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ECOLOGICAL AND TECHNICAL - TECHNOLOGICAL RECONSTRUCTIONS AND THEIR EFFECT ON THE EFFICIENCY OF ENTERPRISE

Abstract

Under the influence of technical progress, the radical changes are brought in the technical-technological and socio-economic systems. Technical progress, which has a universal characteristic of diffusion, does not any of areas of economic and social activities. This dual effect of technical progress manifests itself in affirmation the new products, new technologies, new knowledge and simultaneous devaluation the existing products, technology, skills. The task of dynamically sustainable development is, actually, to reconcile what is irreconcilable. In this affirmation and devaluation under the influence of technical progress, the advent of ecological principles receives a special importance. Simply put, with every technical and technological change, it is easier and more effective to incorporate the environmental requirements in it which means that the efficiency of output and its quality will be dominant in relation to the previous level of output regardless the quantity and value of resources consumed and engaged workforce.

Keywords: *technology process, environmental technologies, profitability, relative efficiency*

1 INTRODUCTION

Since the end of the eighteenth century to the second half of the twentieth century there was no comprehensive theoretical concept which specifically dealt with the environmental problems and consequences of economic and overall social development and a need for this was necessarily imposed together with the processes of industrial growth and its impact on the balance in nature. The second half of the twentieth century is characterized by the problem of pollution, but also the problem of environmental protection. Technological innovations in the field of traffic, chemical industry, energy, raw material processing, etc., became evident through the advent of the economic theory of mass production. Access to this theory led to the above average use and exploitation of natural resources and to the increased environmental degradation.

In different countries, the challenges for violation of environment are mostly economic in nature, which means that the need to address them is in accordance with the logic that the goal of human community is organization and economic formulation the desired output, because the economic development is based on growth and its maintenance. It is necessary to change the human morality within the community structure and to give absolute

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political support to the environmental movement. The moral way of thinking at the moment is opposite to the profitable way, but political decisions and institutions are obliged to reconcile and harmonize these two irreconcilable approaches. The way out is seen in affirmation a higher degree of knowledge and in recognition the new dominant technologies.

In this paper, the assumption was that the permanently sustainable development means a transition from classical market economy to the environmental economy because market economy encourages the irrational use of resources, considering natural resources unlimited and free. The concept of continuous, dynamic - sustainable development will be considered as a continuous use of limited energy sources, resources, and limited space for development the economic goods production.

2 VERIFICATION OF THEORETICAL VIEWS ON THE EFFECTIVENESS OF ENVIRONMENTAL TECHNOLOGIES AND TECHNICAL RECONSTRUCTION ON AN PRACTICAL EXAMPLE OF THE "X" COMPANY

In particular a company that exists with specific technological setting and specific product range has noticed that its competitive position is becoming weak, and that the geographic spatial horizons are narrowing. Empirical data show that the implementation of the plan as the only mechanism for resource allocation is practically impossible at the current level of scientific and technological development from the postion of realistically foreseeable future, and nor will it be possible even in the near future. [1]

There is a twofold approach to the resource exploitation. On one side is globalization, which is realized through the process of approaching the centers of origin of raw materials and centers of energy sources, and on the other side, those that proclaim this kind of globalization imlement the process of storing and saving of resources in their own geographical spatial environment. [4]

To that end, the company management was in a dilemma whether to undertake the completely new investment activities through purchase of new technological equipment and the shift in product mix, to perform certain rationalization in terms of maintaining operational readiness of business and technological equipment, or to perform a reconstruction of the existing capacity in terms of their narrowing or extension, etc. It means that a number of alternative solutions were available to the management of the company. From the position of the ethical approach, the changes in terms of pollution the natural environment emerged as an extremely complex task, which may not be obvious at first glance. [5]

Control as an instrument that should ensure compliance with standards and regulations, receives a significant role in relation to companies that are emitters of pollution. [2]

Bearing in mind the possibility of reaction and the freedom of choice, the company decided to replace certain product lines in the following way: in a certain number of production lines the existing equipment would be kept but fully amortized, while a part of the equipment in the existing production lines would be replaced with new highly productive and ecological standard quality lines.

3 ECONOMIC EVALUATION THE INVESTMENTS INTO EQUIPMENT OF ENVIRONMENTAL TYPE

In order to analyze the efficiency assessment of investments into environmental equipment, it is primarily necessary to make an information base of investment through creation the review of financial

flows of the investment project in the period of the so-called economic life of the investment project. [3]

The average life of amortization of fixed assets after completion of the investment for purchase the technological equipment of ecological type is 8.26 years, or, rounded, 8 years, which represents an average economic life of the investment project.

a. Calculation the Rest of the Investment Project of Reconstruction

Table 1 *Calculation the rest of the investment project*

Ser. no.	Description	Basis for calculation	Average annual rate	Annual depreciation	Life-time	Total	Residual value
1.	Technol. equipment for production	1,544,455	1.,5	193,057	8	1,544,455	0
2.	Supporting technol. equipment	296,235	10	29,623	8	236,984	59,251
	Total:	1,840,690	xx	222,680	xx	1,781,439	59,251
3.	Permanent current assets	-	-	-	-	-	100,000
	Total:	xx	xx	xx	xx	xx	159,251

b. Assessment the Profitability of the Investment Project of Reconstruction

The accounts of liquidity of the investment project show whether the effects of the envisaged investments will be sufficient to cover all expenditures which will be included in the investment project in its economic lifetime, where the liquidity criterion requires that the so-called "net proceeds" should be greater than zero or, at worst, equal to zero in order to measure whether the economic assessment of the investment is positive.

In order to determine in this particular case whether the project is liquid in certain years of its economic life, the calculation of "Financial Progress of the Project" is given hereinafter.

One of the most important sources of information about the possibility of evaluation the profitability of the investment project is called "Economic Progress of the Project."

For assessing profitability of the investment project in this programme, the dynamic analysis was used with the following methods:

1. method of investment payback period,
2. method of the net present value of the investment project ,
3. the methods of internal of internal profitability rate of the investment project.

Table 2. *Economic progress of the project*

CALCULATION OF ECONOMIC PROGRESS OF THE PROJECT (in RSD 000)									
STRUCTURE	**DURATION OF THE PROJECT EXPRESSED IN YEARS**								
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
I. GAINS – TOTAL INCOME	-	5,003,657	5,003,657	5,003,657	5,003,657	5,003,657	5,003,657	5,003,657	5,003,657
RESIDUAL VALUE OF THE PROJECT	-	-	-	-	-	-	-	-	159,251
-TOTAL GAINS	-	5,003,657	5,003,657	5,003,657	5,003,657	5,003,657	5,003,657	5,003,657	5,162,908
II. EXPENSES - INVESTM. IN FIX. ASSETS	1.840.690	-	-	-	-	-	-	-	-
INVESTMENTS IN TOS	100.000	-	-	-	-	-	-	-	-
CONTRIBUTION TO ENERGETICS	110.442	-	-	-	-	-	-	-	-
MATERIAL COSTS	-	2,973,510	2,973,510	2,973,510	2,973,510	2,973,510	2,973,510	2,973,510	2,973,510
LIABILITY FROM INCOME	-	222,779	222,779	222,779	222,779	222,779	222,779	222,779	222,779
GROSS INCOME	-	1,303,712	1,303,712	1,303,712	1,303,712	1,303,712	1,303,712	1,303,712	1,303,712
SHARED SPENDING	-	41,585	41,585	41,585	41,585	41,585	41,585	41,585	41,585
RESERVES	-	72,299	72,299	72,299	72,299	72,299	72,299	72,299	72,299
LIABILITIES FROM BUSI-NESS FUND	-	28,412	33,410	38,412	43,420	47,752	52,748	57,570	62,223
TOTAL COSTS:	2.051.132	4,642,297	4,647,295	4,622,297	4,657,305	4,661,637	4,666,633	4,671,455	4,676,108
III. NET GAINS	-2.051.132	+361,360	356,362	+351,330	+346,352	+342,020	+337,024	+332,202	+486,800

c. Calculation the Investment Payback Period

For calculation the investment payback period serves the following formula:

i = OTI i = i = O NP i

$$\sum_{i=0}^{n} TI_i = \sum_{i=0}^{tp} NT_i$$

wherefrom it follows that:

TI = investments in the first year

NT_i = net income in the first year of the project operation

n = number of years in the project life

tp = payback period of the investment

tm = duration of the project

Table 3 *Payback period of investments*

Year in the project life	Investment			Net gains	Uncovered part of investment
	Annual amount	Cumulative	Annual amount	Cumulative	
0	-2,051,132	-2,051,132	+	-	2-051,132
1		-2,051,132	+ 361,360	+ 361,360	- 1,689,772
2		-2,051,132	+ 356,362	+ 717,722	-1,333,410
3		-2,051,132	+ 251,360	+ 1069,082	- 982,050
4		-2,051,132	+ 346,352	+ 1415,434	- 635,698
5		-2,051,132	+ 342,020	+ 1757,454	-293,678
6		-2,051,132	+ 337,024	+ 2094,478	+ 43,346

Payback period (tp) is rounded to 6 years and several months. Project duration (tm) is rounded to 8 years.

tp <tm = which means that return of the investments requires less time than the maximum set time limit (average economic life), and thus, the investment project is acceptable for the investors.

d. Calculation the Present Value of the Investment in the Process of Reconstruction

The following formula serves for calculation the present value of the investment project:

$$So = \sum_{i=0}^{n} \frac{NPi}{(1+\frac{P}{100})^{i}}$$

wherefrom it follows that:

So - present value of the investment project,

NP_i - net gains during the eonomic life of the project in the first year, when I = 0 ... n

P - individual discount rate that reflects time preferences of the company

4 DETERMINING THE DISCOUNT RATE

Following the usual practice, the average discount rate, derived from the different or same interest rates on loans (real interest rates), is taken for determining a discount rate when calculating the present value of an investment project. [3] Since the sources of financing the investment provides for the use of financial loans (domestic sources) with different interest rates, it is necessary to find the average interest rate (real) which will be equal to the discount rate, according to the following formula.

$$P = \frac{\sum_{m=A}^{K} Kmxkm}{\sum_{m=A}^{K} km}$$

Table 4 *Parameters of discouont rate*

in RSD 000.

Loan label	Loan amount	Real interest rate	Loan amount multiplied with interest rate (Km · km)
A	250,000	0	
B	250,000	12%	3,000,000
Total	500,000	-	3,000,000

$$P = \frac{3{,}000{,}000}{500{,}000} = 6\%$$

Therefore, the average real interest rate in this case amounts to 6%, which will represent the discount rate as well.

However, as stated, the average real interest rate is lower than the predicted minimum prescribed discount rate of 8%, but in terms of a common methodology for assessing the social and economic feasibility of investments and investment efficiency, the discount rate will be 8%.

4.1 Determining the Present Value of Anticipated Reconstruction

Table 5 *Results of the present value*

In 000 din.

Year in a life of the project	Net gains NP*i*	Discount factor with discount rate 8%	NP*i* x 8%.
0	-2,051,132	1.0000	-2,051,132
1	+361,360	0.9259	+334,583
2	+356,362	0.8573	+305,509
3	+351,360	0.7938	+278,910
4	+346,352	0.7350	+254,569
5	+342,020	0.6806	+232,779
6	+337,024	0.6302	+212,393
7	+332,202	0.5835	+193,840
8	+486,800[x)]	0.5403	263,018
Total:	xx	xx	+24,469

The stated amount of 486,800/millions include the amortized cost of an investment project of RSD 159,251/million dinar.

So = Therefore, the present value of the investment project amounts to 24.469 million dinar, which means that, with the aforementioned increase, this project will contribute to the increase in the amount of material base of the investor during its economic life, and given that the present value of the project is larger than 0, this project is acceptable for the investors.

4.2 Calculation the Internal Profitability Rate of Anticipated Reconstruction

For calculation the internal profitability rate of the investment project the following formula was used:

$$0 = \sum_{i=0}^{v} \frac{NPi}{(1 + \frac{:P}{100})^1}$$

wherefrom it follows that:

NPI = net gains in the first year of the economic life when I=0 ... n

P = individual discount rate, which reduces the present project value to 0. It represents an internal profitability rate

n = years of the project life, a n = 0 ... t.

Table 6 *Confidence intervals in terms of net present value*

Finding intervals for (±)

Years	Net gains	Discount factor with		Present value	
		8%	8.50%	8%	8.50%
0	-2,051,132	1.0000	1.0000	-2,051,132	-1,051,132
1	+361,360	0.9259	0.9216	+334,583	+333,029
2	+356,362	0.8573	0.8494	+305,509	+302,694
3	+351,360	0.7938	0.7829	+278,910	+275,080
4	+346,352	0.7350	0.7216	+254,569	+249,928
5	+342,020	0.6806	0.6650	+232,779	+227,443
6	+337,024	0.6302	0.5129	+212,393	+206,562
7	+332,202	0.5835	0.5649	+193,840	+187,661
8	+486,800	0.5403	0.5206	+263,018	+253,428
Total	xx	xx	xx	+24,469	-15,307

Thus, it follows from the abovestated that

1. present value with the discount rate of 8% is +24,469
2. latest present value with a positive balance and with a discount rate of 8% is +24,469
3. first present value with a negative balance and discount rate of 8, 5% is -15.307

In order to determine the exact internal profitability rate of this investment project, in continuation of this programme is the calculation of these rates through interpolation and using the following formula:

$$p^r = P_p + \frac{Sop(Pn - Pp)}{So^p - So^n}$$

p^r = internal profitability rate

P_p = discount rate with which the present value is positive for the last time

Pn = discount rate with which the present value of the project is negative for the first time

So^P = present value of the project with the discount rate Po

So^n = present value of the project with the discount rate Pn

Calculation:

$$p^r = 8\% \frac{24,469(8.5-8)}{24,469(-15,307)} =$$

$$= \frac{12,234,500}{39,776} = 0.31 = 8 + 0.31 = 8.31\%$$

Therefore, the internal profitability rate of this project is 8.31%

4.3 Indicators of Relative Efficiency

4.3.1 Calculation the Present Value of the Investment Project Costs

Table 7 *Present value as an idicator of relative efficiency*

Year in a project life	Net expenditures	Discount factor with discount rate of 8%	NP*i* x 8%.
0	2,051,132	1.0000	2,051,132
1	4,642,297	0.9259	4,298,303
2	4,647,285	0.8573	3,984,126
3	4,652,297	0.7938	3,692,993
4	4,657,305	0.7350	3,423,119
5	4,661,637	0.6806	3,172,710
6	4,666,633	0.6302	2,940,912
7	4,671,455	0.5835	2,725,794
8	4,676,108	0.5403	2,526,501
Total:	xx	xx	28,815,590

4.3.2 *Calculation the Relative Efficiency*

Table 8 *Relative efficiency of the investment project*

Item	Item size
Present value of the project (So)	24,469
Present value of the investments (Ui)	2,051,132
Present value of expenditures (I)	28,815,590
Number of workers (N)	-

a. Indicator the relative efficiency of the project in relation to the total investment

$$e^n = \frac{So}{Ui} = \frac{24{,}469}{2{,}051{,}132} = 0.01$$

b. Indicator the relative efficiency of the project in relation to the expenditures during its life

$$e^i = \frac{So}{} = \frac{24{,}469}{28{,}815{,}590} = 0.0008$$

c. Indicator the relative efficiency of the project in relation to the number of workers

Procurement of highly productive technological equipment for the same or increased level of production, reduces the number of workers by eight.

5 SUMMARY

On the basis of the calculation of the payback period, the current values of the investment project, internal rates of profitabiliy as well as the indicators of relative efficiency, the following conclusions can be drawn:

The payback period of the investment in the project is 6 years, which is shorter than the maximum time limit (economic life of the project) of 8 years.

The present value of positive net income is greater than the negative expenditures by 24.469 dinar. Therefore, the project is acceptable, given that the present value is greater than 0.

The discount rate is 8%.

5.1 Additional Criteria for Evaluating the Social Contribution

a. Effect on Employment

In the previous chapters it was pointed out that the purchase of a highly productive technological equipment, which will largely replace the completely obsolete and dilapidated equipment, carries a message of the increased volume of production with fewer workers.

After completion of the investments and putting the new machines and equipment into regular operation from 1 January 2003, 8 skilled workers will be removed from the production process, and deployed to other manufacturing jobs within the enterprise.

In addition to savings in energy, achieving increased production with fewer workers will also have the economic effects on total accumulation after the investment.

b. Impact on Balance of Payment

Out of the total projected amount of income for the increased volume of production, it can be seen that the investors anticipate export of their products to the convertible markets, and in this respect they anticipate a significant foreign exchange effect.

Accordingly, this investment project has a very positive impact on the balance of payments, since in the course of its economic life of 8 years, it will receive DM 20,921,056 from the convertible market, and $ 4,656,000 from the other markets.

c. Impact on Technical-Technological Level of Society

According to the technological project, which is an integral part of the programme, there is a plan for procurement the modern equipment, with strong ecological characteristics and quality standards. It has a major impact on improving the organization of work and acquiring even better work habits of the employees.

Such impacts of the project have a positive influence on the level of the overall technical and technological modernity of wider community.

In the executed calculations, it was determined that if the environmental technologies meet the prerequisites and laws of the market from the perspctive of economics, despite the fact that they initially require the increased resources of investment, they can show their dominance over at first sight cheaper technology and less investment. It will be shown that, in essence, the environmental requirements are economic assumptions, which can realize their very successful evaluation in the market through the so-called value chain.

6 CONCLUSION

The usability of economic instruments to protect the natural environment is fairly limited due to an extremely large number of different factors. These factors are not only and exclusievely found in the rigidity of behavior the state bureaucracy accustomed to managing through mandatory regulations, or in the fact that most members of the government authorities responsible for the implementation of environmental protection are non-economists who, the advocates of economic and market instruments prefer to identify as the main reasons for their previous poor implementation, but also, and foremost, they are found in the objective existence of a series of problems of an economic, technical and environmental nature that occur when it is tried to implement in practice the economic instruments for protection the natural environment.

The main economic technical problem occurs in identification of contaminants. Who has to pay a penalty or tax for an in

creased concentration of harmful substances in the air or in a local river, for instance, in circumstances where there are multiple potential causes? This is a question that is still impossible to answer precisely. Due to this fact, the problem of ecology is, the first of all, a global problem, and then individual. Individual problems can be easily observed, troubleshot, affected and their behavior can be controlled. The global problems, the problems in the environment, always come after the facts and are manifested in the longer time perspective. Individual ecological performances are environmentally ex ante moves or a reaction before a fact. The author of this study proved this with the project that he implemented.

The problem becomes particularly acute when there is a small number of major pollutants and when the use of economic instruments of protection may appear as completely counterproductive. Then the application of environmental taxes can lead not to a decrease but to an increase in pollution, while the introduction of tradable permits may appear as negative from the standpoint of development a competition in the market, due to the fact that then appears the phenomenon of discriminatory nature for all potential new entrants in a given production process who initially do not have the already distributed emission quotas of permitted pollution.

It follows that permitted pollution arises as the main problem, since the environmental duties and understandable rights, as two basic types of economic and market instruments of protection, may be used only in cases of permitted pollution tolerance. Apart from this standpoint that the certain environmental requirements should be respected, there are also problems related to the existence of spatial and temporal imbalances in emitting pollution. The problem of introduction the economic instruments of protection occurs in all cases where pollution is territorially limited, and when it is concentrated at the certain peak hours. In the first case, the use of these instruments is practically impossible due to too narrow market of potential pollutants, and in the second, due to the lack of any possibility that their use will prevent exceeding the permitted quoata of pollution in a specific environment at certain parts of day or year. Are the earth, water and air public goods? Issuers of pollution are exactly oriented towards this holy trinity of environmental protection. If this trinity would were threatened, it would not be written about these problems.

Modern demands for a greater market measure of the environment protection, which are generally accompanied by controversy at the expense of large inefficiencies of previous reliance of the state on imperative regulation measures in the form of prohibitions, regulations, technical standards and norms, appear as misplaced. This, however, does not mean that the measures and instruments of economy should not be nurtured where possible. The same is applied for government regulations, processes and procedures that are aimed to the environment preservation.

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