PRACTICE
ON THE SUBJECT: "INVESTMENT MANAGEMENT"

NET PRESENT VALUE METHOD

Net present value method (also known as **discounted cash flow method**) is a popular capital budgeting technique that takes into account the time value of money. It uses net present value of the investment project as the base to accept or reject a proposed investment in projects like purchase of new equipment, purchase of inventory, expansion or addition of existing plant assets and the installation of new plants etc.

Net present value (NPV):

Net present value is the difference between the present value of cash inflows and the present value of cash outflows that occur as a result of undertaking an investment project. It may be positive, zero or negative. These three possibilities of net present value are briefly explained below:

Чистая приведенная стоимость (NPV):

Positive NPV:

If present value of cash inflows is greater than the present value of the cash outflows, the net present value is said to be positive and the investment proposal is considered to be acceptable.

Положительная NPV:

Zero NPV:

If present value of cash inflow is equal to present value of cash outflow, the net present value is said to be zero and the investment proposal is considered to be acceptable.

Negative NPV:

If present value of cash inflow is less than present value of cash outflow, the net present value is said to be negative and the investment proposal is rejected.

1. Present value of cash inflow > Present value of cash outflow
   NPV is positive and the project is acceptable

2. Present value of cash inflow = Present value of cash outflow
   NPV is zero and the project is acceptable

3. Present value of cash inflow < Present value of cash outflow
   NPV is negative and the project is not acceptable

The following example illustrates the use of net present value method in analyzing an investment proposal.

Example 1 – cash inflow project:

The management of Fine Electronics Company is considering to purchase an equipment to be attached with the main manufacturing machine. The equipment will cost $6,000 and will increase annual cash inflow by $2,200. The useful life of the equipment is 6 years. After 6 years it will have no salvage value. The management wants a 20% return on all investments.

Required:

1. Compute net present value (NPV) of this investment project.
2. Should the equipment be purchased according to NPV analysis?

Solution:

(1) *Computation of net present value:*

Initial cost	$6,000
Life of the project	6 years
Annul cash inflow	$2,200
Salvage value	0
Required rate of return	20%

Item	Year(s)	Amount of cash flow	20% Factor	Present value of cash flow
Annual cash inflow	1 - 6	$ 2,200	3.326*	$ 7,317
Initial investment	Now	(6,000)	1.000	(6,000)
Net present value				$ 1,317

Salvage value - ликвидационная стоимость (оценочная стоимость при выбытии)
Annual cash inflow- годовой приток денежных средств
Initial investment – первоначальные инвестиции

$$Annuity\ PV\ Factor = \frac{1-(1+r)^{-n}}{r}$$

$r = rate\ per\ period$
$n = number\ of\ periods$

For example: i=20%. $F = \frac{1-(1+r)^{-n}}{r} = \frac{1-(1+0{,}2)^{-6}}{0{,}2} 3.226$

*Value from "present value of an annuity of $1 in arrears table".
Текущая стоимость аннуитета в долларах США за 1 доллар ».

	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	21%	22%	23%	24%	25%
1	0.962	0.952	0.943	0.935	0.926	0.917	0.909	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833	0.826	0.820	0.813	0.806	0.800
2	1.886	1.859	1.833	1.808	1.783	1.759	1.736	1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528	1.509	1.492	1.474	1.457	1.440
3	2.775	2.723	2.673	2.624	2.577	2.531	2.487	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106	2.074	2.042	2.011	1.981	1.952
4	3.630	3.546	3.465	3.387	3.312	3.240	3.170	3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.289	2.540	2.494	2.448	2.404	2.362
5	4.452	4.329	4.212	4.100	3.993	3.890	3.791	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991	2.926	2.864	2.803	2.745	2.689
6	5.242	5.076	4.917	4.767	4.623	4.486	4.355	4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326	3.245	3.167	3.092	3.020	2.951
7	6.002	5.786	5.582	5.389	5.206	5.033	4.868	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605	3.508	3.416	3.327	3.242	3.161
8	6.733	6.463	6.210	5.971	5.747	5.535	5.335	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837	3.726	3.619	3.518	3.421	3.329
9	7.435	7.108	6.802	6.515	6.247	5.995	5.759	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031	3.905	3.786	3.673	3.566	3.463
10	8.111	7.722	7.360	7.024	6.710	6.418	6.145	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192	4.054	3.923	3.799	3.682	3.571
11	8.760	8.306	7.887	7.499	7.139	6.805	6.495	6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327	4.117	4.035	3.902	3.776	3.656
12	9.385	8.863	8.384	7.943	7.536	7.161	6.814	6.492	6.194	5.918	5.660	5.421	5.197	4.988	4.793	4.611	4.439	4.278	4.127	3.985	3.851	3.725
13	9.986	9.394	8.853	8.358	7.904	7.487	7.103	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533	4.362	4.203	4.053	3.912	3.780
14	10.563	9.899	9.295	8.745	8.244	7.786	7.367	6.982	6.628	6.302	6.002	5.724	5.468	5.229	5.008	4.802	4.611	4.432	4.265	4.108	3.962	3.824
15	11.118	10.380	9.712	9.108	8.559	8.061	7.606	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675	4.489	4.315	4.159	4.001	3.859
16	11.652	10.838	10.106	9.447	8.851	8.313	7.824	7.379	6.974	6.604	6.265	5.954	5.668	5.405	5.162	4.938	4.730	4.536	4.357	4.189	4.033	3.887
17	12.166	11.274	10.477	9.763	9.122	8.544	8.022	7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775	4.576	4.391	4.219	4.059	3.910
18	12.659	11.690	10.828	10.059	9.372	8.756	8.201	7.702	7.250	6.840	6.467	6.128	5.818	5.534	5.273	5.033	4.812	4.608	4.419	4.243	4.080	3.928
19	13.134	12.085	11.158	10.336	9.604	8.950	8.365	7.839	7.366	6.938	6.550	6.198	5.877	5.584	5.316	5.070	4.843	4.635	4.442	4.263	4.097	3.942
20	13.590	12.462	11.470	10.594	9.818	9.129	8.514	7.963	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870	4.657	4.460	4.279	4.110	3.954
21	14.029	12.821	11.764	10.836	10.017	9.292	8.649	8.075	7.562	7.102	6.687	6.312	5.973	5.665	5.384	5.127	4.891	4.675	4.476	4.292	4.121	3.963
22	14.451	13.163	12.042	11.061	10.201	9.442	8.772	8.176	7.645	7.170	6.743	6.359	6.011	5.696	5.410	5.149	4.909	4.690	4.488	4.302	4.130	3.970
23	14.857	13.489	12.303	11.272	10.371	9.580	8.883	8.266	7.718	7.230	6.792	6.399	6.044	5.723	5.432	5.167	4.925	4.703	4.499	4.311	4.137	3.976
24	15.247	13.799	12.505	11.469	10.529	9.707	8.985	8.348	7.784	7.283	6.835	6.434	6.073	5.746	5.451	5.182	4.937	4.713	4.507	4.318	4.143	3.981
25	15.622	14.094	12.783	11.654	10.675	9.823	9.077	8.422	7.843	7.330	6.873	6.464	6.097	5.766	5.467	5.195	4.948	4.721	4.514	4.323	4.147	3.985
26	15.983	14.375	13.003	11.826	10.810	9.929	9.161	8.488	7.896	7.372	6.906	6.491	6.118	5.783	5.480	5.206	4.956	4.728	4.520	4.328	4.151	3.988
27	16.330	14.643	13.211	11.987	10.935	10.027	9.237	8.548	7.943	7.409	6.935	6.514	6.136	5.798	5.492	5.215	4.964	4.734	4.524	4.332	4.154	3.990
28	16.663	14.898	13.406	12.137	11.051	10.116	9.307	8.602	7.984	7.441	6.961	6.534	6.152	5.810	5.502	5.223	4.970	4.739	4.528	4.335	4.157	3.992
29	16.984	15.141	13.591	12.278	11.158	10.198	9.370	8.650	8.022	7.470	6.983	6.551	6.166	5.820	5.510	5.229	4.975	4.743	4.531	4.337	4.159	3.994
30	17.292	15.372	13.765	12.409	11.258	10.274	9.427	8.694	8.055	7.496	7.003	6.566	6.177	5.829	5.517	5.235	4.979	4.746	4.534	4.339	4.160	3.995

(2) Purchase decision:

Yes, the equipment should be purchased because the net present value is positive ($1,317). Having a positive net present value means the project promises a rate of return that is higher than the minimum rate of return required by management (20% in the above example).

In the above example, the minimum required rate of return is 20%. It means if the equipment is not purchased and the money is invested elsewhere, the company would be able to earn 20% return on its investment. The minimum required rate of return (20% in our example) is used to discount the cash inflow to its present value and is, therefore, also known as *discount rate*.

Investments in assets are usually made with the intention to generate revenue or reduce costs in future. The reduction in cost is considered equivalent to increase in revenues and should, therefore, be treated as cash inflow in capital budgeting computations.

The net present value method is used not only to evaluate investment projects that generate cash inflow but also to evaluate investment projects that reduce costs. The following example illustrates how this capital budgeting method is used to analyze a cost reduction project:

Example 2 – cost reduction project:

Smart Manufacturing Company is planning to reduce its labor costs by automating a critical task that is currently performed manually. The automation requires the installation of a new machine. The cost to purchase and install a new machine is $15,000. The installation of machine can reduce annual labor cost by $4,200. The life of the machine is 15 years. The salvage value of the machine after fifteen years will be zero. The required rate of return of Smart Manufacturing Company is 25%.
Should Smart Manufacturing Company purchase the machine?

Solution:

Initial cost	$15,000
Life of the project	15 years
Annual cost savings	$4,200
Salvage value	0
Required rate of return	25%

Item	Year(s)	Amount of cash flow	25% Factor	Present value of cash flow
Annual cost savings	1 - 15	$ 4,200	3.859*	$ 16,208
Initial investment	Now	(15,000)	1.000	(15,000)
Net present value				$ 1,208

Solution:
According to net present value method, Smart Manufacturing Company should purchase the machine because the present value of the cost savings is greater than the present value of the initial cost to purchase and install the machine.

Net present value method – uneven cash flow:

Notice that the projects in the above examples generate equal cash inflow in all the periods (the cost saving in example 2 has been treated as cash inflow). Such a flow of cash is known as **even cash flow**. But sometimes projects do not generate equal cash inflows in all the periods. When projects generate different cash inflows in different periods, the flow of cash is known as **uneven cash flow**. To analyze such projects the present value of the inflow of cash is computed for each period separately. It has been illustrated in the following example:

Example 3:

A project requires an initial investment of $225,000 and is expected to generate the following net cash inflows:
Year 1: $95,000
Year 2: $80,000

Year 3: $60,000
Year 4: $55,000
Required: Compute net present value of the project if the minimum desired rate of return is 12%.
Solution:
The cash inflow generated by the project is uneven. Therefore, the present value would be computed for each year separately:

Year	Present value of $1 at 12%	Cash flow	Present value of cash flow
1	0.893*	$95,000	$ 84,835
2	0.797	80,000	63,760
3	0.712	60,000	42,720
4	0.636	55,000	34,980
Total			$ 226,295
Initial investment			(225,000)
Net present value			$ 1,295

The project seems attractive because its net present value is positive.
Проект кажется привлекательным, потому что его чистая текущая стоимость является положительной.

Choosing among several alternative investment proposals:

Sometime a company may have limited funds but several alternative proposals. In such circumstances, if each alternative requires the same amount of investment, the one with the highest net present value is preferred. But if each proposal requires a different amount of investment, then proposals are ranked using an index called **present value index (**or **profitability index)**. The proposal with the highest present value index is considered the best. Present value index is computed using the following *formula*:
Formula of present value or profitability index:

$$\text{Present value/profitability index} = \frac{\text{Present value of cash inflows}}{\text{Investment required}}$$

Формула текущей стоимости или индекс рентабельности:

Example 4:

Choose the most desirable investment proposal from the following alternatives using profitability index method:

	Proposal X	Proposal Y	Proposal Z
Present value of cash inflow	$ 212,000	$ 171,800	$ 185,200
Investment required	(200,000)	(160,000)	(180,000)
Net present value	$ 12,000	$ 11,800	$ 5,200

Solution:

Because each investment proposal requires a different amount of investment, the most desirable investment can be found using present value index. Present value index of all three proposals is computed below:

Proposal X: 212,000/200,000 = 1.06

Proposal Y: 171,800/160,000 = 1.07

Proposal Z: 185,200/180,000 = 1.03

Proposal X has the highest net present value but is not the most desirable investment. The present value indexes show proposal Y as the most desirable investment because it promises to generate 1.07 present value for each dollar invested, which is the highest among three alternatives.

Assumptions:

The net present value method is based on two assumptions. These are:

1. The cash generated by a project is immediately reinvested to generate a return at a rate that is equal to the discount rate used in present value analysis.
2. The inflow and outflow of cash other than initial investment occur at the end of each period.

Advantages and Disadvantages:

The basic advantage of net present value method is that it considers the time value of money. The disadvantage is that it is more complex than other methods that do not consider present value of cash flows. Furthermore, it assumes immediate reinvestment of the cash generated by investment projects. This assumption may not always be reasonable due to changing economic conditions.

Преимущества и недостатки:

Internal rate of return method

Like net present value method, **internal rate of return (IRR) method** also takes into account the time value of money. It analyzes an investment project by comparing the internal rate of return to the **minimum required rate of return** of the company.

The **internal rate of return** sometime known as **yield on project** is the rate at which an investment project promises to generate a return during its useful life. It is the discount rate at which the present value of a project's net cash inflows becomes equal to the present

value of its net cash outflows. In other words, internal rate of return is the discount rate at which a project's net present value becomes equal to zero.

The **minimum required rate of return** is set by management. Most of the time, it is the cost of capital of the company.

Under this method, If the internal rate of return promised by the investment project is greater than or equal to the minimum required rate of return, the project is considered acceptable otherwise the project is rejected. Internal rate of return method is also known as *time-adjusted rate of return method*.

To understand how computations are made and how a proposed investment is accepted or rejected under this method, consider the following example:

Example:

The management of VGA Textile Company is considering to replace an old machine with a new one. The new machine will be capable of performing some tasks much faster than the old one. The installation of machine will cost $8,475 and will reduce the annual labor cost by $1,500. The useful life of the machine will be 10 years with no salvage value. The minimum required rate of return is 15%.

Required: Should VGA Textile Company purchase the machine? Use internal rate of return (IRR) method for your conclusion.

Solution:

To conclude whether the proposal should be accepted or not, the internal rate of return promised by machine would be found out first and then compared to the company's minimum required rate of return.

The first step in finding out the internal rate of return is to compute a discount factor called *internal rate of return factor*. It is computed by dividing the *investment required for the project* by *net annual cash inflow* to be generated by the project. The formula is given below:

Formula of internal rate of return factor:

$$\text{Internal rate of return factor} = \frac{\text{Net initial investment}}{\text{Annual cash inflow}}$$

In our example, the required investment is $8,475 and the net annual cost saving is $1,500. The cost saving is equivalent to revenue and would, therefore, be treated as net cash inflow. Using this information, the internal rate of return factor can be computed as follows:

Internal rate of return factor = $8,475 /$1,500= 5.650

After computing the internal rate of return factor, the next step is to locate this discount factor in "present value of an annuity of $1 in arrears table". Since the useful life of the machine is 10 years, the factor would be found in 10-period line or row. After finding this factor, see the rate of return written at the top of the column in which factor 5.650 is written. It is 12%. It means the internal rate of return promised by the project is 12%. The

final step is to compare it with the minimum required rate of return of the VGA Textile Company. That is 15%.

Conclusion:

According to internal rate of return method, the proposal is not acceptable because the internal rate of return promised by the proposal (12%) is less than the minimum required rate of return (15%).

Notice that the internal rate of return promised by the proposal is a discount rate that equates the present value of cash inflows with the present value of cash out flows as proved by the following computation:

Текстильная компания VGA. Отобрать 15%.

Initial cost	$8,475
Life of the project	10 years
Annual cost savings	$1,500
Salvage value	0

Item	Year(s)	Amount of cash flow	12% Factor	Present value of cash flow
Annual cost savings	1 - 10	$ 1,500	5.650*	$ 8,475
Initial investment	Now	(8,475)	1.000	(8,475)
Net present value				$ 0

Payback method

Under **payback method**, an investment project is accepted or rejected on the basis of payback period. Payback period means the period of time that a project requires to recover the money invested in it. It is mostly expressed in years.

Unlike net present value and internal rate of return method, payback method does not take into account the time value of money.

According to payback method, the project that promises a quick recovery of initial investment is considered desirable. If the payback period of a project is shorter than or equal to the management's maximum desired payback period, the project is accepted, otherwise rejected. For example, if a company wants to recoup the cost of a machine within 5 years of purchase, the maximum desired payback period of the company would be 5 years. The purchase of machine would be desirable if it promises a payback period of 5 years or less.

Payback period formula – even cash flow:

When net annual cash inflow is even (i.e., same cash flow every period), the payback period of the project can be computed by applying the simple formula given below:

$$\text{Payback period} = \frac{\text{Investment required}}{\text{Net annual cash inflow*}}$$

*The denominator of the formula becomes incremental cash flow if an old asset (e.g., machine or equipment) is replaced by a new one.

Example 1:

The Delta company is planning to purchase a machine known as machine X. Machine X would cost $25,000 and would have a useful life of 10 years with zero salvage value. The expected annual cash inflow of the machine is $10,000.

Required: Compute payback period of machine X and conclude whether or not the machine would be purchased if the maximum desired payback period of Delta company is 3 years.

Solution:

Since the annual cash inflow is even in this project, we can simply divide the initial investment by the annual cash inflow to compute the payback period. It is shown below:

Payback period = $25,000/$10,000

= 2.5 years

According to payback period analysis, the purchase of machine X is desirable because its payback period is 2.5 years which is shorter than the maximum payback period of the company.

Example 2:

Due to increased demand, the management of Rani Beverage Company is considering to purchase a new equipment to increase the production and revenues. The useful life of the equipment is 10 years and the company's maximum desired payback period is 4 years. The inflow and outflow of cash associated with the new equipment is given below:

Initial cost of equipment: $37,500

Annual cash inflows:

Sales: $75,000

Annual cash Outflows:

Cost of ingredients: $45,000

Salaries expenses: $13,500

Maintenance expenses: $1,500

Non cash expenses:

Depreciation expense: $5,000

Required: Should Rani Beverage Company purchase the new equipment? Use payback method for your answer.

Solution:

Step 1: In order to compute the payback period of the equipment, we need to workout the net annual cash inflow by deducting the total of cash outflow from the total of cash inflow associated with the equipment.

Computation of net annual cash inflow:

$75,000 – ($45,000 + $13,500 + $1,500)

= $15,000

Step 2: Now, the amount of investment required to purchase the equipment would be divided by the amount of net annual cash inflow (computed in step 1) to find the payback period of the equipment.

= $37,500/$15,000

=2.5 years

Depreciation is a non-cash expense and has therefore been ignored while calculating the payback period of the project.

According to payback method, the equipment should be purchased because the payback period of the equipment is 2.5 years which is shorter than the maximum desired payback period of 4 years.

Comparison of two or more alternatives – choosing from several alternative projects:

Where funds are limited and several alternative projects are being considered, the project with the shortest payback period is preferred. It is explained with the help of the following example:

Example 3:

The management of Health Supplement Inc. wants to reduce its labor cost by installing a new machine. Two types of machines are available in the market – machine X and machine Y. Machine X would cost $18,000 where as machine Y would cost $15,000. Both the machines can reduce annual labor cost by $3,000.

Required: Which is the best machine to purchase according to payback method?

Solution:

Payback period of machine X: $18,000/$3,000 = 6 years

Payback period of machine y: $15,000/$3,000 = 5 years

According to payback method, machine Y is more desirable than machine X because it has a shorter payback period than machine X.

Payback method with uneven cash flow:

In the above examples we have assumed that the projects generate even cash inflow but many projects usually generate uneven cash flow. When projects generate inconsistent or uneven cash inflow (different cash inflow in different periods), the simple formula given above cannot be used to compute payback period. In such situations, we need to compute the cumulative cash inflow and then apply the following formula:

$$\text{Payback period} = \text{Years before full recovery} + \frac{\text{Unrecovered cost at start of the year}}{\text{Cash flow during the year}}$$

Example 4:

An investment of $200,000 is expected to generate the following cash inflows in six years:

Year 1: $70,000
Year 2: $60,000
Year 3: $55,000
Year 4: $40,000
Year 5: $30,000
Year 6: $25,000

Required: Compute payback period of the investment. Should the investment be made if management wants to recover the initial investment in 3 years or less?

Solution:

(1). Because the cash inflow is uneven, the payback period formula cannot be used to compute the payback period. We can compute the payback period by computing the cumulative net cash flow as follows:

Initial investment: $200,000		
Year	Cash inflow	Cumulative cash inflow
1	$ 70,000	$ 70,000
2	60,000	130,000
3	55,000	185,000
4	40,000	225,000
5	30,000	255,000
6	25,000	280,000

Payback period = 3 + (15,000*/40,000)
= 3 + 0.375
= 3.375 Years
*Unrecovered investment at start of 4th year:
= Initial cost – Cumulative cash inflow at the end of 3rd year
= $200,000 – $185,000
= $15,000
The payback period for this project is 3.375 years which is longer than the maximum desired payback period of the management (3 years). The investment in this project is therefore not desirable.

Advantages and disadvantages of payback method:

Some advantages and disadvantages of payback method are given below:

Advantages:

1. An investment project with a short payback period promises the quick inflow of cash. It is therefore, a useful capital budgeting method for cash poor firms.
2. A project with short payback period can improve the liquidity position of the business quickly. The payback period is important for the firms for which liquidity is very important.
3. An investment with short payback period makes the funds available soon to invest in another project.
4. A short payback period reduces the risk of loss caused by changing economic conditions and other unavoidable reasons.
5. Payback period is very easy to compute.

Disadvantages:

1. The payback method does not take into account the time value of money.
2. It does not consider the useful life of the assets and inflow of cash after payback period. For example, If two projects, project A and project B require an initial investment of $5,000. Project A generates an annual cash inflow of $1,000 for 5 years whereas project B generates a cash inflow of $1,000 for 7 years. It is clear that the project B is more profitable than project A. But according to payback method, both the projects are equally desirable because both have a payback period of 5 years ($5,000/$1,000).

Exercise-1 (Computation of simple and compound interest)

A company is considering to start a new product line. The new product line requires the installation of new machines and equipment. For this purpose, company wants to borrow money by issuing bonds of $10,000 for 12-year period. The interest on these bonds (ипотека, облигации) is to be paid at a rate of 8% per year.

Required:

Compute the amount of interest to be paid to bondholders over 12-year period:

1. if the simple interest is charged. *1. если взимаются простые проценты.*
2. if the interest is compounded annually. *2. если проценты составляются ежегодно.*

Solution:

(1) If interest is simple:

I = Pin

= $10,000 × 8% × 12

= $10,000 × 0.08 × 12

= $9,600

(2) If interest is compounded annually:

To compute compound interest for 12-year period, we would compute compound amount first using compound amount formula and then compute compound interest by deducting the principal amount from compound amount.

$S = P(1 + i)^n$

= $10,000 × $(1 + 8\%)^{12}$

=$10,000 × 2.518*

= $25,180

Interest to be earned over 8-year period: $25,180 – $10,000 = $15,180

*Value of $(1 + 8\%)^{12}$ from future value of $1 table: 12 periods; 8% interest rate.

Economic justification of project proposals

The cost of implementing an integrated information system with modules costs 180 million UAH with an annual maintenance cost of 1.5 million UAH. According to statistical data, the effect of introducing such a system in the company on average increases the company's revenues by 10-15%. For calculation, let's take 10% in the first year of the project. The company's revenue for 2017 is 424.7 million UAH. So the benefits of implementation will be :

1) in the first year: 0.1 * 424.7 million UAH (profit for 2017) = 42.47 million UAH.
2) Year 2: (424.7 + 42.47) * 0.1 = 467.17 * 0.1 = 46.717 million UAH.
3) Third year: (467.17 + 46.717) * 0.1 = 513.887 * 0.1 = 51.388 million UAH.
4) Year 4: (513,887 + 51,388) * 0,1 = 565,275 * 0,1 = 56,275 mln. UAH.
5) The fifth year (565,275 + 56,275) * 0,1 = 621,55 * 0,1 = 62,155 million UAH.

For the decision of the project, various criteria are used, based on the idea of discounting.

1. Net Present Value (NPV).

$$NPV = \sum_{t=1}^{n} \frac{B_t - C_t}{(1+i)^t} \qquad (3.7)$$

B t - benefits of the project per year t ;
C t - project costs per year t ;
i - discount rate;
n - duration (lifetime) of the project.

Calculations for the net present value of the project, benefits and costs are presented in tab. 1.

Table 1

года	Benefits, млн.грн	Costs, млн.грн	net benefits	discount rate i = 10%	Discounted net benefits	discount rate i = 15%	Discounted net benefits
t	Bt	C_t	$B_t - C_t$	$1 / (1 + i)^t$		$1 / (1 + i)^t$	
1	42,47	180	-137,53	0,909	-125,027	0,870	-119,591
2	46,717	1,5	45,217	0,826	37,369	0,756	34,191
3	51,388	1,5	49,888	0,751	37,482	0,658	32,802
4	56,275	1,5	54,775	0,683	37,412	0,572	31,318
5	62,155	1,5	60,655	0,621	37,662	0,497	30,156
			73,005	NPV =	24,898	NPV =	8,8755

2. Internal Rate of Return (IRR).

$$IRR = A + \frac{a(B - A)}{(a - b)} \qquad (3.8)$$

A - the discount rate at which NPV is positive;

B - the discount rate at which NPV is negative;

a - the value of the positive NPV, with the discount rate A;

b - the value of the negative NPV, with the discount rate B.

So, $IRR = 10\% + \left(\frac{24{,}898(15-10)}{24{,}898-8{,}875} \right)\% = 17{,}77\%$

Also, the internal rate of return IRR can be found graphically. In Fig. 2 shows the dependence of NPV on the discount rate.

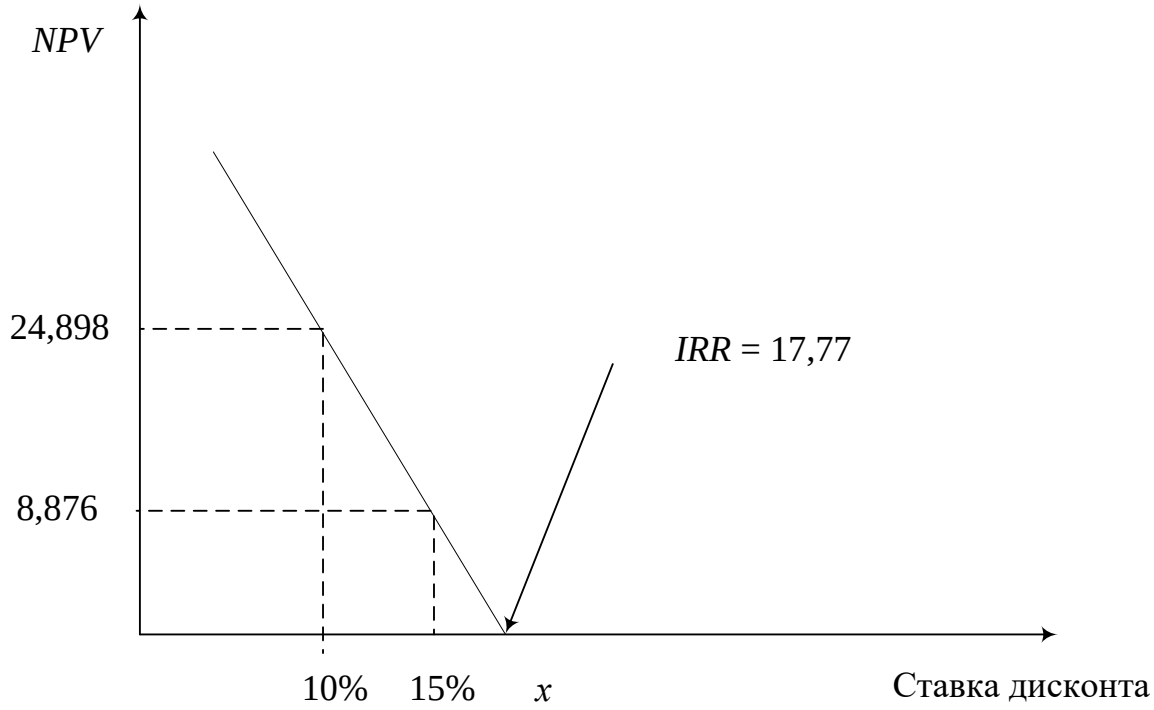

Fig. 2. Dependence of NPV on Discount Rate

3. Benefit / Cost Ratio (BCR).

$$BCR = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+i)^t}} \qquad (3.9)$$

Table

Расчет коэффициента BCR

Year	Benefits	Costs	BCR i= 10%		BCR i= 15%	
t	Bt	Ct	Bt i = 10%	Ct i = 10%	Bt i = 15%	Ct i = 15%
1	42,47	180	38,609	163,636	36,930	156,521739
2	46,717	1,5	38,609	1,240	35,325	1,1342155
3	51,388	1,5	38,609	1,127	33,788	0,98627435
4	56,275	1,5	38,437	1,025	32,175	0,85762987

5	62,155	1,5	38,593	0,931	30,902	0,7457651
Всего	259,005	186	192,857	167,959	169,121	160,246
			BCR =1,148		BCR =1,055	

4. Payback period.

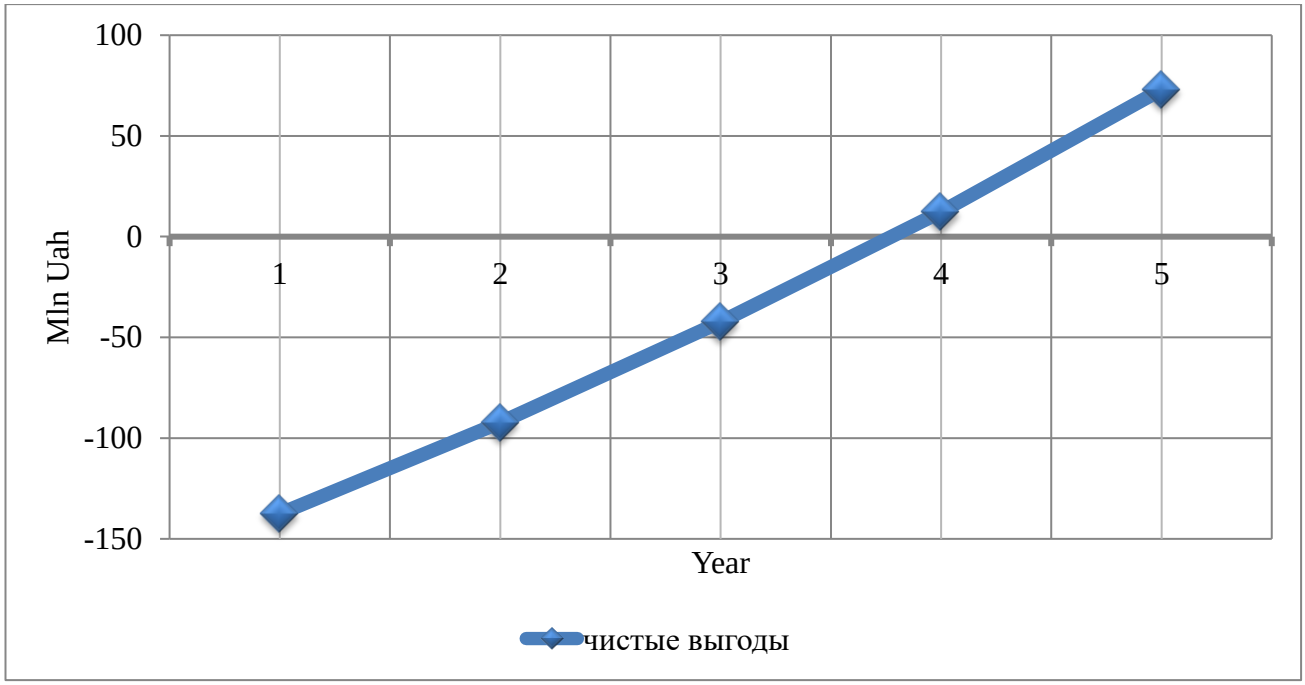

Fig 2

This indicator indicates the number of years needed to recover capital investments in the project by the sum of cash flows of net benefits from the operation of the project. It is convenient for quick calculation and may indicate a variant of the project, deserves further consideration. So Fig. 2 shows that the payback period of investments is approximately 4 years.