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AN INTEGRATED APPROACH TO EVALUATION OF ECO-ECONOMIC EFFICIENCY

In this paper we present the results of a complex method analysis of investment in environmental economical projects. The main characteristics of the statements given in this article are the integrity of the statements as well as taking into consideration of the dominant alternatives of rational natural resource management, that is to say payment for environmental pollution or investing in environmental projects. This method covers and describes all the stages of the investment project development and is based on modern approaches of economic assessment. The paper provides a description of every step of the environmental and economic assessment, including the evaluation of the financial condition, break-even analysis, cash-flows, considering the financial structure.

Key words: emissions penalty, environmental capital investment project, financial analysis, break-even analysis, cash-flows, eco-economical effectiveness criteria.

Formulation of the problem. Nowadays the tendency of considering environment in manufacturing process by the industrial companies, which duly develop environmental investment projects, is not only stable but is steadily growing.

Here we would like to point out the evidence of this tendency, which is from our point of view fundamental. Among them are the following: significant economic downfall in almost all branches of domestic economy, resulting in environmental impact decline and pointed out the significance of economic effectiveness in prejudice of ecological efficiency and social performance. Should also be noticed inconsistency and weak motivation coming from the legislation in management of natural resources and never ending debates about methodological approach to eco-economic assessment? All this described here above is the timeliness of our topic.

Analysis of the latest research and publications. There is a wide range of scientists that have investigated on the subject, the most prominent of which were done by O. Amosha, O. Balatskiy, P. Vilenskiy, S. Iliashenko, L. Melnyk, N. Pakhomova, K. Rykhter and others [1,3,4,7,8,11], and which provide the description of the principles of methodological approach to economic assessment of environmental investments. The methodological approach to eco-economic assessment is based on static and dynamic evaluation criteria of economic effectiveness. In general, most of authors and researchers adhere to this position. The debates commonly suggest the integration of some sources of positive (or negative) cash-flow into the effectiveness measure formula, as well considering the importance of discounting of all the cash-flows regardless their origin. List of authors, such as [5, 6, 9] point out the necessity of the intergrated approach of evaluation, although they introduce it as a sequence of managing decisions.

We are not going to cast doubt on those suggestions, although we should point out that this approach needs an upgrade. The assessment of the criteria leads in most cases to negative results since environmental investments give little economic benefit. It is much more profitable to pay inconsiderable fines for pollution (first alternative), rather than to invest in environmental projects (second alternative). This discrepancy is, in our opinion, one of the main causes of inefficient rational natural resource management. Administrative levers are in general of no use. The companies which pollute must be motivated to invest in environmental projects. On the other hand, the right choice can only be made using the methodical approaches that suppose that on every stage the ecological factor is taken into consideration.

Choosing one of the here above mentioned alternatives (pay fines or invest in environmental projects), to our point of view, should be done based on the improved intergrated approach.

Formulation of article purposes. Everything said here above was to define the aim of the article which is to describe the intergrated approach analysis of investment in eco-economical projects.

Presenting of the main material. As previously noted, the common method is based on criteria assessment of economical effectiveness (net present value,

internal rate of return etc.). It is our opinion that, general method in its main part includes but is not limited to the calculation and analysis of investment projects effectiveness indexes NPV and IRR. It possesses a complex character and in addition to the above consists of the enterprise financial conditions analysis and the analysis of its breakeven point.

As noted earlier, the launch of an investment project is directed to realization of one of the alternatives: ecological capital investments as the part of total project investments or environment pollution payments. Mixed strategy of the investment project realization is possible when an enterprise along with ecological investments provides for individual insignificant ecological payments.

Another important principle of an investment project effectiveness assessment is the necessity to compare the initial investment volume with net cash flows resulting in the process of the project realization. The decision of the financial effectiveness of the project is made basing on NPV and IRR criteria.

The net cash flow forecast is made on the basis of expected gross revenue and costs of the enterprise, ecological payments and costs connected with the ecological equipment operation included. The resulting cash flow constitutes the net profit, depreciation charges added and payments made from the profit subtracted.

Before the investment analysis a standard analysis of the enterprise financial conditions taking into consideration its ecological orientation is carried out. This analysis is obligatory if the enterprise plans to use the financial resources of some external portfolio or strategic investor. An essential element of an investment project analysis is its breakeven analysis (security reserve assessment included) carried out considering ecological features of the project.

In our opinion, eco-economical analysis of investment must consist of the following stages.

Stage 1. Financial Analysis of the Enterprise before the Investment.

Financial ratio analysis is a common method which describes a financial state of the company in general and allows to conduct a complex evaluation of its financial possibilities. This stage includes the calculation and analysis of the dynamics of the main financial indexes. Out of all the financial indexes the indexes given in Table 1 are recommended to use. When choosing these coefficients authors considered the conciseness of the system of financial indexes in whole, as well as the entire and precise financial situation of companies polluters. Such information can be found in common financial statements as it is required by Ukrainian legislation.

Financial Indexes

| # | Group of Indexes |
|--|--|
| Management Effectiveness Characteristic: | |
| 1 | Revenues Index |
| 2 | Net Income Index |
| 3 | Earnings before interest and taxes Index |
| 4 | Administrative Costs Index |
| 5 | Interest Expense Index |
| 6 | Asset Turnover Ratio |
| 7 | Inventory Reserves Turnover Ratio |
| 8 | Receivables Ratio |
| Profitability Characteristic: | |
| 9 | Return on Assets |
| 10 | Return on Net Assets |
| 11 | Return on Equity |
| 12 | Return Per Share |
| 13 | Price/Earnings Per Share |
| Indexes Describing the Creditors' Interests: | |
| 14 | Overall Liquidity Ratio |
| 15 | Instant Liquidity Coefficient |
| 16 | Liability / Assets |
| 17 | Long-term Obligations / Net Assets |
| 18 | Own Equity / Loan Capital |

Source: adopted by authors

It should be mentioned that financial indexes are calculated for, at least, the last three years and at the beginning of the investment project development.

Stage 2. Table of Investment Requirements.

At this stage should be defined the structure and calculated the amount of the investment that will be funded by the owner's equity or bank loans. The content of investment requirements is different for different investment project strategies. If the company is planning to invest in process or equipment upgrading (first strategy), existence of a special section. This section may include:

- building and reconstruction of ecological plants,
- waste disposal equipment,
- personnel training,
- researches in new ecological technologies,
- patent and license acquisition.

If the company has a limited amount of financial resources they should estimate the amount that can be invested in ecological projects, this is to say that putting all its financial capabilities into it can result in lack of resources needed to cover its main technological costs.

Along with ecological investment requirements assessment it is necessary on this stage to estimate the amount of funds needed for ecological equipment. This assessment should result in two indexes: fixed costs F_E , which don't vary with changing output for the period of time; and variable costs v_E , which depend on the output produced.

Stage 3. Financial Resources Structure and Composition.

Owner's equity and loans may be used as financial resources. The first consists of the following:

- retained accumulated earnings of the company,
- outside funds from strategic investor,
- resources obtained from selling shares in second emission to the wide range of investors and to the company's employees.

Loan resources under the current conditions of Ukraine are mainly credits of home banks. Note that a number of foreign investors are especially worried about the ecological aspects of investment projects.

An essential feature of this stage which has no ecological content but is very important for further analysis is the capital cost defining, i. e. the annual interest revenue of the investor.

The final source of investment may be one or complex of the following: net income, shares emission, bank loans, etc.

Stage 4. Choosing the Investment Project Alternative.

This stage is a crucial one as it determines further development of the company in the context of the investment project.

It stands to mention, that instable and downward financial and economical situation of Ukrainian companies caused disappearing of incentive impact of the economical tool provided by sustainable management of natural resources. In such a way, due to the absence of severe environmental fines and penalties, polluting companies exclude the possibility to invest in environmental projects as an alternative and keep on paying fines. There are however several exceptions, e.g. large foreign companies.

Such a situation should not be considered as the only one possible and constant, and we suggest that the choice concerning the environmental project should be made taking into account the criterion which we proposed in [10].

It is natural that the owner of the company is guided by considerations of personal profit. Thus, if there is a need for a choice, then the criterion is the maximum net economic result. Each alternative corresponds to a specific investment project. In accordance with the general practice of economic efficiency assessing which is based on dynamic criteria, more effective is the project, the evaluation of the

NPV criterion is higher. Therefore, as a criterion for choosing an appropriate alternative, the difference between the *NPV* criteria values can be used.

Thus, the resulting *V*- criterion has this form:

$$V = NPV_1 - NPV_2 \quad (1)$$

Not describing the individual steps of the calculation, below is the final formula for calculating the criterion:

$$V = -K_E + \left\{ (-v_E \cdot M - F_E + q \cdot N) \cdot (1 - s) + \frac{K_E}{T} + z \cdot (M - N) \right\} \times \sum_{i=1}^T \frac{1}{(1+r)^i} \quad (2)$$

K_E – investment in environmental equipment, UAH;

M – real turnover, UAH;

N – limiting turnover at exceeding of which ecological payment from net income, UAH;

q – variable ecological costs, UAH;

z – variable ecological costs paid from income, UAH;

s – income tax rate;

T – project lifetime, years;

i – period number;

r – discount rate, prop. of units.

Positive value of the criterion is the evidence of the first investment project alternative preference.

It should be underlined that *V*-criterion is applied for making a preliminary decision only. This is especially true when the value obtained is close to zero. Due to some simplifying assumptions made at the criterion grounding the accuracy of the assessment made with its help is not high in some case. It is recommended to decide in favor of one of the alternatives at *V*-criterion more than 0.5. This corresponds to benefit in *NPV*-projects value at the level of half a volume of ecological capital investments. In this case the difference between the alternatives is as big that it can cover inaccuracy in the calculation connected with the assumptions made at developing *V*-criterion.

Stage 5. Breakeven Analysis.

Breakeven analysis makes checking for project success effective. Actually the effectiveness of the project results in its profitability. Breakeven analysis intends to assess the breakeven point and further safety factor.

Breakeven analysis of eco- investment projects has its own features: our study [10] confirms that for this kind of project the traditional so-called breakeven analysis and safety factor estimation cannot apply as such.

As for the second alternative, the classical outline cannot be applied at all because of extra ecological taxes and payments. For this reason the breakeven point (BEP) for the second alternative should be defined in as [10].

In the end of this stage it is necessary to compare the estimated turnover with the breakeven point as well as to define the safety margin.

Stage 6. Profit and Net Cash Flows Forecast.

According to the general approach to investment projects assessment, the cash flows estimated schedule under the investment project should correspond to the discount index accepted for the *NPV*-project calculation. Taking into consideration current Ukrainian situation, the best solution is to use such an outline of estimated cash-flows with calculated discount rate, that will include all the debt pay-offs in the cash flow forecast schedule. This outline is called an “in-house capital” outline as at further investments analysis only in-house capital investments effectiveness is estimated [5,6,10-12]. Here below is the sequence of cash-flows determination:

Table 2

Cash Flows Forecast

| # | Cash Flow Element |
|-----|--|
| 1. | Turnover (without VAT and excise duty) |
| 2. | Product cost (without depreciation, interest and ecological tax) |
| 3. | Depreciation costs |
| 4. | Ecological costs |
| 5. | Interest payments |
| 6. | Gross profit |
| 7. | Profit tax |
| 8. | Net profit |
| 9. | Depreciation costs |
| 10. | Ecological tax |
| 11. | Principal of the loan |
| 12. | Depreciated book value of fixed assets |
| 13. | Current assets left after project completion |
| 14. | Cash flow |
| 15. | Net cash flow |

Source: adopted by authors

Stage 7. Investment Project Effectiveness Indexes.

This stage is a final one and consists in calculating NPV (IRR, etc.) indexes for the project examined. Let us recall the main points of justification in conjunction with the chosen scheme. The cost of equity is taken as a discount-rate *r*. If the enterprise can take two and more resources weighted average cost is used as the discount-rate.

The project is approved by the financial criteria if *NPV* value is greater than zero.

The conclusions and recommendations for further research. Now the statements given here above lead us to the following conclusion:

- it is expedient to present the economic substantiation of ecological investments in the form of an integrated approach with a description of each stage;
- if the results of financial situation evaluation of the company, planning to invest in the environmental project, show its downward dynamic, then the probability of either type of investment (using company's own funds or loan-based funding) is weak, which places under a threat the success of such a project – this is why the stage of eco-economical assessment is crucial;
- the choice concerning the source of funding as well as the investment requirements estimation needed for the development of the environmental project influence the resulting cash-flow;
- evaluation and analysis of the resulting V-criterion allows to make a choice between one of the dominant alternatives– invest in environmental projects or keep paying fines for pollution – due to the results of the researches done so far we cannot see an economical motivation for management of natural resources.

One of the most significant directions for future research is elaboration of normative standards for pollution penalties and fines, which will allow to obtain the resulting value of V-criterion, which in its turn will motivate to make a decision concerning the realization of environmental projects.

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Комплексний підхід оцінки еколого-економічної ефективності

В статті розглянуто комплексний підхід до обґрунтування доцільності інвестування в екологічні інвестиційні проекти. Відмінністю представлених положень є їх комплексність, а також урахування домінуючих альтернатив раціонального природокористування – сплата екологічних штрафів або інвестиції в екологічні інвестиційні проекти. Запропонований підхід охоплює всі стадії інвестиційного проектування та заснований на актуальних підходах економічного обґрунтування. Наведено та охарактеризовано етапи еколого-економічного обґрунтування, що включають оцінку фінансового стану, аналізу беззбитковості, грошових потоків з урахуванням структури фінансування.

Ключові слова: екологічні штрафи, екологічні інвестиційні проекти, фінансовий аналіз, аналіз беззбитковості, грошовий потік, критерії еколого-економічної ефективності.

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Комплексный подход оценки эколого-экономической эффективности

В статье рассматривается комплексный подход к обоснованию целесообразности инвестирования в экологические инвестиционные проекты. Отличием представленных

положений являється їх комплексність, а також урахування домінуючих альтернатив раціонального природопользования – оплата екологічних штрафів або інвестиції в екологічні інвестиційні проекти. Представлений підхід охоплює всі стадії інвестиційного проектування і оснований на актуальних підходах економічного обґрунтування. Приведені і охарактеризовані етапи еколого-економічного обґрунтування, включаючи оцінку фінансового стану, аналіз безубыточності, грошових потоків, з урахуванням структури фінансування.

Ключевые слова: екологічні штрафи, екологічні інвестиційні проекти, фінансовий аналіз, аналіз безубыточності, грошовий потік, критерії еколого-економічної ефективності.