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Dynamic Programming Methods Application for Investment Allocation Optimization at the Mill Factory

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Abstract: In developing countries first established industrial plants mainly are mill factories and these factories are characterized by extreme heterogeneity. In the scientific article the necessity of application of an optimality principle and a method of dynamic programming (DP) is considered at distribution of investments in agro industrial complex. We will notice that the distribution problem as internal and external investments in the given market is extremely actually in view of specificity of an estimation of a complex of risks inherent in given industry and features of a performance evaluation of investments. The basic tendencies and features of internal investments of agrarian and industrial enterprises are considered. Necessity of application of dynamic programming methods is proved at accepting of investment decisions. Possibility of data application methods at construction of financially-mathematical models at the enterprise is opened.

Key words: Dynamic programming · Mathematical modeling · Modeling in agriculture

INTRODUCTION

The Russian market of flour is one the most competitive food markets. For it the great number of independent manufacturers, the absence of obvious market leaders and the increase of production volumes of raw (grain) during last years, at last, obviously expressed price character of a competition is characteristic. We will notice that the distribution problem as internal and external investments in the given market is extremely actually in view of specificity of an estimation of a complex of risks inherent in given industry and features of a performance evaluation of investments. Thereupon enhancement of tools of the financial management adapted for realities of investment processes in the market of agricultural production is necessary.

Let us notice that in the Russian market of flour today there are a great number of manufacturers, consumers and dealers. The basic manufacturers and suppliers of flour in the Russian Federation are large industrial flour-grinding factories and industrial complexes. In total in Russia there are about 450 large and average industrial flour-grinding enterprises with average capacity on processed grain 2650 tons a day [1].

The condition of the flour-grinding enterprises is characterized by extreme heterogeneity. Many of them constructed at the end of the Soviet epoch have modern enough equipment. However as a result of the events of the last 15 years only some of them could conduct its modernization. At the same time within last 15 years in a number of regions there have appeared small enterprises which successfully develop. They were created by agricultural manufacturers and they work on their own grain. There are about 70 similar enterprises. The feature of flour-grinding industry is the concentration of capacities on large enterprises and availability of a considerable quantity of small enterprises of various patterns of ownership. In flour-grinding industries about 90% of capacities of production are concentrated on 380 large mills and bakeries.

Goods of the flour-grinding industry are in constant and stable requisition in the market of the Russian Federation both owing to its social importance and historic and cultural traditions of the people of the Russian Federation. Flour as foodstuff and as the major raw in production of bread and bakery items enters the minimum set of foodstuff for all socially-economic groups of the Russian Federation. Ultimate consumers of goods of the enterprise are bakeries, confectionaries, macaroni factories, the public catering organizations and also the

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population. Finally goods are focused on the population, the requirement for goods and demand for it has uniform character within a year. For this reason the flour-grinding industry is one of the most attractive industries from the point of view of investment attraction.

MATERIALS AND METHODS

In the present research it is offered to consider the directions and efficiency of use of the agro industrial company means involved as a result of issue. As an example the financial reporting of the company Open Society "Pava" existing on the market since 1999 and being one of the leading enterprises of flour-grinding industries of Russia will be used.

The analysis of quarterly reports of the emitter testifies that issue means will be used for financing of strategic plans of development, namely;

- With a view of building and acquisition of the enterprises occupied in all production phases of ready flour-grinding goods, expansions of assortment of issued goods;
- Acquisitions of flour-grinding enterprises of nearby regions;
- The output increases, the caused transfer of all capacities into new hi-tech level;
- Growths in volumes of flour production in various kinds of packing.

The volume of use of the money funds necessary for the further development is presented in the table below [1]:

Project	The present possibilities of production, tons a day	Possibilities after investments, tons a day	Implementation term of project
Acquisition of profile assets (flour-grinding enterprise)	600	700	20011-2012
Increase in production of the packed flour (1-5 kg)	140	500	2011
Reconstruction of flour-grinding enterprise	350	650	2011

In connection with the above-stated it is required to solve a financial task of optimal investment allocation. For this purpose it is offered to use a principle of Bellman's optimality [2]. According to Bellman the main principle of management optimality of multistage processes can be verbally expressed as follows, "Optimum behavior possesses the property that whatever were the initial condition and initial decision the subsequent decisions should constitute optimum behavior concerning the condition which is turning out as a result of initial decision". In other words any site of an optimum trajectory including finishing also is optimum and errors in the management leading to deviations from optimum territory subsequently can't be corrected. Certainly, such general position can't be directly applied to the decision of dynamic programming tasks and needs concrete definition.

To definitely formulate the optimality principle, let us define some supplementary functions $B_0(X_0)$, $B_i(X_i)$, …, $B_N(X_N)$. Functions B_i (X_i), i = 0,1,2,..., N have important economical meaning and they are the maximum values of partial cost functions sum $Z_{i+1}(X_i,U_{i+1}) +... + Z_N(x_{N-1}, U_n)$, calculated by all allowable "shortened" control set $U_{i+1},...,U_N$. In other words B_i (X_i) is conditionally-optimum value of cost function when system is in transit from state X_i after step number i to the final state X_N. The conditionality of optimal value is that it is related not to the process as a whole, but to its final state and depends on the choice of state X_N, which is the original for the "shortened" process.

Therefore $B_i(X_i)$ functions, named Bellman functions, characterize extreme properties of the controlled system S on the final process steps [3]. Also we have an easy and important equality $B_N(X_N)=0$, valid because the state X_N is already final, other state changes do not occur and respective economical effect equals 0.

R. Bellman optimality principle, used as a basis for the DP method to solve the reviewed problems, can be described by the main functional equation:

$$B_{i-1}(X_{i-1}) = \max\{Zi(X_{i-1},U_i) + B_i(X_i) \mid X_i = F_i(X_{i-1},U_i)\} \quad (*)$$

U_i where the i index is changed by numbers of each process steps in reverse order:

$$I = N, N-1,..., 2,1.$$

By its structure, the Bellman functional equation is recurrent. It means that in the sequence of functions $B_0(X_0)$, $B_i(X_i)$, …, $B_N(X_N)$ every previous one is evaluated through the following [4].

It is important to note that when you calculate the maximum in functional Bellman equation for every fixed value X_{i-1} together with $B_{i-1}(X_{i-1})$ that value of variable is calculated U_i (one or several), for which this maximum is reached. This value depends on state X_{i-1} and will define it as $u_i(X_{i-1})$.

In fact $u_i(X_{i-1})$ is (possibly many-valued) function, named conditionally-optimal control (conditionality is found in the control dependence on the state X_{i-1} choice). And though the functions $ui(X_{i-1})$ are not explicitly

mentioned in the equation (*), they play no less important role, than Bellman function $B_{i-1}(X_{i-1})$ and are used for the final construction of optimal solution. Therefore, during calculations, conditionally-optimal controls $u_n(X_{n-})$, $u_{n-1}(X_{n-2})$,..., $u_1(X_0)$ are consequently calculated and stored.

Note, that the Bellman optimality principle deals with exact solvable problem with optimum value $B_0(X_0)$, not separately, but as a set of similar problems with optimum values $B_1(X_1)$,…, $B_N(X_N)$ of smaller dimension, i.e. more simple. There is a connection between the problems of this set, which can be represented by functional equation (*) and allows, starting from the simplest $B_N(X_N) = 0$ function, consequently calculate all other functions $B_{N-1}(X_{N-1})$,..., $B_0(X_0)$, i.e. in fact to get solution of the full problem set [5].

This technique of exchanging the problem with the set of similar problems and in the way that from the set solution we can receive the solution of the initial problem, is called the invariant immersion principle.

In our example, agro-industrial enterprise has the aspiration to invest emission funds in 3 projects P1, P2, P3. The company management decided to totally invest 5 mln. $. The marketing research expects relevant profit from each project, depending investment volume. This data can be found in the table below. It is supposed that with zero investment we would expect zero profit.

We should find such allotment of investment among the projects that would provide the maximum total expected profit

	Expected profit (Mln. $)		
Investment (Mln. $)	P1	P2	P3
1	2,1	1,3	3,3
2	4,2	2,1	6,4
3	6,1	6,5	8,1
4	8,3	10,2	9,2
5	10,5	12,4	10,1

In this problem, the control system is the reviewed agro-industrial enterprise; multistep process-is the process of providing the investment funds for the projects. Economical effect is the total value of expected profit and our goal is to find the maximum. In order to solve the problem, first of all let us create economical-mathematical model [6].

The steps quantity in this problem should be set to 3, corresponding to the quantity of the projects involved: on the first step the funds are allocated for the project P1, on the second step for P2 project, on the third step for the project P3.

The total funds amount, allocated for invested projects after each process step is set as the phase variable X, which defines the state of the system during investment allotment process. Consequently X_i is the funds level, allocated for project investment after first process step (i.e. for project P1 only), X_2 is the funds level, allocated for project investment after second process step (i.e. for enterprises P1 and P3), X_3 is the funds level, allocated for project investment after third process step (i.e. for enterprises P1, P2 and P3). Since in the initial moment, the total amount of allocated funds equals 0 and initial system state is characterized by the value of X_0= 0. By the problem terms, the investment amount equals 5 mln TL i.e. the main condition is followed X_3=5. Since in accordance with the problem logic, the value of the phase variable is not diminished then limit is satisfied X_3 = 5. We should mention that the choice of phase variable with specified economical meaning is not the only possible. For instance, in the reviewed problem, we could choose the remaining unallocated amount as the x variable.

And we would consider the total amount of funds, allocated for investment projects at each process step as control variable. Exactly the variable u_1 is the volume of funds, allocated for the project P1 (at the 1st process step), u_2 is the funds volume, allocated for the project P2 (at the 2nd step), u_3 is the volume, allocated for the project P3(at the 3rd step). Let us consider that the funds for investment project, are allocated in amounts of integers, so all controls can have only integer values 0,1,2,….

The process function $X_i = F_i(X_{i-1},U_i)$ defines the law of system change and for this problem is presented by the formula: $X_i = X_{i-1} + U_i$ and has the following simple meaning: total amount of funds X_i, allocated for the projects by accumulative amount after step number i, equals the total funds amount X_{i-1}, allocated for invest projects after previous step number i-1 (or what means the same, until the current step), plus funds amount u_1, allocated for invest project P1 on the current step.

Function Z_i, defining partial economical effect on the process step number i, depends only on the amount u_1, invested in the project P_i, i.e. $Z_i = Z_i(U_i)$ and is defined by the problem data table, column, responsible for the project. For instance, $Z_1(2) = 4.2$ (from the column for the project P1), $Z_2(3) = 6.3$, $Z_3(4) = 9.2$.

Now we completed mathematical formalization of the defined problem, i.e. building of economical-mathematical model. Let us note, that after we formalized in such a way; main assumptions for DP method are satisfied: absence of after-action is coming from explicit formulas for X_i and Z_i calculation and cost function additivity is

$$Z = Z_1(U_1) + Z_2(U_2) + Z_3(U_3)$$

stipulated by the problem definition itself.

So we can start the calculations themselves in accordance with dynamic programming methods. These calculations are performed in three stages: preliminary, conditional optimization stage and unconditional optimization stage.

Preliminary stage. This problem solving stage is carried out in normal order for i = 1,2,3 and is not explicitly connected with Bellman function $B_i(X_i)$ calculation [7]. On the first column of the complementary table and four left columns of main table are filled out.

I = 1.

Complementary table is filled according to the initial value

$X_0 = 0$ and looks like

X_0	0
$B_0(X_0)$	

The main table is filled out in the following way. For the defined single allowable value $X_0 = 0$, we choose all possible u_1 values (it can equal all integer values from 0 to 5 inclusively) and put them in the second column of the table. In accordance with the formula $X_1 = X_0 + U_1$ (derived from the general formula $X_i = X_{i-1} + U_i$, for i =1) we carry out calculations of the relevant values of variable x_1 and put them in the third column. To fill out the forth column, we use the value of expected profit Z_1 from the problem definition data table, responsible for project P1: for $u_1 = 1$ for this table $Z_1 = 2.1$, for $u_1 = 2$ for the table $Z_1 = 4.2$ and etc. For $u_1 = 0$, $Z_1 = 0$ in accordance with problem definition. The following table is created:

X_0	U_1	X_1	Z_1	$B_1(X_1)$	$Z_{1+}B_1$	$B_0(X_0)$
0	0	0	0			
	1	1	2,1			
	2	2	4,2			
	3	3	6,1			
	4	4	8,3			
	5	5	10,5			

At this stage we completed the filling the left side of the main table and the table has only one column fragment. Let us move to the next step.

I =2.

On the second step, the first column of supplementary table is filled out by all values of X_1 variable, calculated on the previous step and mentioned in the 3rd column of previous main table. We get the following supplementary table:

X_1	0	1	2	3	4	5
$B_1(x_1)$						

To fill out the main table during this step, we, like at the previous step, consequently choose all allowable values of x_1, inputted in the supplementary table and carry out the corresponding calculations. Each value of X_1 will be designated for its string fragment of main table; adjacent string fragment are separated by horizontal line.

For the value X_1=0 we choose all possible control values u_2 (it can be equal to all integer values from 0 to 5 inclusively) and put them in the second column of the table. Using the formula $X_2 = X_1 + U_2$ (derived from the general formula $X_i = X_{i-1} + U_i$ for i =2) we calculate the respective values of X_2 variable and put them in the third column. To fill out the forth column, we use the values of expected profit Z_2, from the definition data table column, relative to project P2 for $U_2 = 1$ for this table Z_2=1.3 and for U_2=2 for table Z_2=2.1 and etc. And now we finished filling out the first string fragment of the main table, corresponding to X_1=0; this fragment looks like:

X_1	U_2	X_2	Z_2	$B_2(X_2)$	$Z_{2+}B_2$	$B_1(X_1)$
0	0	0	0			
	1	1	1,3			
	2	2	2,1			
	3	3	6,5			
	4	4	10,2			
	5	5	12,4			

For the next allowable value X_1=1 we built next string fragment. And now u_2 can have all integer values from 0 to 4 inclusively (since after we allocated X_1=1 funds for project P1, we have only 5-1 = 4). Carrying out the calculation by the same formulas, we will get second string fragment, which looks like this:

X_1	U_2	X_2	Z_2	$B_2(x_2)$	$Z_{2+}B_2$	$B_1(x_1)$
0	0	0	0			
	1	1	1,3			
	2	2	2,1			
	3	3	6,5			
	4	4	10,2			

The string table fragments are formed in the same way for X_1=2,3,4,5. It is obvious that with the increase of X_1 value, the set of allowable values of U_2 is diminished and for X_1=5 there would be only one possible value U_2=0. As a result we get the following main table:

X_1	U_2	X_2	Z_2	$B_2(X_2)$	Z_2+B_2	$B_i(X_i)$
0	0	0	0			
	1	1	1,3			
	2	2	2,1			
	3	3	6,5			
	4	4	10,2			
	5	5	12,4			
1	0	1	0			
	1	2	1,3			
	2	3	2,1			
	3	4	6,5			
	4	5	10,2			
2	0	2	0			
	1	3	1,3			
	2	4	2,1			
	3	5	6,5			
3	0	3	0			
	1	4	1,3			
	2	5	2,1			
4	0	4	0			
	1	5	1,3			
5	0	5	0			

Created table is divided for 6 string fragments-in the same quantity as how many values can variable X_1 can have. We move to next (last) step.

I=3

At the third step in the supplementary table first column we will input all values of X_2 variable, calculated at previous step and present at the third column of the previous main table. This values are repeated many times, but we input them only once (thus decreasing calculation volume). We get the following supplementary table:

X_2	0	1	2	3	4	5
$B_2\{X_2)$						

We fill out the main table as showed above. Some peculiarity of the last step is that since the invested amount should be exactly equal to 5 standard units, than for any X_2 value, the control U_3can get only one value, completing X_2 to 5.

Therefore X_3=5 and the Z_3, as usual, are taken from initial problem definition data table, responsible for P3 project. In consequence the main table looks compact:

X_2	U_3	X_3	Z_3	$B_3(X_3)$	$Z_{3+}B_3$	$B_3(X_2)$
0	5	5	10,1			
1	4	5	9,2			
2	3	5	8,1			
3	2	5	6,4			
4	1	5	3,3			
5	0	5	0			

Now the preliminary problem solving stage is over. Let us point out that supplementary tables second columns and three right main table columns remain blank. We will them out at the next stage of conditional optimization, which we now begin.

Conditional optimization stage. This stage us directly connected with Bellman $B_i(X_i)$ function calculation and is performed in the reversed order for i = 3,2,1. At this stage we the table fragments, which remain blank on the previous stage. We also put "v" at this stage, marking those conditionally optimal control values, at which we achieve intermediate maximum-this values are the function of $u_1(X_{i-1})$.

For presentation simplification once more we show all supplementary and main tables in their final filling order-this method is completely methodical and is used for easier understanding of solution logic. We make such table repeat only once; next time when solving next DP problems, it is not required to rebuild already built and partially filled out, at preliminary stage, tables-it is enough to complete filling them out.

Since in accordance with the Bellman general optimality principle we have an equation $B_N(X_N) = 0$ and for the specified problem N =3, than $B_3(X_3) = 0$ and at the fifth main table column, calculated above for i =3, we put the zero values. And at the sixth column we put the sum of two previous columns and at the seventh last column we input the maximum (since we look for the maximum) from all the sixth column values for each string fragment separately. But, since each string fragment of this table has only one row, then maximum equals with single figure, specified at the sixth column. The column has the final completely filled view:

X_2	U_3	X_3	Z_3	$B_3(X_3)$	Z_3+B_3	$B_3(X_2)$
0	5	5	10,1	0	10,1	10,1
1	4	5	9,2	0	9,2	9,2
2	3	5	8,1	0	8,1	8,1
3	2	5	6,4	0	6,4	6,4
4	1	5	3,3	0	3,3	3,3
5	0	5	0	0	0	0

After all, main table is filled for I=3, all function values $B_2(X_2)$ are calculated (it does not identically equal zero). Those values are inputted at the second raw of supplementary table, which takes the following shape:

X_2	0	1	2	3	4	5
$B_2(X_2)$	10,1	9,2	8,1	6,4	3,3	0

Let us move to next conditional optimization step, moving by recurring order.

I = 2

At this step the main table has 6 string fragments, by which we make the filling. Let us consider the first string fragment, corresponding to X_1=0. At the fifth row of main table, $B_2(X_2)$ values are inputted, chosen from just filled supplementary table. And for the first row of string fragment concerned X_2=0 and, consequently, $B(X_2)=B_2(0)=10.1$, for the second row X_2=1 and $B_2(1)$=9.2, for last row X_2=5 and $B_2(5)$=0. At the sixth row, we put the sums of two digits from two previous columns: at the first row of concerned string fragment 0+10.1=10.1 and for the second row 1.3+9.2=10.4 and the last row 12.4+0=12.4. To fill out the last column with $B_1(X_1)$ we choose the maximum (since we are looking for the maximum) from all digits of sixth row Z_2+B_2 of this string fragment, i.e. max{10.1,10.4,10.2,12.9,13.5,12.4}. This maximum equals 13.5 and is reached when u_2=4; this control value (and it is conditionally-optimal) is marked by «v». First string fragment of main table when i=2 will take the following shape

X_1	U_2	X_2	Z_2	$B_2(X_2)$	Z_2+B_2	$B_1(X_1)$
0	0	0	0	10,1	10,1	13,5
	1	1	1,3	9,2	10,4	
	2	2	2,1	8,1	10,2	
	3	3	6,5	6,4	12,9	
	«v» 4	4	10,2	3,3	13,5	
	5	5	12,4	0	12,4	

Note at previous main table for i=3, signs «v» are not put, since in its every string fragment we have only one control value, which automatically is conditionally-optimal and does not have special marks.

Let us consider second fragment of the table, corresponding to x1=1. Carrying out calculations in the same way, we would get:

X_1	U_2	X_2	Z_2	$B_2(X_2)$	Z_2+B_2	$B_1(X_1)$
1	0	1	0	9,2	9,2	10,2
	1	2	1,3	8,1	9,4	
	2	3	2,1	6,4	8,5	
	3	4	6,5	3,3	9,8	
	«v» 4	5	10,2	0	10,2	

Table string fragments are filled out for other items in the same way, X_1=2,3,4,5. As a result we have the final filled out table:

X_1	U_2	X_2	Z_2	$B_2(x_2)$	Z_2+B_2	$B_1(x_1)$
0	0	0	0	10,1	10,1	13,5
	1	1	1,3	9,2	10,4	
	2	2	2,1	8,1	10,2	
	3	3	6,5	6,4	12,9	
	«v» 4	4	10,2	3,3	13,5	
	5	5	12,4	0	12,4	
1	0	1	0	9,2	9,2	10,2
	1	2	1,3	8,1	9,4	
	2	3	2,1	6,4	8,5	
	3	4	6,5	3,3	9,8	
	«v» 4	5	10,2	0	10,2	
2	«v» 0	2	0	8,1	8	8,0
	1	3	1,3	6,4	7,7	
	2	4	2,1	3,3	5,4	
	3	5	6,5	0	6,5	
3	«v» 0	3*	0	6,4	6,4	6,4
	1	4	1,3	3,3	4,6	
	2	5	2,1	0	2,1	
4	«v» 0	4	0	3,3	3,3	3,3
	1	5	1,3	0	1,3	
5	0	5	0	0	0	0

After we fill out the main table for r=2; all values for $B_1(X_1)$ are calculated; they input at the supplementary second row, which looks like:

X_1	0	1	2	3	4	5
$B_1(X_1)$	13,5	10,2	8	6,4	3,3	0

Let us pay attention to the filled main table. For each X_1 value, only one control value U_2 is marked by «v», at which it reaches maximum for $B_1(X_1)$ calculations (x_1=5 there is no mark, but the situation is certain: U_2=0). Those values represent themselves conditional-optimal control functions $u_2(X_1)$. Those values can be put together:

Xi	0	1	2	3	4	5
u_2(Xi)	4	4	0	0	0	0

However there is not need to build it, since all information can be found in the main table. Let us move to the next (final) step-conditional optimization stage.

I = 1

At this step at the main table we have only one string fragment, corresponding X_0=0. We fill it out by usual way:

X_0	U_2	X_1	Z_1	$B_1(X_1)$	Z_1+B_1	$B(X_0)$
0	«v» 0	0	0	13,5	13,5	13,5
	1	1	2,1	10,2	12,1	
	2	2	4,2	8	12,2	
	3	3	6,1	6,4	12,5	
	4	4	8,3	3,3	11,6	
	5	5	10,5	0	10,5	

Supplementary table looks like:

X_0	0
$B_0(X_0)$	13.5

Now all tables are filled, the conditional optimization step is finished. We start unconditional optimization stage.

Unconditional optimization stage. At this problem solving stage we calculate optimal value for Z*, build optimal control (u*1 u*2, u*3) and optimal trajectory x*0, x*1, x*2, x*3. Since the initial state X_0=0 is strictly defined, than $Z^*=B_0\{X_0\}=13.5$; we assume that also we have $x^*0=X_0=0$. To built optimal control and optimal trajectory, we look through once again all filled main tables in common order for i=1,2,3, using the rows marked with «v», containing conditionally-optimal control values. We will have the following sequence of steps.

I=1

At this stage in the first main table, conditional-optimum control is marked with «v» (U_1=1, which is also optimal: u*1=0; at the same table row, we also find x*1=0

I=2

At this step, respective main table consists of 6 string fragments. Out of which we chose only that string fragment, which is consistent to already found at previous step optimal value x*1=0. In this fragment conditionally-optimal value u*2=4 is marked by «v», which is in the same time is optimal: x*2=4; in the same string we find x*2=4.

I=3

At this step from the corresponding main table we choose the string fragment, which corresponds to one, which is already found at the previous step optimal value x*2=4. This fragment has only one row and one control value, which is also optimal: u*3=1, x*3=5.

Therefore, optimal solution is found, it looks like (0;4;1) and is unambiguously defined. Optimal trajectory is x*0= 0, x*1= 0, x*2 = 4, x^*_3 = 5.This unconditional optimization step of DP method is completed.

So we completely solved defined problem. Considering economical meaning of variables and functions, used for mathematical model construction, we formulate the final solution for the problem.

Consequently, the maximum of total expected profit for the all agro-industrial holding equals 13.5 mln. $ and to achieve it, it is required not to provide funds for project P1 (since u*1=0), for project P2 you should spend 4 mln. $ (u*2=4), for project P3 1 mln. $ (u*3=1).

We point out that not all conditionally-optimal control values, marked in main tables by "v" sign, are unconditionally-optimal for this it is required that relevant phase variable values were on optimal trajectory. For instance, for i=2, U_2=4 was the optimal value, calculated for X_1=0; all other values of x variable were out of optimal trajectory and relevant conditionally-optimal controls were not required.

CONCLUSION

The basic necessary properties of problems to which probably to apply this principle: the problem should suppose interpretation as n-step-by-step decision-making process. Besides, the problem should be defined for any number of steps and have the structure which is not dependent on their number.

In the present economic conditions agriculture development is strictly connected with actualization of applied methods of the analysis of investment processes and perfection of control systems.

Modern methods of reengineering of business processes allow to reconsider existing systems of financial management in system of agrarian and industrial complex and to adapt internal investment processes for current economic conditions.

It is necessary to notice that developed at the enterprises of agriculture the situation causes necessity of formation of new methodical bases and working out of practical recommendations about construction of control systems by the finance, in particular investment activity as one of the major conditions of development of the domestic enterprises entering into structure of agrarian and industrial complex and backbone factors of increase of efficiency of activity of the enterprises of agrarian and industrial complex.

Efficiency of distribution of financial resources concerns constant problems of the enterprises of agriculture that is connected with features of the business dealing, the raised brave component, limitation of free financial resources in the given segment of a national economy.

Dynamic problem of optimization of a portfolio of projects, problem of optimization of financing of a number investment projects within the limits of the target program of financing with long enough term of realization-an actual example of use of methods of financial management in current conditions. Dynamic programming is one of the most effective methods of the decision of similar problems, than and the urgency of given article speaks. It is necessary to add that the resulted example of

optimization of financial resources is one of components of effective financial planning. According to the author, the given method is expedient for using in aggregate with arrangement process priority and risk-component of projects.

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