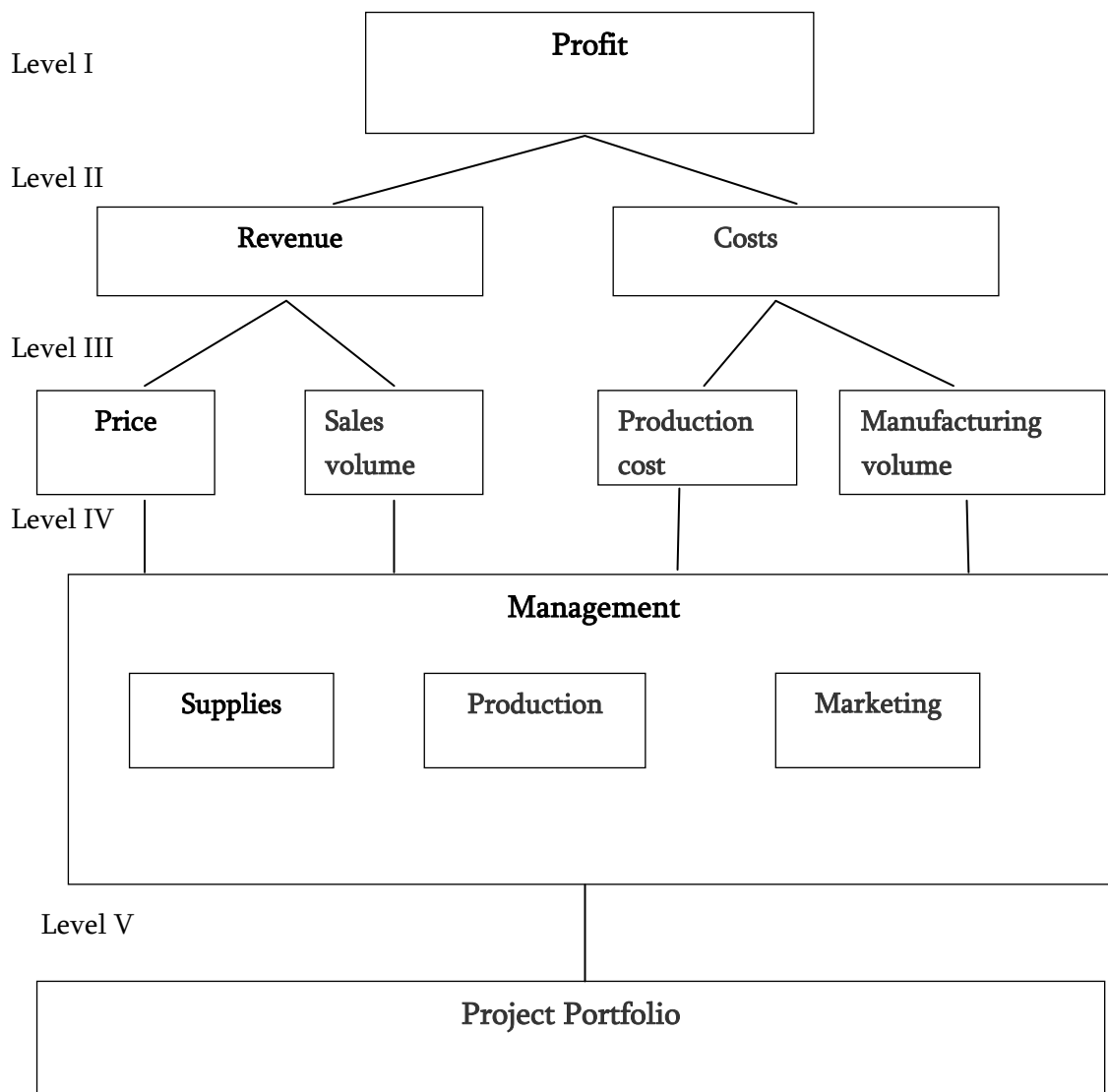


COMPANY INVESTMENT ACTIVITY MANAGEMENT MODEL

The company development management is manifested in the integrity of the activities, methods and assets (tangible and intangible) implemented for attainment of the set goals. The overall development level of the company depends on the following key elements: the economic development level, corporate development level, technical and technological development, management level development. The economic development level is determined by the growth of the following indices: the proprietor's financial results, earnings, profit, cost-effectiveness, income of employees, financial stability factor. At the same time the decrease in the excess liabilities and rate of consumption is also very important. Of course, the ideal variant will be attainment of all above objectives, maximization of all parameters. However, this ideal is above attainment as risk minimization, market extension and so on result in the growth of expenditures and, hence, the decrease in the income; the ongoing consumption growth results in the decrease in the development fund etc. Therefore, the rise of economic level of a company is the multicriterion problem and any decision made in a concrete period is a compromise as only one criterion or a few criteria can be maximized. For the majority of Georgian companies the increase in the financial results is connected with the growth of circulating capital, turnover, production and sales. Finally, the majority of decisions (e.g. the rise of the value of business or current income) are made using different variants of distribution of profit. Therefore, the necessary and adequate condition for the improvement of at least one criterion without deterioration of other criteria is the growth of profit. Implementation of any project related to any pattern of the capital investments (procurement, production, sales or management) effects on the key factors – the economic parameters of a product: price, cost, volume of output and profit (Fig. 1).



Profit P_T is formed from of the company revenue (income) and expenses and the factors effecting on it are the price, cost and volume of output:

$$P_T = \sum_{i=1}^n (P_{i,T} - C_{i,T}) N_{i,T} - \sum_{l=1}^L K_l \rightarrow \max, \quad (1)$$

where $P_{i,T}$, $C_{i,T}$ are the average values of price and unit cost of i -product in T time period ($i=1, n$), n is the quantity of items of manufactured product, $N_{i,T}$ is the volume of output. K_l is the level of investment in l activity of the company ($l=1, L$). The main goal of the investment is selection of the projects in the portfolio and determination of the amount of required funds. The introduction of the target function and procedures for determination of the basic model parameters enables to solve the following problem: to provide the maximum growth of the target function the investment shall be implemented at the concrete stage of the decision-making.

In this case it is reasonable to apply the two-stage technology of the problem of distribution of investment resources. At the first, initial stage, the procedure of strategic planning of the priority choice of investment shall be used. Then the financial flows management methods shall be used, with the further specification of projects in dynamics, calculation of investment flows, adjustment of expenses and results with the repeated iteration companywide. The stage of the strategic planning includes: the strategic analysis (formation of the company targets and criteria in consideration of the analysis of the domestic and outward investment environment); clarification of main patterns of the activity; selection of the priority patterns of the capital investments; planning of the strategy implementation, company budgeting and unit budgeting with the structural distribution of investments.

The investment activity provides for the new value of the price $f_i^0 \rightarrow P_i^n$, as well as a new cost $C_i^0 \rightarrow C_i^n$ and changes the sensitivity of those parameters $\Delta P_i^0 \rightarrow \Delta P_i^n$, $\Delta C_i^0 \rightarrow \Delta C_i^n$ in the conditions $N_i^0 \rightarrow N_i$ of the changed output program and in the interval $(N_i - N_i^0)$ (see Fig. 2). The change in range of values of parameters, to the interval of amount change:

$$\Delta P_i = \left. \frac{\partial P_i(N_i)}{\partial N_i} \right|_{N_i^0} = \frac{\Delta P_i}{N_i - N_i^0};$$

(2)

$$\Delta C_i = \left. \frac{\partial C_i(N_i)}{\partial N_i} \right|_{N_i^0} = \frac{\Delta C_i}{N_i - N_i^0};$$

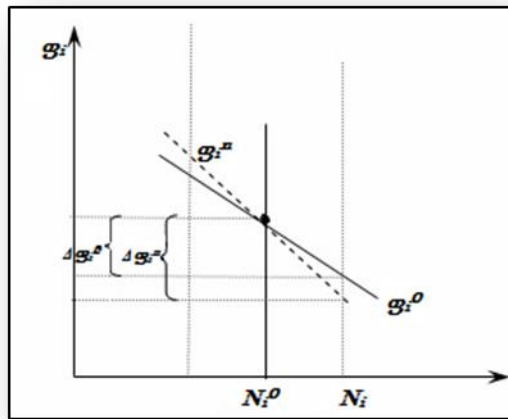
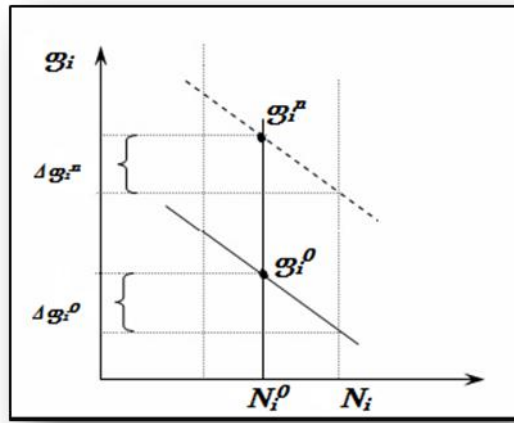


Fig. 2. Change of parameters level and sensitivity

Such change of values of parameters P_i , Δf_i and C_i , ΔC_i is caused by the shares of investments put in the company: K_{pi} , $K_{\Delta pi}$, K_{Ci} , $K_{\Delta Ci}$.

The effect of the investment on those parameters is determined by special coefficients calculated before investment (index "0") and after investment (index "n").

$$k(K_{pi}) = f_i^n / P_i^0, \quad k(K_{\Delta pi}) = \Delta f_i^n / \Delta P_i^0, \quad (3)$$

$$k(K_{Ci}) = C_i^n / C_i^0, \quad k(K_{\Delta Ci}) = \Delta C_i^n / \Delta C_i^0,$$

where $k(K_{pi})$, $k(K_{\Delta pi})$, $k(K_{Ci})$ and $k(K_{\Delta Ci})$ are the coefficients of effect of the investments on the price and cost levels and sensitivity.

The change of the product price and the unit cost in case of change of the volumes of sales and output (from value N_i^0 to the value N_i) is determined as follows:

$$P_i(N_i) = P_i(N_i^0) - \Delta p_i(N_i - N_i^0),$$

$$C_i(N_i) = C_i(N_i^0) - \Delta C_i(N_i - N_i^0). \quad (4)$$

In consideration of formulas (1-4) the target function may be presented as follows:

$$Pr = \sum_{i=1}^n [k(K_{\Delta i}) g_i - k(K_{\Delta i}) \Delta f_i (N_i - N_i^0)] N_i - \sum_{i=1}^n [k(K_{C_i}) g_i - k(K_{\Delta C_i}) \Delta C_i (N_i - N_i^0)] N_i - \sum_{l=1}^L K_l \rightarrow \max, \quad (5)$$

where there are the balance restrictions:

$$\sum_{i=1}^n \alpha_{ji} N_i \leq R_j + \Delta R_j (K_j), \quad (j = 1, m) \quad (6)$$

and with the admissible value interval:

$$0 \leq N_i \leq N_i^{\max}, \quad 0 \leq \sum_{l=1}^L K_l \leq K^{\max}, \quad (I = 1, n), \quad (7)$$

where α_{ji} is the expenditure of j type resource for manufacturing of i type product, N_i^{\max} , K^{\max} the maximum possible indicators of the output program and investments, ΔR_j is j resource increase K_j within the investment, K_l – the investment level in production by the first pattern (see Fig. 1).

The key factors that form the price level and sensitivity coefficients $k(K_{pi})$ da $k(K_{\Delta pi})$ are the product quality, product strategic development plan and the activities of its market promotion, expenses for the use of product. Each of these factors is formed through implementation of the investment project determined by the relevant pattern.

The product quality and product market promotion coefficients (k_{Qi} and k_{Mi} accordingly) are calculated by the relevant integral indicators before and after investment activities:

$$k_{Qi} = Q_i^n / Q_i^0; \quad k_{Mi} = M_i^n / M_i^0;$$

where Q_i^n and Q_i^0 are the integral coefficients of i product quality and M_i^n and M_i^0 – i product market promotion parameters before and after investment activities, accordingly.

The parameter (k_{Di}) specifying the product development strategic plan is estimated by two components: coefficient k_1 which determines the pricing policy ($k_1 < 0$ – in case of price drop and $k_1 > 0$ in case of price rise) and the product service life coefficient k_2 ($k_2 > 1$, in case of intensive rate of growth of or decline in output; $k_2 < 1$ in case of slow rate) and is determined as follows: $k_D(t) = 1 + k_1 k_2^t$.

The price level change coefficient $k(K_{pi})$ is calculated as the product of the above listed indices in consideration of the operating costs that are calculated as the share of the operating costs change in the price structure: $k_{ei} = 1 + \Delta x_i / P_i$, where $\Delta e_i = e^{\rho} - x^{\rho}$ is the operating costs change after the investment activities. Accordingly: $k(K_{pi}) = k_{Di} k_{Qi} k_{Mi} k_{ei}$. The coefficient can be determined both on the basis of the factor quantitative values and by the expert method.

The research in the effect on the price sensitivity was carried out in the company: of product quality index k_{Qi} , product strategic development plan k_{Di} , product market promotion activities k_{Mi} . Subject to the new strategy it is reasonable to determine the price sensitivity change coefficient $k(K_{\Delta pi})$ in direct proportion to coefficients k_{Qi} and k_{Mi} and inversely to coefficient k_{Di} , that is:

$$k(K_{\Delta pi}) = k_{Qi} k_{Mi} / k_{Di}.$$

The effect of coefficients on the cost is calculated in the subsystems of supplies, production and distribution. In the units which are associated with the procurement and distribution, the costs per product unit subject to the output volume are of growing character. This is due to the extension of the turnover of material resources followed by the necessity of use of the additional transport and storage facilities and growth of expenses with the search for new customers in the conditions of the limited demand. The production costs will decrease along with the increase of

the output since, as a rule, the conditional-fixed costs per product unit decreases and the technology becomes stable. Accordingly, in case of the extension of the output program after the investment activities the cost $\Delta_{Ci}(N_i) = C^0_i(N_i) - C^2_i(N_i)$ may: 1) increase Δ^I_{Ci} ; 2) decrease Δ^II_{Ci} or 3) remain the same Δ^III_{Ci} .

The values of cost level change coefficients k_{Ci} in each case study are determined from the following expression:

$$C^2_i(N^p) = C^0_i(N^p) \pm \Delta_{Ci}. \quad (8)$$

If we divide the left and right sides by $C^0_i(N^p)$ for each variant $m=1, 2, 3$, we will receive:

$$C^2_i(N^p) / C^0_i(N^p) = 1 \pm \Delta_{Ci} / C^0_i(N^p), \quad \text{or} \quad k^m_{Ci} = 1 \pm \Delta^m_{Ci} / C^0_i(N^p). \quad (9)$$

The cost sensitivity coefficient is determined in consideration of the possible actual sensitivity changes Δ_{Ci}/N^p , according to the variants $\Delta C^2_i = \Delta C^0_i \pm \Delta_{Ci}/N^p$. If we divide this expression by ΔC^0_i we will receive, according to the variants:

$$k^I_{\Delta Ci} = 1 - \Delta_{Ci} / \Delta C^0_i N^p; \quad k^II_{\Delta Ci} = 1 + \Delta^II_{Ci} / \Delta C^0_i N^p; \quad k^III_{\Delta Ci} = 1.$$

The investment effect on the cost parameters is determined as the product of coefficients of different variants:

$$k(K_{Ci}) = k^I_{Ci} k^II_{Ci} k^III_{Ci}, \quad k(K_{\Delta Ci}) = k^I_{\Delta Ci} k^II_{\Delta Ci} k^III_{\Delta Ci}.$$

These calculations are based in the actual value of the cost change Δ_{Ci} according to the investment activities variants.

The solution of problem (5) with the restrictions (6-7) enables us to determine the optimal volume of the production program in consideration of the effect of the selected investment projects.

Development of the Domestic Investment Strategy and Investment Flow Optimization

The basic problem of the investment is to select projects and to determine the amount of required funds. The introduction of the target function and the procedure for determination of the basic parameters of the model enable to solve this problem – the implementation of investment is reasonable in line of maximization of the target function at each concrete stage of the decision-making.

The two-stage technology of the problem of distribution of investment resources has been reviewed. At the first, initial stage, the strategic planning of selection of the priority patterns of investment shall be used. At the next stage the financial flow management methods shall be used, with the further specification of projects in dynamics, calculation of investment flows, adjustment of expenses and results with the repeated iteration companywide. The stage of the strategic planning includes the following: the strategic analysis (formation of the company targets and criteria in consideration of the analysis of the domestic and outward investment factors); clarification of main patterns of the company activity and selection of the priority vectors of the investment; planning of the strategy implementation, company budgeting and unit budgeting with the structural distribution of investments [1]. The problem of formation of the domestic investment strategy is reviewed as the complex technology of profit maximization based on the interconsistent solution of the following problems: selecting the budgetary policy, outward credit and domestic investment policies; distinguishing priority patterns in the fixed plan period.

The initial parameters are: list of projects, expenses and desirable performance (target), defined amount of equity, possibility of the use of attracted funds at the given rate of interest (in case of

lack of the equity capital), or alternative placement of the own cash funds in outward investments (in case of lack of the effective investment variants and excess capital).

The algorithm of selection of priority patterns of investment is as follows:

- 1) to determine the number m of variants (projects) in 1 pattern of development;
- 2) to assess the response of each one pattern, the target function $P_{im}(K_{im})$ of each variant m to the volume involvement of investments K_{im} in it;
- 3) to assess the effectiveness F_{im} or adverse intensity f_{im} of each variant (in different periods of project implementation):

$$4) F_{im} = P_{im}(K_{im}) / K_{im}, \quad \text{or} \quad f_{im} = P_{im}(K_{im}) / K_{im} T_{im}.$$

- 4) to rank projects according to the decrease of their effectiveness and to assign to the projects new numbers by the project rank:

$$F_1 > F_2 > \dots > F_i > \dots > F_n, \quad \text{or} \quad f_1 > f_2 > \dots > f_i > \dots > f_n.$$

- 5) to determine the total investments K_{Σ} of the ranked projects (by the incremental sum):

$$K_{\Sigma} = \sum_{i=1}^n K_i (F_i).$$

- 6) to select the marginal project Z whereupon the total investments will be added to the own investment resources K_{cc}^{max} of the company:

$$\sum_{i=1}^Z K_i (F_i) \leq K_{cc}^{max}.$$

- 7) to determine the investment pattern 1 and variants m which will provide for the maximum target function using the given own resources.

In order to develop the investment patterns and to distribute equity among those units which implement investment projects, the ranked projects shall be differentially systematized by each pattern, according to each unit with determination of marginal projects Z_i (according to the criterion of less effectiveness F_{Zi}). The total investments of most effective projects by the incremental sum represent the resources required for the given units, for implementation of the investment activity:

$$K_{\Sigma}^i = \sum_{i=1}^{Z_i} K_i^i (F_i^i).$$

Distribution of the company budget based on those totals will enable us to differentiate the resources as well as the activity of units and the company by their effectiveness.

In this view the procedure of the budgetary provision balancing is reasonable which is based on two main principles: 1) the funds of the units shall be allocated for more effective projects; 2) the maximum profit of the company is based on the maximum effective activity of all units in consideration of the marginal value of expenses. Two variants of the balancing are admissible. First: the resource unit is withdrawn from that unit which has the minimum loss and added to that one which has the maximum increase in the effect. Second: based on the analysis of the difference of the marginal effectiveness of projects we obtain the average value and determine the minimum required expenses by each unit. If their total is less than the available funds, the excessive funds shall be added to more effective projects; if the total exceeds the available funds, the deficit will be covered from the less effective projects. The balancing criterion is the equity of effectiveness of marginal projects.

Selection of the company investment policy is determined in consideration of the capital adequacy and credit and deposit rates. In principle, the decision-making is quite simple: those projects shall be maintained which effectiveness exceeds the rates of credits and deposits. In case of capital adequacy and excess of capital, it is reasonable to place a part of the funds on the bank deposit instead of their investment in the projects which effectiveness is less than the rate of deposit. At the same time, determination of the equity capital amount is the optimization problem and should

be considered along with the company investment activity and the economic results obtained in this pattern.

We have presented the model of optimization of the investment flow structure which is the two-criterion problem of congruence of interests:

$$\begin{aligned} \text{For the company} \quad P_T = \sum_{t=1, T_k} P_t \frac{1}{(1+E)^t} \rightarrow \max \\ \text{for a creditor} \quad Q_T = \sum_{t=1, T_k} Q_t \rightarrow \max. \end{aligned} \quad (10)$$

The additional condition of problem solution is the system of three interrelated equations which determine, in consideration of the investment activities, the following:

the dynamics of the company results

$$P_{t+1} = \lambda P_t + K_t; \quad (11)$$

the total credit and payment flow

$$G_{t+1} = G_t + y_t; \quad (12)$$

the Bank capital change

$$Q_{t+1} = Q_t + \eta_t G_t - y_t, \quad (13)$$

where P_t is the current company profit value t at the point of time ($t = 1, \dots, T_k$), T_k - the time periods in the reporting period T ; E - the discount rate, λ - the coefficient which reflects the current profit value change without the investment activities; K_t - the investment flow generating the profit growth for the company; η_t - the loan interest rate; y_t - the credit and payment flow, $y_t = K_t^k - h_t$. The amount of required credit resources K_t^k (the credit flow) is determined on the basis of the cash flow balance, from the company balance equation:

$$K_t^k = \eta_t \sum (K_j^k - h_j) + \sigma_t + h_t + K_t - K_t^{ss}, \quad (14)$$

where σ_t - payments to the budget (taxes); h_t - the credit repayment flow; K_t^{ss} - the company equity capital.

The total credit flow and taxes by the given period of time t is: $G_t = \sum (K_t^k - h_t)$. The status of funds placed at the bank is defined by the following ratio: $Q_t = Q_0 + \eta G_t - y_t$, where Q_0 - the initial amount of funds in the bank.

The problem is solved through the modeling of the controlling action parameters: investment flow K_t , credit and payment flow y_t , loan interest rate η_t . The optimal result is determined by the method of successive concessions in consideration of the restrictions of the initial and limited values of parameters.

Company Investment Management

The above described methodology that provides for the technology of modeling of the company investment management can be presented as the single system of preparation, making and execution of investment decisions. The main typical problems solution of which ensures the implementation of the investment activity of the company may be classified in 2 groups: 1) the strategic planning of priority investment patterns, and 2) the investment flow management. Namely, the strategic decision-making covers the following problems: the assessment of the productive potential of the company and its units; separation of the priority patterns and projects; selection of the credit, domestic investment and budgetary policies beneficial for the company and distribution of investments among the projects; assessment of the investment project implementation effect on the company final financial results; profit maximization; selection of beneficial proportions of variability (change) of the company limiting (restricting) factors.

The investment flow management subsystem includes the following components: the cash funds estimate and flow forecast; forecast of movement of the congruent material and financial flows; estimation of the minimum amount of benefit of borrowed funds, determination of terms of borrowing and repayment; determination of the investment flow efficiency; selection of the beneficial parameters of reinvestment; calculation of the compromising variant of solution of the set multicriterion problem.

The system of preparation, making and implementation of investment decisions is the basis of the investment management and represents those algorithms, programs and information technologies of solution of problems which should be implemented in kind of the program module. The structure of the subsystem of provision if the investment flow management contains three groups of programs and relevant programming modules: main problems and modules of the financial flow planning and control; information blocks which provide preparation of data for main modules; design modules created by the study of variant selection and the feasibility study basis. The modules of the main group are divided according to the management levels: the project, the unit, the company (see Tables 1, 2).

Table 1

Project

Main problems and modules of the investment flow management and control

1. Calculation of cash flow and project feasibility study;
2. Estimation of minimum amounts and terms of attracted investments.
3. Determination of project effectiveness (assessment of the product cost-effectiveness in the certain period of time, assessment of efficiency of the attracted financial funds).
4. Revenue structure analysis (from sales and operations: main, financial, investment);

Information problems and modules

1. Grouping of revenue and payment flows at any point of time in wider intervals (week, month, quarter, year);
2. Formation of revenue and payment plan in the conditions of duration of the given schedule cycle of implementation.
3. Estimation of revenues and payments by financial cycles.
4. Payment plan formation by the following patterns: materials and assemblies; transport and commercial costs; fixed costs; taxes; transfers to units; other expenses.

Reporting tasks and modules

1. Calculations in the module at one product level with the following parameters: the cycle duration, number of cycles, reinvestment share, product unit cost-effectiveness.
2. The financial result sensitivity analysis (if applicable at the year-end) in case of change of the variable parameters.
3. Determination of the term for: beginning of revenues; attainment of self-financing; return of investment; attainment of the profit rate planned for the investment; attainment of the 100% profit rate.
4. Assessment of project efficiency in the given period.

The mechanism of implementation of the company investment activities is the procedure which divides the main problem into subproblems and regulates blocks, the solution of which is assigned to the given unit or workplace, provides the reforming of the organizational chart through specification of the functions and official duties in frames of the projects to be implemented.

Unit

1. Calculation of the consolidated financial flow of a unit (according to the total projects).
2. Calculation of the consolidated (total) flow in consideration of the direct fixed costs of the unit.
3. Unit performance evaluation.
4. Flow structure analysis and unit profit estimation (marginal – from the main activity, net profit – in consideration of taxes).
5. Estimation of the amounts and terms of attracted funds beneficial for the unit in consideration of the total liquidity factor of the company.
6. Estimation of the term of return to profitability.

Company

1. Consolidation of flows of units.
2. The company total consolidated flow in consideration of the total operating expenses.
3. Assessment of the company breakeven point and the term of return to this point.
4. The flow structure analysis and profit estimation (marginal, gross (before taxes), net (after taxes): from the main, financial and investment activities).
5. Assessment of the amounts and terms of attracted resources beneficial for the company (with the further purposeful channeling to certain units).
6. Management of vertical movement of investment flows (down-up transfers - from the units to the company, up-down investments – from the company to the units).

Therefore, the company investment management is understood as the single system which provides the attainment of the final results through the implementation of interrelated management processes on the basis of sets of models and information technologies.

Based on the developed methodology the complex of investment activities promoting the quality of the fruit juices and extension of their sales is determined; the optimal program of their manufacturing has been developed; the feasibility study of respective business plans has been provided.

Conclusions:

1. The effective implementation of the investment activity requires solution of the problem of determination of the priority patterns of investment along with the development of the methods for solution of tasks for preparation, making and realization of the investment decisions.
2. The problem of advancement of the company economic development level is the multicriterion problem and any variant of its solution in a concrete planned period is a compromise which results in the maximization of one criterion. However, the necessary and adequate condition for the improvement of one criterion without deterioration of other criteria is the growth of profit.
3. The considerable effect on the profit performance is made by the product price, cost, sensitivity of their values, amounts of output and sales, which in their turn, depend on the company investment patterns and variants. Implementation of every project in any pattern effects directly or indirectly on the main factors. The methodology of assessment of basic model parameters is proposed according to the variants of investment projects, which are based on the factor analysis of their effect quality along with the determination of the company optimal production program.

4. The project implementation requires resources. Determination of the structure of the investment resources is the optimization problem. The work presents the economic-mathematical model of the planning of the credit and respective payment flow in the process of implementation of the investment activities. This is the two-criterion problem of the congruence of interests of the company and creditor. Its solution is made by the successive concession method in consideration of the formal and informal restrictions.
5. The investment management mechanism is the integrity of the management technologies which provide for the interrelation and interaction of the structural models: the management object, target hierarchy and set of measures, interrelation of essential factors, executors, resources, time periods and investment flows. The basis of the management mechanism is the system of investment decision preparation, making and realization, that, in its turn, represents the complex of algorithms, programs and information technologies which is aimed at the solution of problems of the strategic planning and management of the investment flows on the level of projects, company and its dedicated units.

References

1. Rose P. S. 2005. *Bank Management & Financial Services With Powerweb*. McGraw-Hill.
2. Brigham & Erndhardt. 2008. *Financial Management Theory and Practice*. Thompson Learning Inc. (12th ed.).
3. Mishkin S. F. 2004. *The Economics of Money, Banking and Financial Markets* (7th ed). Addison-Wesley.
4. Frost S. M. 2004. *The Bank Analyst's Handbook*. John Wiley & Sons, Ltd.
5. Campbell C. D., Campbell R. G., Dolan E.G. 1988. *Money, Banking, and Monetary Policy*. The Dry-den Press.
6. Friedman D. 1989. *Money & Banking*. American Bankers Association.
7. Miller, R.L., VanHoose D. 2001. *Money, Banking & Financial Markets*. Cincinnati.
8. Dzneladze G. 2010. Analysis of Investment Sector and Perspectives of Economic Growth in Georgia. *Bulletin of the Centre of Strategic Researches and Development of Georgia*, N116.
9. Dzneladze G. 2003. Modeling Mechanism of Financial Flow in Georgia. *Journal "Bank"*, N 16.
10. Kakulia R. 2001. *General Theory of Finance*. Tbilisi: Finance.
11. Kakulia R., Khelaia G. 2000. *General Theory of Cash Flow and Credit*. Tbilisi.
12. Gudushauri L. 2007. *Credit and Modern Bank Mechanism*. Tbilisi University Press.
13. Bard V. S. 2000. *Investment Problems of the Russian Economy*. Moscow: Ekzamen.
14. Bard V. S. 2003. *Investment Potential of the Russian Economy*. Moscow: Ekzamen.
15. Bernard Y., Colli J.C. 1994. *Economic and Finance Dictionary- French-English-German-Spanish*. International Relations.
16. Birman G. 1997. *Economic Analysis of Investment Projects*. Moscow.
17. Blank I. A. 2002. *Investment Management: Training Course*. Kiev.
18. Milovidov V. D. 1996. *Unit Investment Funds*. Moscow.
19. Zaitsev D. A, Churaeva M. N. 1998. *Organization and Activity of Unit Investment Funds*. Moscow.
20. Captain M. E. 2003. *Who is Who on the Collective Investments Market*. Moscow.