1 Unit	n_2 Unit	n_3 Unit	n Unit	y_{22}^{SC1} mln. dol.	y_{23}^{SC1} mln. dol.	y_{24}^{SC1} mln. dol.	y_2^{SC1} mln. dol.	Level of Demand Satisfaction (LDS), %
50	64	0,169	5,29	0,529	0	0,529	24,35	2,4354	14	0	10	24	1,199	0,1753	0,052	3,8617	88

Note: $LDS = \frac{(N - n^*)}{N}$, where N – the total number of buyers.

Table 3.5.

Options of the multiply chain for the optimum

i, %	x, days	j_2	g, mln. dol	y_1^{SC2} mln. dol	y_2^{SC2} mln. dol
50	64	0.169	5.29	0.2645	0.1929

Table 3.6.

Systemwide options for the optimum

i, %	x, days	B mln. dol	B1 mln. dol	B2 mln. dol	Q, mln. dol	y_1 mln. dol	y_2 mln. dol	y mln. dol
50	64	150	100	50	20	0.7935	4.0546	4.8481

3.2. Algorithm of "careful" management of the working capital at the stage of mutual settlements

The developed algorithm is based on securitization, by which we mean the formation of funds in circulation in the supply chain using securities – instruments of mutual settlements (Fig. 3.24). In current crisis times of business management improving the system of settlements for goods, works and services through the introduction of payment tools in the form of bills and warehouse certificates, as well as widespread use of factoring, is an important factor in enterprise adaptation to the environment and money funds saving. Securitization has as its foundation mechanism of mutual settlements, established by company's economic department, for which ensuring are necessary:

- algorithm for applying one or another settlements options depending on the state of the environment;
- possibility of company's obligations payment to creditors by received buyers' notes with minimum exchange losses to accelerate turnover and reduce the costs for receivables and payables maintenance;
- possibility of selling bills received from debtors for cash which are necessary to make certain payments, such as taxes, wages, or their conversion into more liquid bank bills;
- monitoring for promisers' solvency, maturity of the bills received, liquidity of their commodity provision;
- liquidity maintaining of their own bills issued by their occupancy with liquid products, the promiser wish to pay one's obligations when there is money deficit;
- coordinated functioning of funds in circulation and circulating productive assets of the all chain members;
- effective contractual relationships between supply chain members or vertical integration in the chain.

We consider an algorithm for structuring financial flows of the industrial enterprise. Firstly they determine the structure of working capital and receivables share as a controlled at this stage part of the working capital. Then you should go to the analysis of accounts receivable in order to find opportunities to accelerate their turnover. The tools applied here are the promissory note and warehouse certificate. However, not every buyer agrees with bill debts as it relates to additional costs in the form of interest. It is necessary to estimate the buyers' creditworthiness on the following criteria: a positive history of company relations with this buyer; perfect credit history; trade turnover established by buyer. In case of the buyer's spotless solvency delivery of products should be done without bills issuing, in other cases to issue bills debt.

Depending on the financial and economic situation, the company financial manager should prefer (or combine) a bill or buyer's warehouse certificate based on comparative analysis (see Table in the Chapter 2). If company will be able to register its outbound financial flows as warehouse certificates, then, given the smallest property risk,

warehouse certificates are preferable as non-debt instruments. Here we assume that the settlements control focused primarily on acceleration of the working capital turnover, but is not speculative, although taking profit from settlement operations is necessary.

Mechanism of the mutual settlements control contains the following steps. At the first step (Fig. 3.24) we perform the calculation of average inventory turnover period, average time of the inbound and outbound financial flows movement, operating cycle, rate of settlement funds conversion Cr, rate of receivables absolute liquidity. Maturities of debts for supplier compared to operating production and commercial cycle of company (section 3). If case of operating cycle exceeding over maturities of debts for supplier, that is, when the company does not have time to fulfill its obligations from revenue not yet received, you need to start reducing the production cycle, controlling material flow (section 4); otherwise – you need to reduce additionally the commercial cycle by controlling financial flow (section 20).

Then verification of the following condition performed: "production time should be less than maturity of payables" (section 5). In this case, you should control operating cycle of the second component – financial flow – to reduce maturity of receivables (section 6). If the condition is not satisfied, what means the need for company to pay its accounts payable despite current assets being still in the production stage, the company needed to structure urgently its financial flow by means of liquid payment tools in order to pay to the supplier.

If the high quality of receivables was achieved via impact on the financial flow (section 6), the company should seek to repay outbound financial flow by assignment of inbound flow, structured by warehouse certificate, to the lender (sections 14, 15, 16). If this is not possible, it is necessary to evaluate the quality of elementary financial flows, structured by notes, according to criterion of minimum exchange losses on repay of accounts payable. From these positions settlement means can be divided into lossless means "Alpha", and means with certain losses "Beta"; and one should select control algorithm depending on the specific elementary financial flow – sections 17, 18, or 17, 19, 9. Receivables low liquidity ratio dictates the need to coordinate less effective forms of payment with the supplier (section 7).

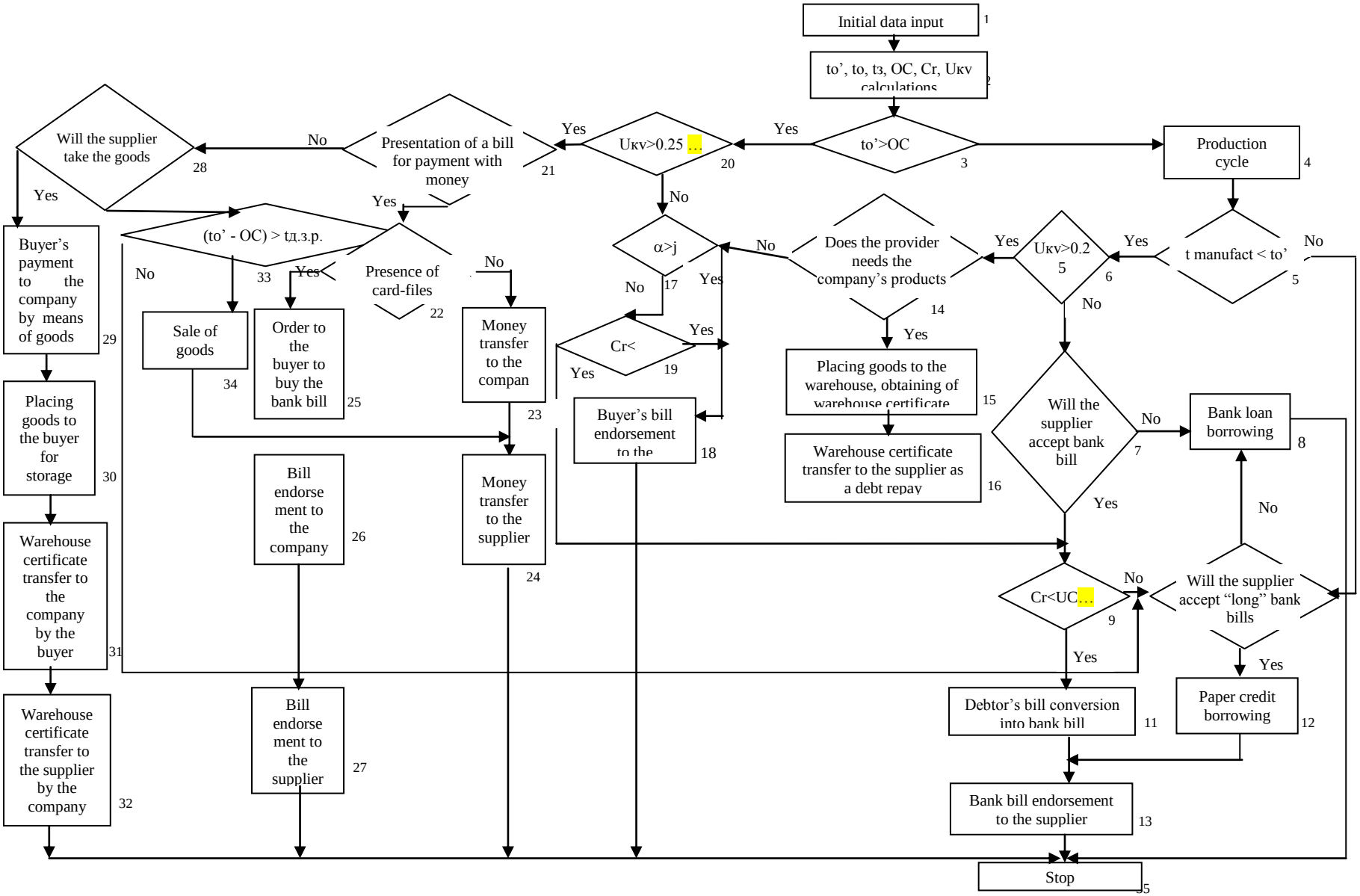

Fig. 3.24. Mechanism of management of material and securitized financial flows of the company

If the supplier is not sure about the solvency of the bank-maker, has no possibility to pay in turn to creditors by bill offered, or he needs but the money, the company will be denied. In this case, you must take out a bank loan (section 8), the source of which repayment will be payment of receivables in this local situation. If the supplier agrees to accept the bank bill with a maturity matching the maturities of accounts payable, the company needs to convert the buyer's bill to the bank bill. It is more profitable for the company to receive bank bill in exchange for debtor bill, as in this case the discount rate will be lower, because the bank does not puts its resources into operation immediately. During the accounting operation carrying out the following condition is checked: "bills conversion ratio is less than penalties for untimely payment under the contract for raw materials supply." If the costs in the bills conversion are justified and they are less than the interest on bank loan UC (section 9), the company carries out the conversion operation (section 11) and pays to supplier with the bank bill (section 13). In case of exceeding the costs of debtor's bill maintenance over the penalties, lending through package of bank bills is the least expensive form of liquid payment tools involvement in order to pay to the supplier. The company should arrange with the supplier the following form of mutual settlements: if he will accept bank bills with a maturity exceeding maturity of payables (section 15).

The supplier can accept bills if he will be able to pay them to his creditors without loss. Then the company needs to take a paper credit in the bank (section 12) and to pay to the supplier with these bills (section 13). If a supplier will prefer the money, the classic bank loan is needed (section 8).

In the next step we return to check the liquidity of receivables (section 20). If receivables are liquid, the company needs to reduce the term of debt repayment by paying to the supplier with liquid means of payment received from the buyer – a bill (section 21). Otherwise, the company has to get the payment from debtor by itself, herewith one need to define what form of payment he will offer – money or goods.

If supplier agrees to pay your bill in cash, make sure you have a card file (section 22); if supplier doesn't agree – the company needs to use it (bill) as a means of payment (section 28). When there is the supplier's agreement it's better to use the financial equivalent of the goods – a warehouse certificate (sections 29,30,31,32); in case of failure – the marketing and economic departments of the company should evaluate, whether enough time to sell the goods and pay to the supplier (section 33). If the goods are liquid, the company sells goods (section 34) and transfers money to the supplier (section 24); otherwise, it must look for options to raise capital (sections 8, 10, 12, 13).

This algorithm has allowed to generate and apply the basic 14 "lean" options for handling funds in the supply chain "first-tier supplier – manufacturer – first-tier buyer", allowing to free up money funds [23], [20].

In the Fig. 3.25 material flow in the chain is reflected by ties 1,3; financial flow – by ties 2,4,5,6.

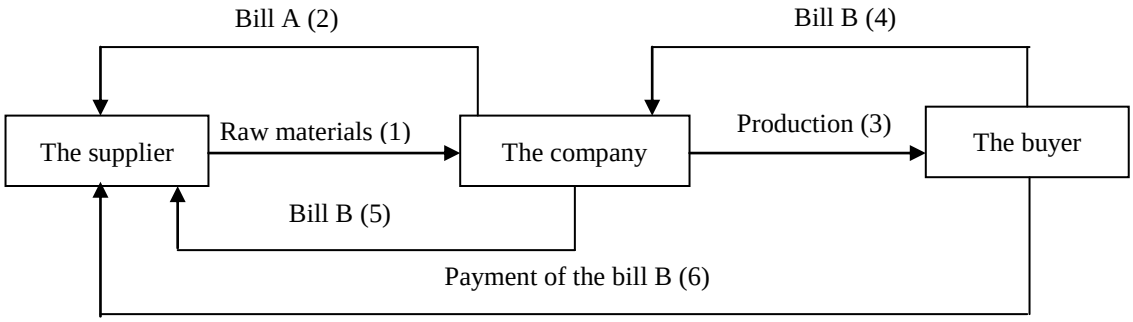

Fig. 3.25. The 1st option of payments organization in the supply chain

Supplier delivers raw materials to the company (1) under its bill A (2), the company supplies production to the buyer (3) under the bill B (4). The resulting situation of a commercial loan is considered by interest rate or discount on the bill (product released for amount less than bill par value). Status of funds in circulation in the payments depends on the liquidity of bills used in the chain: on the day when the B bills received from the solvent debtor, company repays with this bill to the lender by endorsement (5), without waiting for the date of payment and not receiving money funds (6). When using their own notes companies lose much less on charged interest, as they give each other commercial loan and convert it into bank loan only when a shortage of liquidity arises. Money funds withheld in the form of discount or interest rate remain ultimately in the companies – chain members.

In the Fig. 3.26 material flow in the chain is reflected by ties 1,3; financial – by ties 2,4,6,7; regulating flows – by ties 5 and 8.

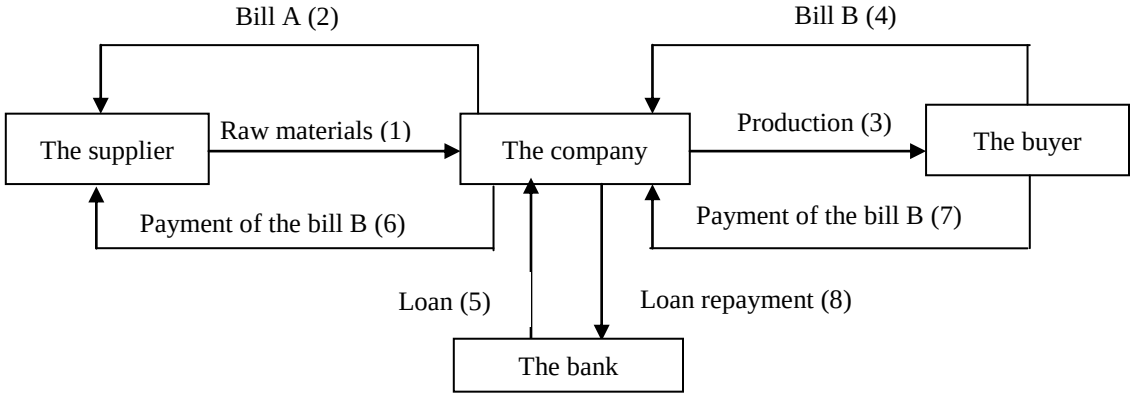

Fig. 3.26. The 2nd option of payments organization in the supply chain

Supplier delivers raw materials to the company (1) under its bill A (2), the company supplies production to the buyer (3) under its bill B (4). If the time comes to repay the debt to the supplier, and current assets are under receivables and company cannot pay its obligations with buyer's or bank bill, the company needs to take out a bank loan (5) for a

period coinciding with the maturity of a bill B. Lender, appreciating company receivables as illiquid, will establish high interest rate on this high risk loan. Note that here it is likely non-payment of accounts receivable on time and loan rollover with higher interest rate, as buyer's pay of his bill B (7) is a source of repayment of the loan (8) Thus, the high costs of a bank loan maintenance can be regarded as the company charge for a low receivables turnover.

In the Fig. 3.27 material flow in the chain is reflected by ties 1,3; financial – by ties 2,4,7; regulating flow - by ties 5, 6, 8, and 9.

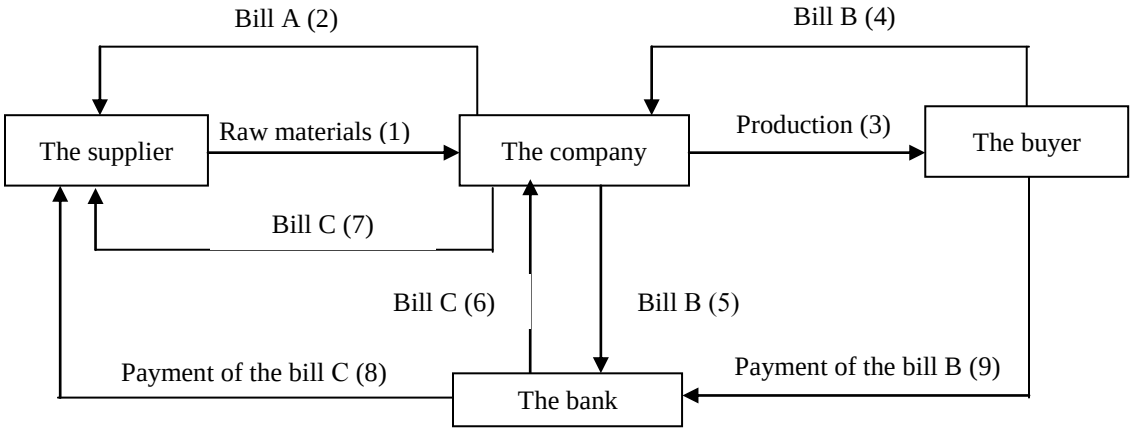

Fig. 3.27. The 3rd option of payments organization in the supply chain

Supplier delivers raw materials to the company (1) under its bill A (2), the company supplies production to the buyer (3) under its bill B (4). To pay the issued bill, the company, after supplier's agreement of possibility of payment by bank bills, accounts buyer's bill in this bank, which (bill) maturity exceeds maturity of its issued bill. Bills accounting is to sell bill belonging to the company (6) to bank for money or bank bill (5). Sale of one bill for the other is conversion (exchange) of bills. Company costs in form of a discount on the sale of bills to the bank for money are higher than costs for the bills conversion, as in the bills conversion period from investing money by bank to bill repayment by the buyer usually is less due to the fact that the holder is seeking to pay to his lender with bank bill and do not present immediately bill to the bank for payment. In addition, the costs for the bills conversion are lower than the costs of a bank loan. Therefore the company needs to carry out the bills conversion in order to reduce costs. With bank bill C received, the company pays with it to supplier for a bill issued A (7). Supplier presents the bill for payment to the bank, followed by payment (8). When the date of bill payment by buyer comes the bank presents it for payment and receives payment (9). In the case of buyer's non-payment of his bills bank can recourse against the company as the endorser. Therefore, when there is bills conversion, the company should include clause to the endorsement "without recourse to me" – in order to protect itself from additional costs to pay bills. The advantage of this scheme for the bank in that it invests in high-yield and collateralized short-term assets: buyers' bills, reflecting

an adjusted trade turnover. Bills conversion will allow avoiding financial liquidity to the company.

In the Fig. 3.28 material flow in the chain is reflected by ties 1,3; financial – by ties 2,4,5,6,7,8,9.

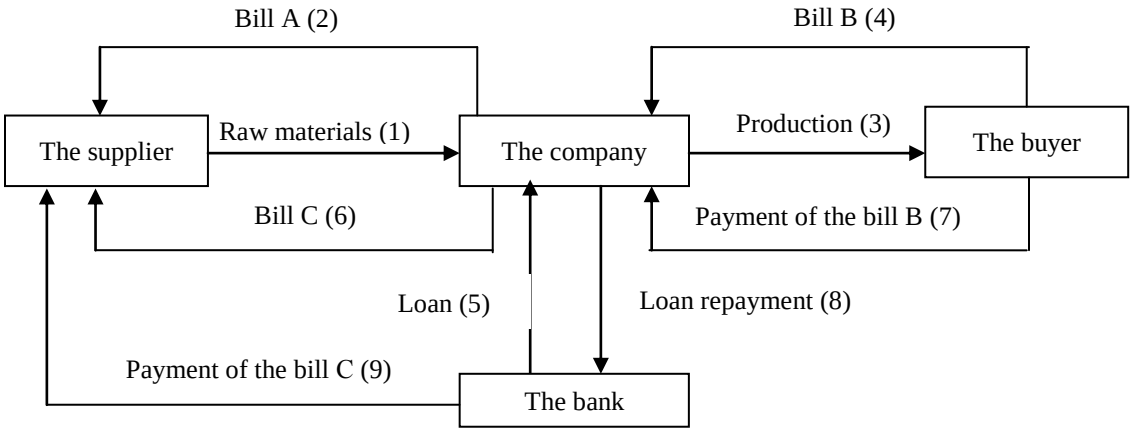

Fig. 3.28. The 4th option of payments organization in the supply chain

Supplier delivers raw materials to the company (1) under its bill A (2), the company supplies production to the buyer (3) under its bill B (4). If the company's costs for bills conversion exceed the permissible level (the amount of penalties for late payment to the supplier) due to the high bank interest rates, the company needs to take paper credit in order to reduce costs of payables maintenance, having obtained preliminarily the supplier's consent for this form of payment. Under the loan agreement, the bank provides loan to the company by the bill with a par value equal to the supplier's debt (5). After receiving the bank bill, company pays with it the bill issued to the supplier by endorsement (6). Under the loan agreement the borrower is obliged to repay to the bank in agreed deadline funds corresponding to the amount of received bill and pay low interest on paper credit. Term of the paper credit is determined by the maturity of debtor's bill. It is more advisable for company to repay the loan (8) after receiving payment from the buyer (7). Here, the bank does not use its credit resources, as it pays his bill (9) to new noteholder - supplier after the company-borrower paid it off under the credit agreement (8). Consequently, the bank can to establish an interest rate for paper credit equal to its margin that minimizes the costs of the company payable maintenance.

In the Fig. 3.29 material flow in the chain is reflected by ties 1,3, financial – by ties 2,4,6,7; regulating – 5 and 8 ties.

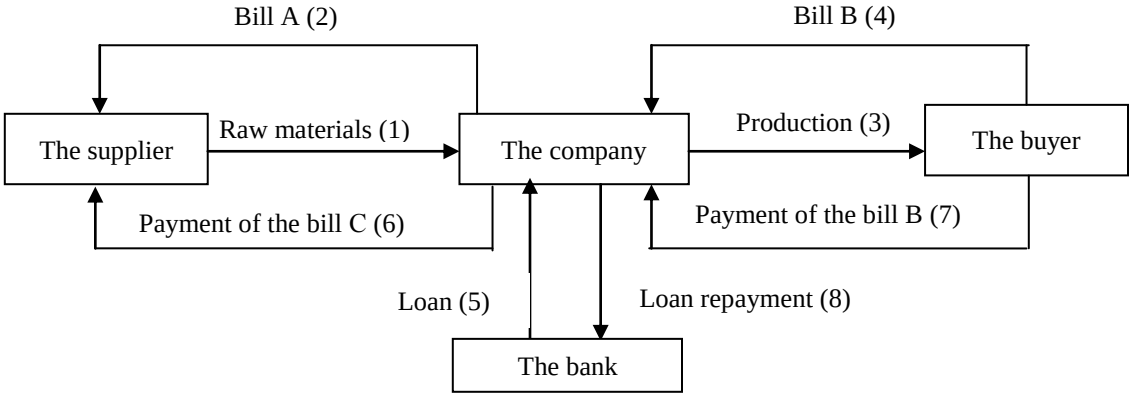

Fig. 3.29. The 5th option of payments organization in the supply chain

Supplier delivers raw materials to the company (1) under its bill A (2), the company – products (3) to the purchaser under the bill B (4).This scheme is characterized by a high turnover of stocks and weak management of financial flows. First, because of the low liquidity of receivables, having a bill shape, the bank has established a high discount rate for the bills conversion as payment for a high risk of the debtor non-payment in time; and costs of bills conversion have exceeded the cost of a bank loan. Second, as a result of inefficient interaction with supplier's economic department, which refused to take payment in "long" bank bills, the company had to supplement its working capital by high-cost method to pay to supplier (6) – by taking a bank loan (5). After buyer's payment of its bills (7) the company repays the loan to the bank (8).

In the Fig. 3.30 material flow in the chain is reflected by ties 1,5, financial – by ties 2,4,6,7, regulating – by ties 3, 8 and 9.

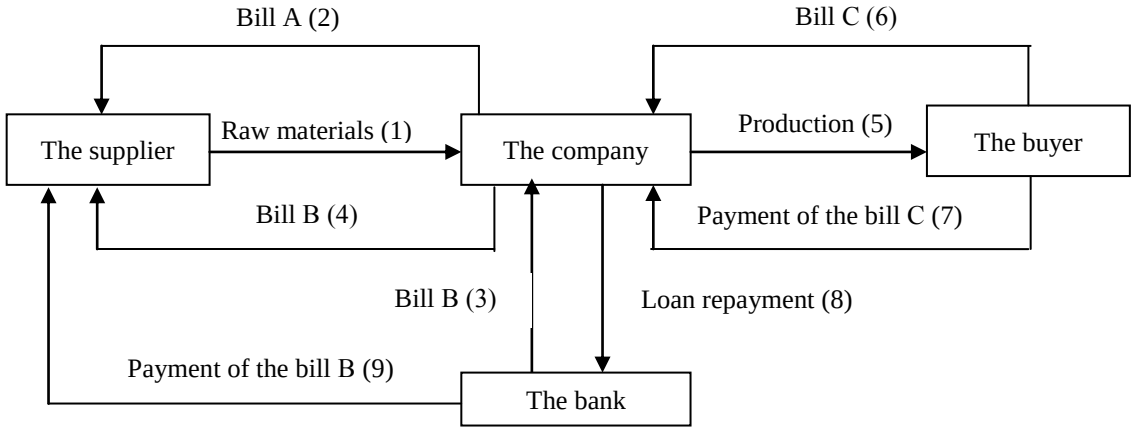

Fig. 3.30. The 6th option of payments organization in the supply chain

Supplier delivers raw materials to the company (1) under its bill A (2). At maturity term provider's working capital is in stocks. To fulfill its contractual obligations, the

company goes to a bank for a paper credit, after agreeing such form of payment with the upstream - supplier. Loan agreement signed under which the bank lends the company with its bill (3), through which the company pays its bill to supplier A (4). The company produces goods, ships it to the buyer (5) under his bill C (6). Payment term of bills C for buyer should not exceed the repayment term of the loan to the bank for the company. Buyer pays the note C (7), the company repays the loan to the bank (8), which will cover its bill in (9). In case of card-files forming in the current account of the company on the day of loan repayment, it can pay off to the bank through endorsement of buyer's bill, not receiving money from him the to its account. Bank agrees to such an embodiment, if it is satisfied about the buyer's solvency.

In the Fig. 3.31 material flow in the chain is reflected by ties 1,5, financial – by ties 2, 4,6,7, regulating – by ties 3,8.

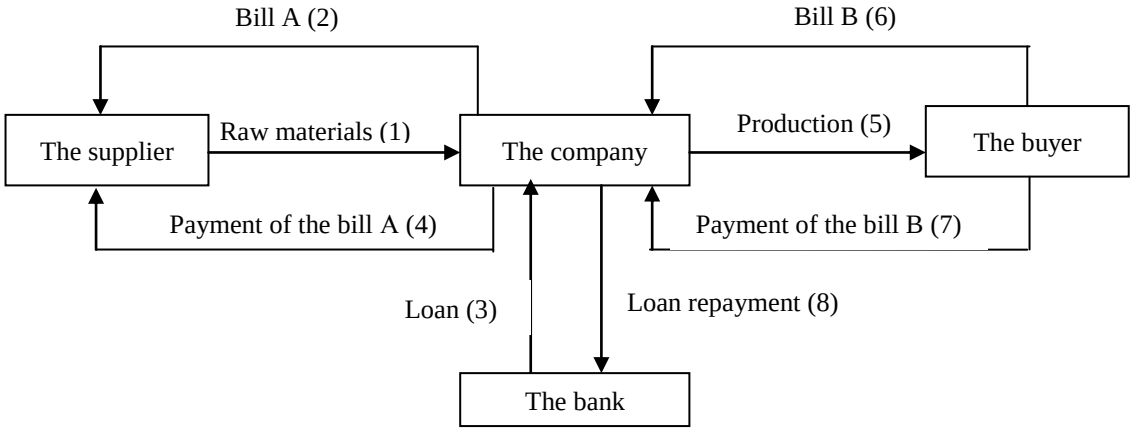

Fig. 3.31. The 7th option of payments organization in the supply chain

Supplier delivers raw materials to the company (1) under its bill A (2). On maturity date of bill A supplier refuses to accept payment in securities, demands to pay money. But since that time working capital is in stocks, the company has only one way to pay off to the supplier (4): take a classic bank loan (3). Buyer pays his bill in (7), the company repays the loan to the bank (8). There is very high costs of bank credit maintenance in this scheme as working capital "deadening" in stocks and do not bring income. Therefore, measures are needed to accelerate the turnover of stocks.

The 8th option is equal to the 1st one (fig. 3.25) but material flow in the chain is the following.

Supplier delivers raw materials to the company (1) under its bill A (2), the company delivers finished products (3) to the buyer under the bill B (4). At payment term to the supplier comes, the company pays him by buyer's bills endorsement (5), after agreeing this form of payment with the supplier. Supplier presents to the buyer his bill for payment and receives payment (6). Success for the company in this payment chain depends on high liquidity of buyer's bills. High market liquidity and quotation provided by competent management of financial flows when demand exceeds supply for bills issued. In addition, the buyer needs to avoid non-payment of his bills on time, maintain a liquid commodity collateral for issued bills.

In the Fig. 3.32 material flow in the chain is reflected by ties 1,3; financial – by ties 2,4,5,6.

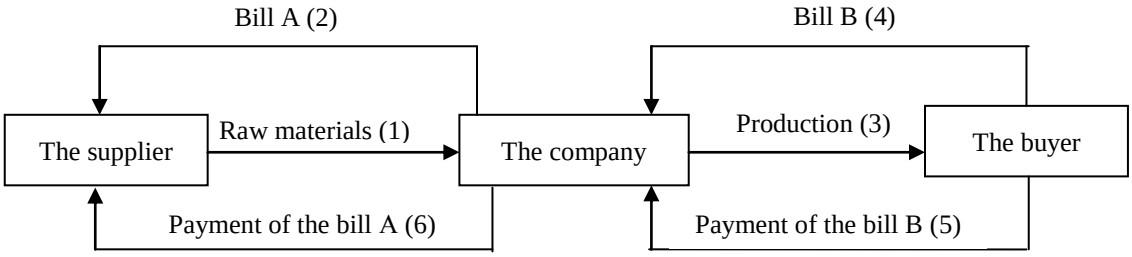

Fig. 3.32. The 9th option of payment organization in the supply chain

Supplier delivers raw materials to the company (1) under its bill A (2), the company delivers finished products (3) to the buyer under the bill B (4). Supplier does not accept the payment from the company in a bill A debtors' notes, so the company presents to the buyer a bill B for payment, receives payment (5), then pays its bill A to supplier (6). Stability of the chain depends on buyer's repayment of his bill B in money on time.

In the Fig. 3.33 material flow in the chain is reflected by ties 1,3; financial – by ties 2,4,7,8; regulating – by ties 5,6 and 9.

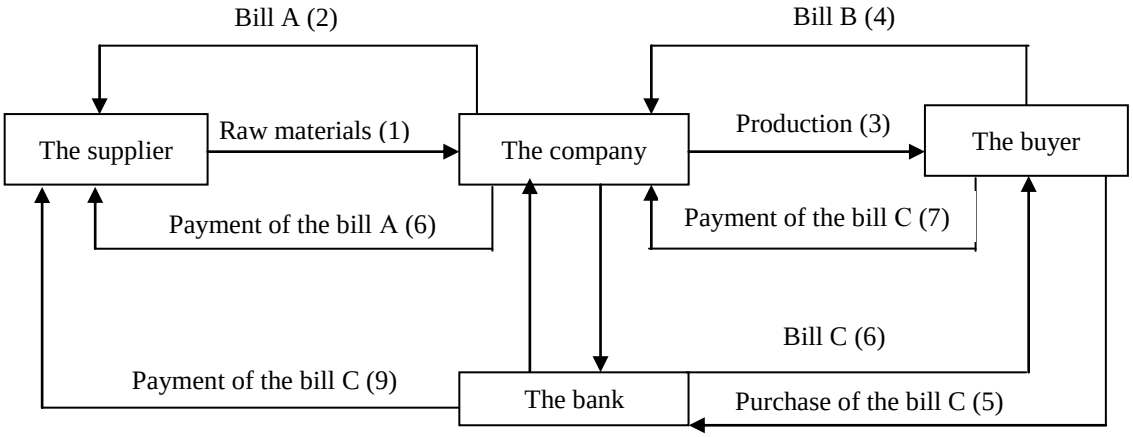

Fig. 3.33. The 10th option of payment organization in the supply chain

Supplier delivers raw materials (1) to the company under its bill A (2), the company delivers finished products (3) to the buyer under the bill B (4). At the maturity date of bill B the company, working in conditions of card-files presence in the current account, asks the buyer to buy the bank's bill C (5,6) with a payment term "on demand" and pay to him with this bill (7). For the buyer it will not be difficult, since it buys his bill B for bill C without exchange losses. The company will pay to supplier with bill C (8), supplier will show it to the bank for payment and receive payment (9). Payments time in this scheme exceeds the payments time in the previous scheme for the time of issuing bills by the bank and its endorsements: a buyer for the company and company for the supplier (see Fig. 2.6). As in the previous scheme, the stability of this chain depends on the buyer's payment discipline.

In the Fig. 3.34 material flow in the chain is reflected by ties 1,3; financial – by ties 2,4,5,6.

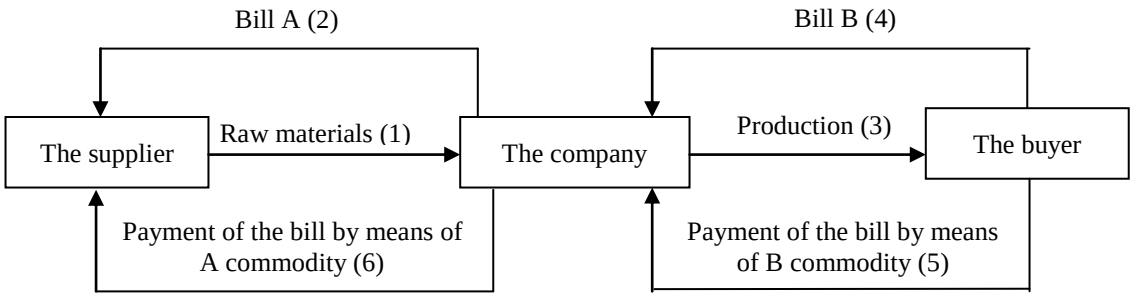

Fig. 3.34. Option 11 of payment organization in the supply chain

As noted above, the buyer’s fulfillment his obligation just in time is imperative to maintain the liquidity of the supply chain. This clearly confirms options 11, 12, 13. Supplier delivers raw materials (1) to the company under its bill A (2), the company delivers finished products (3) to the buyer under the bill B (4). On the payment date of bill B the company presents it for payment and discovers that the buyer cannot pay money and offers to repay its debt by goods. To the commodity-form payment was effective and did not result "immobilization" of capital, company economic department must monitor constantly the financial condition of the buyer, to know the composition of its means of payment, to monitor the commodity liquid collateral of receivables. The company needs to know the potential market of the goods offered, first, whether supplier will take this product, and to assess prospects of paying money from the buyer. Upon receiving information that a supplier interested in this product, the company takes the goods in repayment of buyer debt (5), makes the minimum margin, and transmits it to the supplier to pay his bill A (6) (see Fig. 2.6).

In the Fig. 3.35 material flow in the chain is reflected by ties 1,3,5,6; financial – by ties 2,4,7.

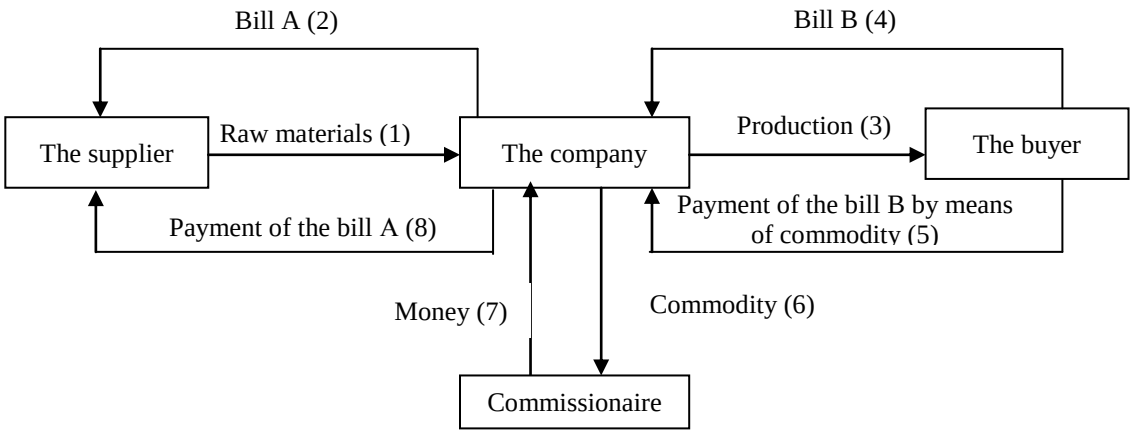

Fig. 3.35. Option 12 of payments organization in the supply chain

Supplier delivers raw materials (1) to the company under its bill A (2), the company delivers finished products (3) to the buyer under the bill B (4). On the payment date of bill B the buyer offers to the company payment by goods that interested supplier, in turn, take from the company to repay bills A. Company, knowing the potential seller of the goods offered and comparing the maturity date of possible buyer paying his bill B in cash and the maturity date of the issued bill A, has decided not to wait for payment of bill by money (5) and signed the Commission contract with payment date no later than payment date of bill A (6) (see Figure 2.6). Commissionaire sells goods (7), then the company pays its bill A (8).

In the Fig. 3.36 material flow in the chain is reflected by ties 1,3,5,6; financial – by ties 2,4,8,9; regulating – by ties 7 and 10.

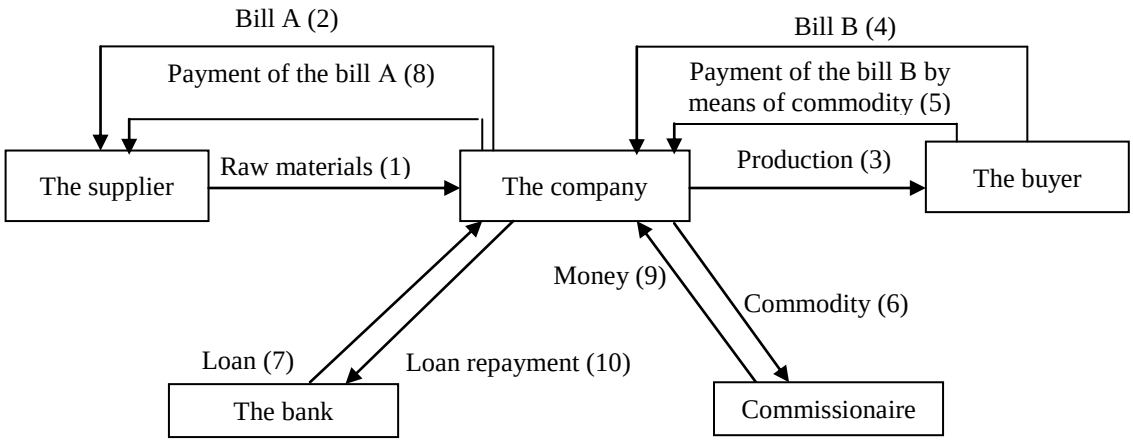

Fig. 3.36. Option 13 of payments organization in the supply chain

Supplier delivers raw materials (1) to the company under its bill A (2), the company delivers finished products (3) to the buyer under the bill B (4). On the payment date of

his bill buyer pays by goods (5). The company takes it as payment, as it assumes getting money from goods selling faster than from the buyer to repay his bill B. Assessing with the commissionaire liquidity of goods and sales period (b), the company concludes that it is not time to pay to the provider of revenue (see Fig. 2.6). Therefore, it needs to replenish current assets by liquid means of payment. Since the supplier does not agree to accept payment in "long" bank bills there remains only a high-cost method of short-term financing for the company – bank lending (7) on the security of sold goods for a period equal to the period of its sales. Company pays to the supplier from a bank loan (8), the commissionaire sells goods (9), then the company repays the loan to the bank (10).

In the Fig. 3.37 material flow in the chain is reflected by ties 1,3,5,6; financial – by ties 2,4,8,9,11; regulating – by ties 7 and 10.

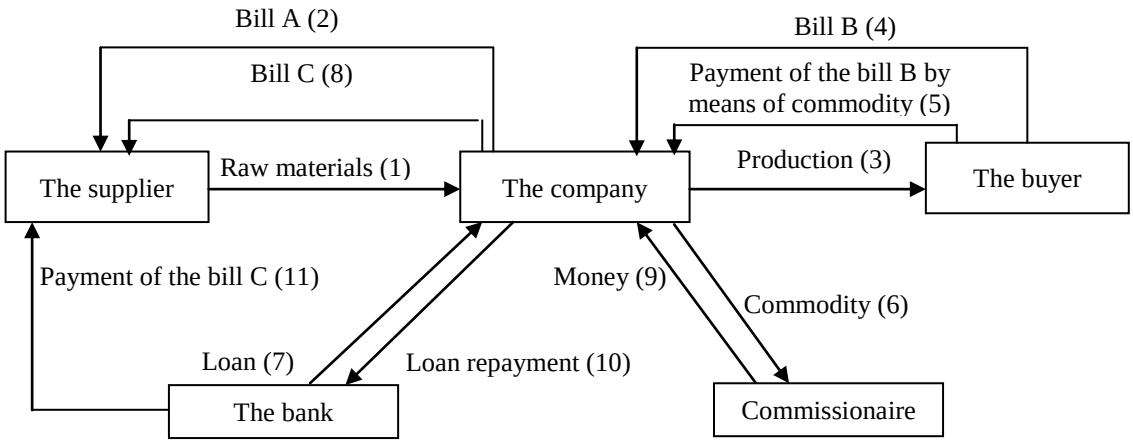

Fig. 3.37. Option 14 of payments organization in the supply chain

Supplier delivers raw materials (1) to the company under its bill A (2), the company delivers finished products (3) to the buyer under the bill B (4). In this scheme, the company economic department conformed to the supplier payment by "long" bank bills (i.e. bills, payment by which can be received after a time of its preparation). "Credit" bank bills involvement in the turnover is the most low-cost way to fund working capital as a interest for the use of paper credit is rate two-three times below than the market interest rate. So, the buyer sends to the company goods (5) to repay bill, the company signs a Commission contract (6), takes the paper credit (7) and pays to the supplier with a bank bill C (8).Supplier can use received bill C as follows: to endorse it to the party above the chain (the creditor), reducing its payables and reducing the costs of its maintenance; to sell to the issuing bank or another bank, receiving for it another bills with a sooner maturity with the ability to receive cash (for salaries). Then the commissionaire pays on a Commission contract (9), and the company returns the paper credit to the bank from received proceeds (10).

Identification of payments options in viewed flowchart shown in Table. 3.7, Fig. 3.38.

Table 3.7

Identification of payments options

	Name of operation	Number of material and financial flows options													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Initial data input	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2	Calculation of indicators	+	+	+	+	+	+	+	+	+	+	+	+	+	+
3	Debt maturities to supplier is less than operating cycle Debt maturities to supplier is more than operating cycle	+	+	+	+	+	+	+	+	+	+	+	+	+	+
4	Improving of material flow	+	+	+	+	+	+	+							
5	Receivables absolute liquidity ratio is more than 0.25 Receivables absolute liquidity ratio is less than 0.25								+	+	+	+	+	+	+
6	Production time is less than debt maturity to supplier Production time is more than debt maturity to supplier	+	+	+	+	+	+	+							
7	Improvement of financial flow	+	+	+	+	+									
8	Receivables absolute liquidity ratio is more than 0.25 Receivables absolute liquidity ratio is less than 0.25	+	+	+	+	+									
9	Endorsement of buyer’s bill for supplier	+							+						
10	Buyer pays his bill in cash Buyer cannot pay his bill in cash									+		+	+	+	+
11	Supplier accepts payment in bank bill Supplier requires cash payment		+	+	+	+									
12	Borrowing of bank loan		+			+		+						+	
13	Bills conversion rate is less than penalties for late payment under the supply agreement Bills conversion rate is more than penalties for late payment under the supply agreement			+	+	+		+							
14	Bills conversion rate is less than costs for bank loan maintenance Bills conversion rate is more than costs for bank loan maintenance			+		+									
15	Supplier accepts payment in "long" bank bills				+		+								+

	Supplier does not accept payment in "long" bank bills					+		+						+	
16	Conversion of buyer’s bill to bank bill			+											
17	Paper credit borrowing				+		+								+
18	Endorsement of bank bill to supplier			+	+		+								+
19	Buyer pays his bill in goods											+	+	+	+
20	Company has card-files Company has no card-files									+	+				
21	Transferring money by buyer to the company's account									+					
22	Designation to the buyer to buy the bank bill										+				
23	Transferring money by the company to the supplier's account									+					
24	Endorsement of bill to the company										+				
25	Endorsement of bill to the supplier										+				
26	Supplier accepts the goods in repay of buyer’s debt Supplier doesn’t accept the goods in repay of buyer’s debt											+	+	+	+
27	Debt maturities to supplier is more than operating cycle and time of goods sales Debt maturities to supplier is less than operating cycle and time of goods sales												+	+	+
28	Goods transfer to supplier by company											+			
29	Sale of goods												+		
30	Transferring money to the supplier by the company												+		

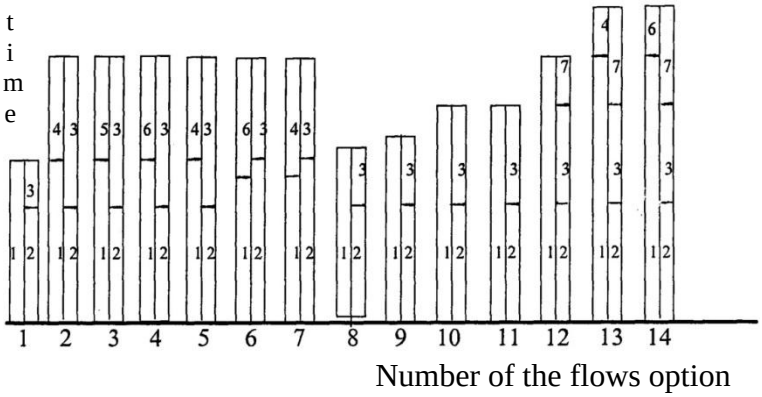

Fig. 3.38. Analysis of the supply chain duration and payables maturity

Legend:

1- time of debt to the supplier;
2- manufacturing time;
3- time of buyer's receivables;
4- time of bank loan;
5- time of bills conversion;
6- time of paper credit;
7- time of commissioner's receivables.

Classification of proposed 14 payment options is shown in Fig. 3.39.

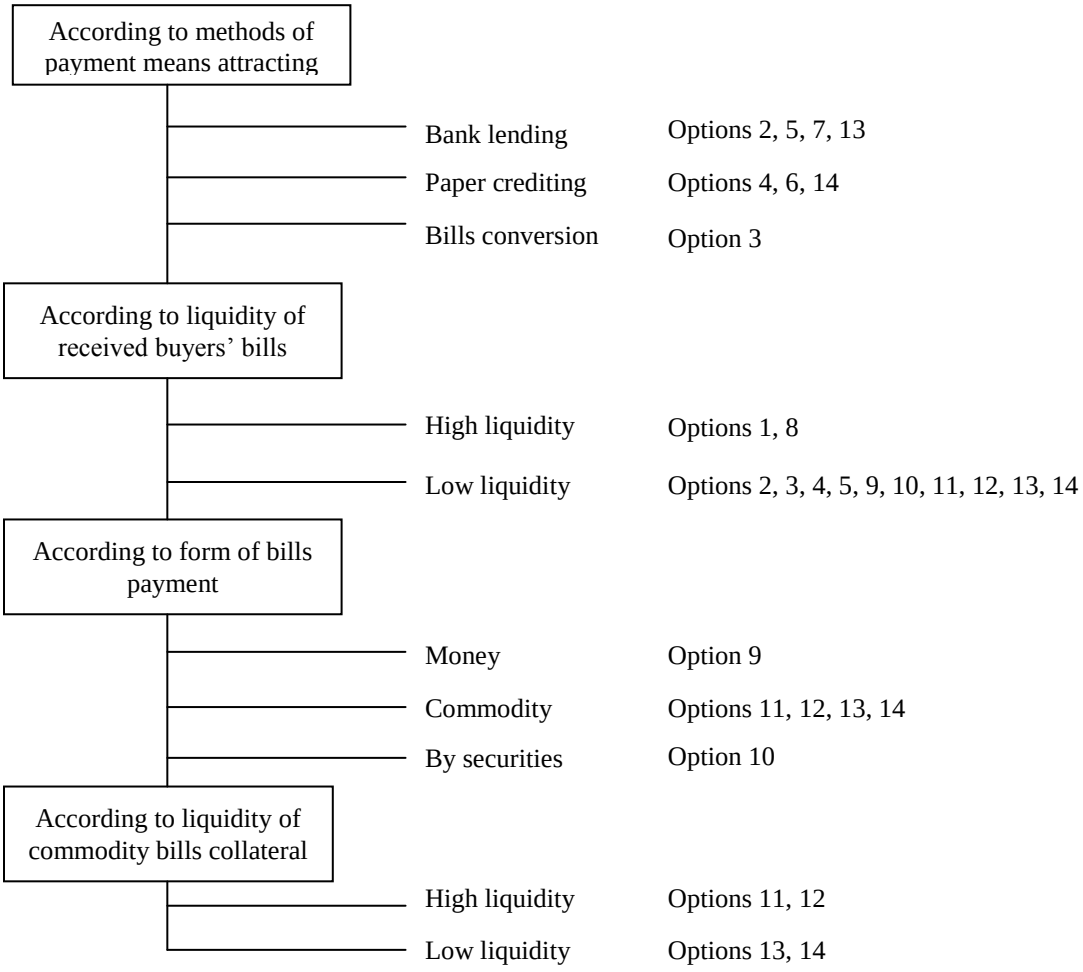

Fig. 3.39. Classification of payment options

Thus, one has proposed "lean" options for working capital organization in an industrial enterprise in the conditions of using modern methods of mutual settlements. Practical implementation of one option or another depends on the status of the market environment and economic situation of the company. In any situation analysis requires of the options effectiveness under consideration, which is a separate problem.

Conclusions of the third chapter

1. Economic and mathematical model allowed us to determine the optimal parameters of current assets under contractors mutual in the supply chain of industrial enterprises – the focus company, which confirms the validity and reliability of the obtained results. Optimization criterion was the maximum synergy, obtained as a result of system management of financial and material parts of working capital.

2. Designed algorithm of funds in circulation management based on the securitization process, under which it is proposed to understand the structuring of funds in circulation by low-cost means of payment. First developed and tested 14 "lean" options for mutual settlements in the supply chain of the enterprises, freeing up funds, to ensure the continuity of the working capital turnover and liquidity of the supply chain. Recommendations developed on the choice of a particular option, depending on the status of the external and internal environment.

CONCLUSION

This research led to the following conclusions.

1. Classical approach to working capital management is limited to viewing funds in circulation in the "narrow sense": only within the same subject. Today, however, in conditions of the integration processes domination, this is not enough objectively, and the concept of supply chain management (SCM) is development of an integrated approach beyond the focus company (in our study it is industrial enterprise-manufacturer) different subjects. SCM is an integrated functional, including three or more participants involved in the flow of goods, services, finance, and information from the source to the consumer, as well as the bank as financial infrastructure of the chain. Notion "supply chain in delayed finance mode" introduced – it is interconnected sequence of units for which the goods are delivered to the final consumer in delayed mode of payment; notion "supply chain in advanced finance mode" introduced – it is interconnected sequence of units for which the goods are delivered to the final consumer in the pre-payment mode. The following principles proposed for organization and control of payments in the supply chain concept: transition from competition to focus on cooperation with consumers and suppliers; cooperation with a small amount of reliable buyers of products; vertical integration with key customers and suppliers located at least at the first level in order to reduce risks; joint control of material, financial and information flows; quick response to order and different forms of payment; presence of an established settlement system for the supplied resources; focus on reducing overall costs and losses; bank involvement as a supply chain infrastructure; decrease in entropy in the entire chain; providing a positive synergy effect.

2. Authors' method for payments optimization (in the second chapter: optimization of funds in circulation of industrial enterprise) allowed us to determine the synergies arising from the supply chain multiplication, where financial flows are structured with modern payment instruments – bills and warehouse certificates.

3. Economic and mathematical model allowed us to determine the optimal parameters of current assets under contractors mutual in the supply chain of industrial enterprises – the focus company, which confirms the validity and reliability of the obtained results. Optimization criterion was the maximum synergy, obtained as a result of system management of financial and material parts of working capital.

4. Designed algorithm of funds in circulation management based on the securitization process, under which it is proposed to understand the structuring of funds in circulation by modern means of payment. Developed and tested 14 "lean" options for mutual settlements in the supply chain of the enterprise, freeing up funds, ensuring the continuity of the working capital turnover and liquidity of the supply chain. Recommendations developed on the choice of a particular option, depending on the status of the external and internal environment.

LIST OF THE LITERATURE

1. Андреев А.Н. Совершенствование механизма корпоративного управления на базе концепции интегрированных цепей: автореф. дис …. канд. экон. наук / А.Н. Андреев. – СПб, 2009.– 22 с.

2. Баев И.А. Оптимизация потоковых процессов промышленных предприятий/ И.А. Баев, А.Г. Бутрин / Экономика и производство. – 2002.– № 2. – С. 7–10.

3. Барыкин С.Е. Управление материальными потоками и сопутствующими финансовыми и информационными потоками в микрологистической системе предприятия»: дис …. докт. экон.наук / С.Е. Барыкин. – ИНЖЭКОН, 2009.– 330 с.

4. Батехин С. Л. Финансовая инженерия и оптимизация финансовых потоков. // Финансы.-2001.-№ 1.-С.68-69.

5. Бауэрсокс Д., Логистика: интегрированная цепь поставок/ Д. Бауэрсокс, Д. Клосс; пер. с англ. – М.: ЗАО «Олимп -Бизнес», 2001.– 640 с.

6. Башлыков Е.В. Совершенствование управления оборотным капиталом промышленного предприятия: дис …. канд. экон.наук / Е.В. Башлыков. – Челябинск, 2008.– 130 с.

7. Белоусова О.В. Системный анализ и оценка эффективности процессов управления корпоративными слияниями: дис …. канд. экон. наук / О.В. Белоусова.- М, 2003.

8. Коласс Б. Управление финансовой деятельностью предприятия. Проблемы, концепции, методы.: учебное пособие / Пер.с франц. под ред. Я.В. Соколова. – М.: Финансы, ЮНИТИ, 1997. – 576с.

9. Бертонеш М., Найт Р. Управление денежными потоками. − СПб.: Питер, 2004. – 240 с.

10. Бланк И.А. Концептуальные основы финансового менеджмента/И.А. Бланк.- Киев: Эльга, Ника-Центр,2003.-448с.

11. Бочаров В.В. Корпоративные финансы: учеб. пособие для вузов/ В.В. Бочаров, В.Е. Леонтьев.- СПб.: Питер, 2002.-544с.

12. Бочаров В.В. Управление денежным оборотом предприятий и корпораций/ В.В. Бочаров. – М.: Финансы и статистика, 2002.-144с.

13. Бочаров В.В. Финансовое моделирование: учеб. пособие /В.В. Бочаров.- СПб.: Питер, 2000.-208с.

14. Брейли Р. Принципы корпоративных финансов/Р. Брейли/ пер. с англ. Н. Барышниковой. – М.: ЗАО «Олимп–Бизнес», 2007. – 1008 с.

15. Бригхэм Ю. Энциклопедия финансового менеджмента/Ю.Бригхэм: пер. с англ./Общ. ред Б.Н. Пенькова.-5-е изд.-М.: Экономика, 1998. – 823 с.

16. Бутрин А.Г. Исследование и оптимизация потоковых процессов на промышленном предприятии: монография / А.Г. Бутрин. – Челябинск: Изд-во ЮУрГУ, 2005. – 192 с.

17. Бутрин А.Г. К интегральной оценке эффективности потоковых процессов / А.Г. Бутрин // Логистика. – 2002. – № 1. – С. 29–30.

18. Бутрин А.Г. Критерии управления взаимосвязанными потоковыми процессами / А.Г. Бутрин // Логистика. – 2001.– № 4. – С. 29–31.

19. Бутрин А.Г. Логистика для финансового директора: учебное пособие / А.Г. Бутрин. – Челябинск: Изд-во «Абрис-Принт», 2009.–180 с.

20. Суслов С.А. Управление фондами обращения в цепи поставок промышленного предприятия: монография / С.А. Суслов, А.Г. Бутрин. – Челябинск: Изд-во «Абрис-Принт», 2010.–100 с.

21. Бутрин А.Г. Складские свидетельства в финансово-хозяйственном обороте предприятия: учебное пособие / А.Г. Бутрин. – Челябинск: Изд-во ЮУрГУ, 1998.–29 с.

22. Бутрин А.Г. Теория и методология управления потоковыми процессами на промышленном предприятии: дис …. докт. экон. наук / А.Г. Бутрин. – Челябинск: Изд-во ЮУрГУ, 2003.– 375 с.

23. Бутрин А.Г. Управление оборотными средствами в условиях рынка монография / А.Г. Бутрин. – Челябинск: Изд-во ЧГТУ, 1997. – 125с.

24. Бутрин А.Г. Управление потоковыми процессами в логистической системе предприятия: монография / А.Г. Бутрин.– Челябинск: Изд-во ЮУрГУ,2008.–160 с.

25. Ван Хорн. Основы финансового менеджмента, 11-е издание./ В.Хорн, Дж. Вахович / пер. с англ. – М.: Издательский дом «Вильямс», 2003. – 992 с.

26. Вахрушина Н. Как управлять оборотными активами / Н. Вахрушина/ Финансовый директор. – 2005. – N 1. – С. 34– 41.

27. Вахрушина Н. Определение размера скидок и оценка их эффективности/ Н. Вахрушина / Финансовый директор. – 2004. – N 11. – С. 24–30.

28. Вахрушина Н. Создание системы управления дебиторской задолженностью / Н. Вахрушина // Финансовый директор.– 2005.– № 5. –С. 30–43.

29. Вертлюгина А.Е. Методы оценки корпоративного управления в вертикально-интегрированных компаниях: дис …. канд. экон. наук / А.Е. Вертлюгина. - СПб, 2003.

30. Гарнов А.П. Логистика и управление цепями поставок: концептуальные и стратегические аспекты/ А.П. Гарнов, И.О. Проценко. - М.: ГОУ ВПО "РЭА им. Г.В. Плеханова", 2009. - 96с.

31. Гущина И.В. Формирование кредитной политики промышленного предприятия: автореф. дис …. канд. экон. наук /И.В. Гущина. - Челябинск, ЮУРГУ, 2006. – с.

32. Дерюгина Е.Ю. Развитие моделей и методов управления материальными и финансовыми потоками логистической системы с учетом их взаимосвязи и взаимодействия: дис. …канд. экон. наук / Е.Ю. Дерюгина. – СПб, 2005.− 142 с.

33. Долженкова Е.В. Управление материальными потоками промышленных предприятий на основе синергетического подхода: автореф. дис …. канд. экон. наук /Е.В. Долженкова. - Екатеринбург, УГТУ – УПИ, 2007. – 23 с.

34. Дыбская В.В. Развитие логистики и supply chain management в России/В.В. Дыбская, В.И. Сергеев // Логистика и управление цепями поставок: современные тенденции в России и Германии: сб. статей российско-немецкой конфер. по логистике.- СПб.: Изд-во Политех. универ., 2008.

35. Зайков В.П. Теория и методология управления финансовыми потоками: дис …. докт. экон. наук / В.П. Зайков.– ИНЖЭКОН, 2008.– 320 с.

36. Зеваков А.М. Логистика материальных запасов и финансовых активов / А.М. Зеваков. – СПб.: Питер, 2005. – 352 с.

37. Зубкова О.В. Финансовая политика предприятия: учебно-практическое пособие / О.В. Зубкова, Е.В. Башлыков, Т.А. Петренко, В.А. Коровина.– Уральский социально-экономический институт Академии труда и социальных отношений.– Челябинск, 2005. – 168 с.

38. Иванов В.В. Механизмы управления финансовыми потоками в системе узловых воздействий / В.В. Иванов и др./Экономика и коммерция – 2000. – Вып.2.

39. Иванов В.В. Финансовые потоки в логистических системах /В.В. Иванов/ Логинфо. – 2001– №9. – с.15– 18.

40. Иванов Д.А. Развитие методологических основ гибких организационных форм кооперации промышленных предприятий на основе управления цепями поставок: автореф. дис …. докт. экон. наук / Д.А. Иванов. – СПб, 2008.– 38 с.

41. Иглин С.П. Математические расчеты на базе Matlab/С.П. Иглин. Издательство “BHV – Санкт –Петербург», 2005. – 640с.

42. Игнатова Н.В. Влияние межфирменной интеграции на эффективность промышленного производства: дис …. канд. экон. наук. - Волгоград, 2004.

43. Информационно-справочный материала для экспортеров по определению оптимального логистического решения доставки экспортной продукции на зарубежные рынки. – Астана, 2011.

44. Каплан Р. Стратегическое единство: создание синергии организации с помощью сбалансированной системы показателей; пер. с англ. / Р. Каплан, Д. Нортон. - М.: Вильямс, 2006. - 384 с.

45. Карлашов Е.Ю. Управление оборотными средствами хозяйствующих субъектов рынка (по материалам сахарной промышленности Краснодарского края): Автореф. дис …. канд. эконом. наук / КГТУ. – Краснодар, 1997. – 24 с.

46. Кирищиева И.Р. Комплексный инструментарий поддержки процесса управления в корпоративных интегрированных бизнес-системах: теоретико-прикладной аспект: автореф. дис …. докт. экон. наук/ И.Р. Кирищева. - Ростов на Дону, ГОУ ВПО «Ростовский государственный университет путей сообщения», 2009. - 51 с.

47. Ковалев В.В. Управление активами фирмы: учебно-практ. Пособие / В.В. Ковалев. − М.: ТК Велби, Изд-во Проспект, 2007. − 392 с.

48. Ковалев В.В. Управление денежными потоками, прибылью и рентабельностью: учебно-практ. пособие / В.В. Ковалев. − М.: ТК Велби, Изд-во Проспект, 2007. − 336 с.

49. Косачев Ю.В. Экономико-математические модели эффективности финансово-промышленных структур/ Ю.В. Косачев.- М.: Университетская книга, 2007.

50. Краснова С.В. Финансовый механизм регулирования денежных потоков предприятия в рамках ФПГ/С.В. Краснова // Финансы. - 2003.- № 1.- С. 73-74.

51. Красноперова Т.Я. Экономические интересы клиентов в системе экономической безопасности банка/Т.Я. Красноперова / Деньги и кредит. - 2008. - № 9. - С. 64-67.

52. Красноперова Т.Я. Экономическая безопасность банка: логистический аспект: монография/ Т.Я. Красноперова. – Ижевск, 2008.– 147 с.

53. Куанышбаев Ж.М. Управление грузовой и коммерческой работой: учебник. – Караганда: Изд-во Казахстанско-Российского Университета, 2013. – 226с.

54. Куанышбаев Ж.М., Осик Ю.И., Айдикенова Н.К. Определение провозной платы при международных перевозках массовых грузов с тарифным переломом // Международный журнал экспериментального образования. – 2014. – № 3 – с. 157-159.

55. Куанышбаев Ж.М., Осик Ю.И., Айдикенова Н.К., Касымжанова А.Д. Определение провозной платы при международных перевозках массовых грузов по схеме сквозного плеча // Международный журнал экспериментального образования. – 2014. – № 3 – с. 154-156.

56. Кунин В. А. Управление финансовой и инвестиционной деятельностью предприятия: монография / В.А. Кунин. – СПб.: Изд-во МБИ, 2005. − 156 с.

57. Лаврушин О.И. Банковское дело. Современная система кредитования: учебное пособие/ О.И. Лаврушин и др.. -М.:КНОРУС, 2007. - 264 с.

58. Лебедев, Ю.Г. Логистика: теория гармонизированных цепей поставок / Ю.Г. Лебедев. – М.: Изд-во МГТУ им. Баумана, 2005. – 488 с.

59. Логинов П.В. Теория и методология процессного управления промышленным предприятием: автореф. дис …. докт. экон. наук/ П.В. Логинов. - Санкт-Петербург, ГОУ ВПО «Санкт-Петербургский государственный инженерно-экономический уни-верситет», 2009. - 39 с.

60. Лукинский В. В. Управление запасами в цепях поставок: оптимальный размер заказа: монография / В.В. Лукинский. – Ставрополь: ГОУ ВПО «СевКавГТУ», 2007. – 124 с.

61. Максютов А.А. Управление кредиторскими и дебиторскими долгами компании/А.А. Максютов / Финансы. – 2001. – № 12. – С.14–17.

62. Мешалкин В.П. Организация и управление корпоративными логистическими системами промышленных предприятий: учебное пособие / В.П. Мешалкин.- М.: ОАО «Московский рабочий», 2004.- 250 с.

63. Миронов Ю.Е. Модель совместного управления дебиторской и кредиторской задолженностью при предоставлении товарного кредита / Ю.Е. Миронов // Финансовые проблемы РФ и пути их решения: теория и практика: сб. тезисов V Межд. научно-практической конференции. Ч.2. – СПб.: Нестор, 2004. – 340 с.

64. Миротин Л.Б. Системный анализ в логистике: учебник / Л.Б. Миротин, Ы.Э. Ташбаев. – М.: Экзамен, 2002.– 480 с.

65. Митрохина О.Н. Совершенствование механизмов коммерческого расчета на предприятиях: автореф. дис. на соиск. учен. степ. канд. эконом. наук/ О. Н. Митрохина / ТГУ. – Тамбов, 2002. – 21 с.

66. Мищенко А.В. Динамическая модель управления производственными ресурсами и оборотным капиталом в промышленной логистике / А.В. Мищенко, М.В. Могильницкая // Логистика и управление цепями поставок. – 2007. – № 5 (22). – С. 81 – 90.

67. Моисеева Н.К. Экономические основы логистики: учебник / Н.К. Моисеева. – М.: ИНФРА-М, 2007. – 528 с.

68. Никитина Н.В. Антикризисное финансовое управление промышленным предприятием: теория, методология, практика: автореф. дис …. докт. экон. наук/ Н.В. Никитина. - Саранск, ГОУ ВПО «Мордовский государственный университет им. Н. П. Огарева», 2009. - 39 с.

69. Новиков Д.Т. Взаимодействие базовой и инновационной логистики / Товародвижение и логистика: формирование и развитие научных школ: сб. науч. трудов / Д.Т. Новиков, Ф.Д. Новиков. - Екатеринбург: Изд-во Урал. гос. экон. ун-та, 2007. – С. 27-45.

70. Паламарчук А.С. Оборотные средства предприятия /А.С. Паламарчук// Справочник экономиста - № 3(21).- 2005г.

71. Плотников В.В. Эффект логистической интеграции / В.В. Плотников. – М.: Научная книга, 2002.– 100 с.

72. Проценко И.О. Выстраивая поток. Алгоритм логистизации хозяйственных структур/ И.О. Проценко// Российское предпринимательство.- №4.- 2005г-с.47-50.

73. Радионов Р.А. Как в условиях рыночной экономики следует нормировать на предприятии оборотные средства: по всем балансовым статьям или только их части /А.Р. Радионов //Управление финансами предприятий.- № 1.- 2004.

74. Радионов Р.А. Нормирование и управление запасами и оборотными средствами предприятия в условиях рыночной экономики / Р.А. Радионов // Консультант директора.- №4 (208).- 2004.

75. Радионова О.А. Методология нормирования, риски и надежность обеспечения запасами и оборотными средствами /О.А. Радионова // Финансовый бизнес.- №5, 6.- 2004.

76. Румянцева А.Ю. Управление дебиторской задолженностью на предприятии: автореф. дисс. на соиск. степ. канд. экон. наук /А.Ю. Румянцева / СПбГИЭУ. – Санкт-Петербург, 2004. – 17 с.

77. Самылин А.И. Управление финансовыми потоками предприятия на основе финансового планирования: теория, методика, инструмент: автореф. дис …. докт. экон. наук/ А.И. Самылин. - Москва, ГОУ ВПО «Российский социальный государственный университет», 2009. - 58 с.

78. Семенкова Е.В. Ценные бумаги в системе финансовых потоков/Е.В. Семенкова. – М.: Изд-во. Рос. экон. акад., 1998. – 76 с.

79. Снитко Л.Т. Управление оборотным капиталом организации / Л.Т. Снитко, Е.Н. Красная. – М.: Издательство «РДЛ», 2002. – 216 с.

80. Сорокина Е.М. Анализ денежных потоков предприятия: теория и практика в условиях реформирования российской экономики / Е.М. Сорокина. - 2-е изд., переаб. и доп. - М.: Финансы и статистика, 2004. - 176 с.

81. Тарифное руководство АО НК «Казақстан ТемірЖолы».

82. Тихомиров Е. Ф. Финансовый менеджмент: Управление финансами предприятия: учебник для студ. вузов / Е. Ф. Тихомиров. − М.: Издательский центр «Академия», 2006. − 384 с.

83.Уотерс Д. Управление цепью поставок. – М.:ЮНИТИ-ДАНА, 2003.–503 с.

84. Управление цепями поставок: справочник издательства Gower/ под ред. Дж. Гатторны; пер.с 5-го англ. изд. - М.: Инфра-М, 2008.- 670 с.

85. Фомин П.А. Оценка эффективности использования финансов предприятий в условиях рыночной экономики: монография / П.А. Фомин, В.В. Хохлов. – М.: Высшая школа, 2002. – 200 с.

86. Форрестер Дж. Основы кибернетики предприятия / Дж. Форрестер. – М.: Прогресс, 1971.– 340 с.

87. Хендфилд Р. Реорганизация цепей поставок. Создание интегрированных систем формирования ценности / Р. Хендфилд, Э. Николс. – М.: Вильямс, 2003.– 416 с.

88. Храброва И.А. Корпоративноое управление: вопросы организации, аффилированные лица, организационое проектирование, интеграционная динамика.- М Альпина-Брукс, 2000.-200 с.

89. Черемных О.С. Стратегическое управление холдингом: как организовать его правильно? // Босс.- N 11.- 2003.

90. Шапиро Дж. Моделирование цепи поставок. – СПб: Питер, 2006. – 720 с.

91. Яшин С.Н. Методика определения совокупного экономико-организационного эффекта предприятия с учетом двойственности / С.Н. Яшин, Е.Н. Пузов // Финансы и кредит. - 2005. - № 14. - С. 24-29.

Annex 1

Text of programs

1.1. Subsidiary initializing called software module

```
% Initialization function of the model parameters
function a = Set_Parameters_2cycles();
a=zeros(1,50);
% basic cycle parameters (advance of financial flow)
a=zeros(1,17);
a(1)=0.2; % coefficient of relative stock at the factory v
a(2)=0.1; % rate of return of the company Rr
a(3)=100000000; % annual volume of prepaid sales Rp
a(4)=500000; % volume of prepaid sales per customer m
a(5)=5; % ordering delay at the factory x1
a(6)=5; % delay of goods shipment from the warehouse x2
a(7)=60; % production delay x3
a(8)=10; % delay in the normal order book x4
a(9)=0.8/2; % upper orders limit met by stocks of finished products Jmax
a(10)=0.7/2; % part of orders met by normal stock Jn
a(11)=10; % delay of ordering at the company and products shipping from the
warehouse c
a(12)=0.5 % share (minimum) of prepayment i

% Determination of other parameters
t_end=75;
k_max=0.3;
a(13)=log(k_max+1)/(t_end-a(11));
n1_max=25;
a(14)=log(n1_max+1)/(t_end-a(11));
n2_max=27;
a(16)=0.5; % minimum share of prepayment
a(15)=log(n2_max+1)/(1-a(16));
%n3_max=10;
%a(15)=0;
%a(16)=log(n3_max/0.3)/(0.5-a(17));
a(17)=34666; % per day
discont = inline('(x(1)+x(2)*xdata)','x','xdata');
x = lsqcurvefit(discont,[0,0],[3,60],[0,14]);
a(18:19)=x;
a(20)=0.025;
```

1.2. Core software module

```
%Simulation and optimization of flow processes with the advance mode
% financial flow (delay of products delivery) for the base and
%multiply cycles
clc % Screen initialization procedure
% Initialization of variables and constants
a=zeros(1,18); % Formation of the coefficient vector
a = Set_Parameters_2cycles(); % Call of the initialization procedure

% Formation of the time series
time_step=1;
x=50:time_step:75;
x_vsp=0:time_step:75;

% Calculation of the actual stock of finished goods
c1=-log((a(9)-a(10))/a(9));
Q=a(1)*a(3);
j=(x-(a(5)+a(7)+a(8)))/(a(6)-a(7)-a(8));
g=(-Q/c1)*log((a(9)-j)/a(9));

% Results visualization
My_font_size=20;

% schedule 15
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(g/Q,j,'b','LineWidth',3)
xlabel('g/Q','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('j1,2','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% Costs of capital binding in the actual stock
y11_basis=g*a(2);
y1_multi_05=g*a(2)*0.5;
y1_multi_06=g*a(2)*0.6;
y1_multi_07=g*a(2)*0.7;
y1_multi_08=g*a(2)*0.8;
y1_multi_09=g*a(2)*0.9;
```

```
% schedule 16
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x,y11_basis,'r','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Costs for the flows coordination for SC1 y11,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% schedule 17
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x,y1_multi_05,'r','LineWidth',3)
plot(x,y1_multi_06,'b','LineWidth',3)
plot(x,y1_multi_07,'g','LineWidth',3)
plot(x,y1_multi_08,'k','LineWidth',3)
plot(x,y1_multi_09,'y','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Costs for the flows coordination in SC2 y1,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

y12_basis_05=(0.5-0.5)*a(3)*0.15*x;
y12_basis_06=(0.6-0.5)*a(3)*0.15*x;
y12_basis_07=(0.7-0.5)*a(3)*0.15*x;
y12_basis_08=(0.8-0.5)*a(3)*0.15*x;
y12_basis_09=(0.9-0.5)*a(3)*0.15*x;

% schedule 18
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x,y12_basis_05,'r','LineWidth',3)
plot(x,y12_basis_06,'b','LineWidth',3)
plot(x,y12_basis_07,'g','LineWidth',3)
```

```
plot(x,y12_basis_08,'k','LineWidth',3)
plot(x,y12_basis_09,'y','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Costs for credit use in SC1 y12,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

y1_basis_05=y11_basis+y12_basis_05;
y1_basis_06=y11_basis+y12_basis_06;
y1_basis_07=y11_basis+y12_basis_07;
y1_basis_08=y11_basis+y12_basis_08;
y1_basis_09=y11_basis+y12_basis_09;

% schedule 19
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x,y1_basis_05,'r','LineWidth',3)
plot(x,y1_basis_06,'b','LineWidth',3)
plot(x,y1_basis_07,'g','LineWidth',3)
plot(x,y1_basis_08,'k','LineWidth',3)
plot(x,y1_basis_09,'y','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Total costs for the flows coordination in SC1 y1,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% schedule 20
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x,y1_basis_05+y1_multi_05,'r','LineWidth',3)
plot(x,y1_basis_06+y1_multi_06,'b','LineWidth',3)
plot(x,y1_basis_07+y1_multi_07,'g','LineWidth',3)
plot(x,y1_basis_08+y1_multi_08,'k','LineWidth',3)
plot(x,y1_basis_09+y1_multi_09,'y','LineWidth',3)
xlabel('Delay of finished products delivery,
```

```
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Full costs in the two chains y1,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);


% Discounts
k1=exp(a(13)*(x_vsp-a(11)))-1;
for ii=1:length(k1),
 if (k1(ii)<0) k1(ii)=0; end
end
% Costs for discounts organizing
y21=a(2)*a(3)*k1;

% schedule 21
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x_vsp,k1,'b','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Size of the discount, units','FontSize',My_font_size,'FontName','Times New
Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% Losses from the discount in the basic chain
% schedule 22
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x_vsp,y21,'b','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel(Losses from the discount in the basic chain,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% First component of the number of buyers who left
```

```
n1=exp(a(14)*(x_vsp-a(11)))-1;
for ii=1:length(n1),
 if (n1(ii)<0) n1(ii)=0; end
end

% schedule 23
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x_vsp,n1,'r','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel(' Number of buyers who left n1, units',
'FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);


% Second component of the number of buyers who left
i=[0.5:0.1:0.9];
n2=exp(a(15)*(i-a(16)))-1;
% schedule 24
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(i,n2,'r','LineWidth',3)
xlabel('Share of prepayment in the costs of products,
units','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Number of buyers who left n2,
units', 'FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% Third component of the number of buyers who left
n3=(-100/3)*i+(80/3);
for ii=1:length(n3),
 if (n3(ii)<0) n3(ii)=0; end
end
% schedule 25
set(figure,'Color',[1 1 1]);
hold on
```

```
grid on
plot(i,n3,'r','LineWidth',3)
xlabel('Share of prepayment in the costs of products,
units','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Number of buyers who left n3,
units', 'FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% The total number of buyers who left
n_05=n1+n2(1)+n3(1);
n_06=n1+n2(2)+n3(2);
n_07=n1+n2(3)+n3(3);
n_08=n1+n2(4)+n3(4);
n_09=n1+n2(5)+n3(5);

% Losses from buyers leaving in the basic chain
y22_05=a(2)*a(4)*n_05;
y22_06=a(2)*a(4)*n_06;
y22_07=a(2)*a(4)*n_07;
y22_08=a(2)*a(4)*n_08;
y22_09=a(2)*a(4)*n_09;

% schedule 26
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x_vsp,y22_05,'b','LineWidth',3)
plot(x_vsp,y22_06,'r','LineWidth',3)
plot(x_vsp,y22_07,'k','LineWidth',3)
plot(x_vsp,y22_08,'g','LineWidth',3)
plot(x_vsp,y22_09,'y','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Losses y22 from buyers leaving in the basic chain,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% Company’s losses from discount when handling warehouse certificates in the basic
chain
```

```
d=0.1; % discount rate when handling warehouse certificates
y23_basis_05=d*(1-0.5)*a(1)*a(3)*x_vsp/365;
y23_basis_06=d*(1-0.6)*a(1)*a(3)*x_vsp/365;
y23_basis_07=d*(1-0.7)*a(1)*a(3)*x_vsp/365;
y23_basis_08=d*(1-0.8)*a(1)*a(3)*x_vsp/365;
y23_basis_09=d*(1-0.9)*a(1)*a(3)*x_vsp/365;

% schedule 27
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x_vsp,y23_basis_05,'b','LineWidth',3)
plot(x_vsp,y23_basis_06,'r','LineWidth',3)
plot(x_vsp,y23_basis_07,'k','LineWidth',3)
plot(x_vsp,y23_basis_08,'g','LineWidth',3)
plot(x_vsp,y23_basis_09,'y','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Losses y23 from buyers leaving in the basic chain,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% Losses from suppliers leaving in the basic chain
y24_basis=a(2)*a(17)*(a(18)+a(19)*x_vsp);
for ii=1:length(y24_basis),
 if (y24_basis(ii)<0) y24_basis(ii)=0; end
end
% schedule 28
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x_vsp,y24_basis,'b','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Losses y24 from suppliers leaving in the basic chain,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% Aggregate losses of the company in the basic chain
```

```
y2_basis_05=y21+y22_05+y23_basis_05+y24_basis;
y2_basis_06=y21+y22_06+y23_basis_06+y24_basis;
y2_basis_07=y21+y22_07+y23_basis_07+y24_basis;
y2_basis_08=y21+y22_08+y23_basis_08+y24_basis;
y2_basis_09=y21+y22_09+y23_basis_09+y24_basis;
% schedule 29
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x_vsp,y2_basis_05,'b','LineWidth',3)
plot(x_vsp,y2_basis_06,'r','LineWidth',3)
plot(x_vsp,y2_basis_07,'k','LineWidth',3)
plot(x_vsp,y2_basis_08,'g','LineWidth',3)
plot(x_vsp,y2_basis_09,'y','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Losses of the company y2 in the basic chain,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
axis([0,80,0,5000000]);

% Losses from buyers leaving in the multiplied chain
y2_multi=a(2)*a(4)*exp(a(20)*(x_vsp-a(11)));
% schedule 30
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x_vsp,y2_multi,'b','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Losses y2 from buyers leaving,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% Full losses of the company in the system
y2_05=y2_basis_05+y2_multi;
y2_06=y2_basis_06+y2_multi;
y2_07=y2_basis_07+y2_multi;
y2_08=y2_basis_08+y2_multi;
y2_09=y2_basis_09+y2_multi;
```

```
% schedule 31
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x_vsp,y2_05,'b','LineWidth',3)
plot(x_vsp,y2_06,'r','LineWidth',3)
plot(x_vsp,y2_07,'k','LineWidth',3)
plot(x_vsp,y2_08,'g','LineWidth',3)
plot(x_vsp,y2_09,'y','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel(Full losses y2 in the system, rubles','FontSize',My_font_size,'FontName','Times
New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
axis([0,80,0,5000000]);

% Full aggregate costs and losses of the company in the system
y1_05=y1_basis_05+y1_multi_05;
y1_06=y1_basis_06+y1_multi_06;
y1_07=y1_basis_07+y1_multi_07;
y1_08=y1_basis_08+y1_multi_08;
y1_09=y1_basis_09+y1_multi_09;

y_05=y1_05+y2_05(51:length(x_vsp));
y_06=y1_06+y2_06(51:length(x_vsp));
y_07=y1_07+y2_07(51:length(x_vsp));
y_08=y1_08+y2_08(51:length(x_vsp));
y_09=y1_09+y2_09(51:length(x_vsp));

% schedule 32
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x,y_05,'b','LineWidth',3)
plot(x,y_06,'r','LineWidth',3)
plot(x,y_07,'k','LineWidth',3)
plot(x,y_08,'g','LineWidth',3)
plot(x,y_09,'y','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
```

```
ylabel('Full aggregate costs and losses y in the system,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% schedule 33
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x,y_05,'b','LineWidth',3)
plot(x,y1_05,'r','LineWidth',3)
plot(x,y2_05(51:length(x_vsp)),'g','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Full costs and losses y in the system when i=0.5,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% schedule 34
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x,y_06,'b','LineWidth',3)
plot(x,y1_06,'r','LineWidth',3)
plot(x,y2_06(51:length(x_vsp)),'g','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Full costs and losses y in the system when i=0.6,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% schedule 35
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x,y_07,'b','LineWidth',3)
plot(x,y1_07,'r','LineWidth',3)
plot(x,y2_07(51:length(x_vsp)),'g','LineWidth',3)
xlabel('Delay of finished products delivery,
```

```
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Full costs and losses y in the system when i=0.7,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% schedule 36
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x,y_08,'b','LineWidth',3)
plot(x,y1_08,'r','LineWidth',3)
plot(x,y2_08(51:length(x_vsp)),'g','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Full costs and losses y in the system when i=0.8,
rubles','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);

% schedule 37
set(figure,'Color',[1 1 1]);
hold on
grid on
plot(x,y_09,'b','LineWidth',3)
plot(x,y1_09,'r','LineWidth',3)
plot(x,y2_09(51:length(x_vsp)),'g','LineWidth',3)
xlabel('Delay of finished products delivery,
days','FontSize',My_font_size,'FontName','Times New Roman Cyr');
ylabel('Full costs and losses y in the system when i=0.9,
rubles ','FontSize',My_font_size,'FontName','Times New Roman Cyr');
set(gca,'FontSize',My_font_size,'FontName','Times New Roman Cyr')
%axis([0,90,0,20]);
```

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Monograph

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