INVESTMENT DECISIONS ANALYSIS TO PROVIDE SUSTAINABLE INDUSTRIAL ENTERPRISE DEVELOPMENT

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Summary: *Order of substantiation decisions on investing in resource saving technologies to update the fixed assets of engineering enterprises based on various schemes for implementing the pre-investment and investment phases is created. Various variants of formation of costs of the resources involved in the process of investing in resource saving technologies for renewal of fixed assets of machine-building enterprises based on graphs and formula costs over the life cycle of products are researched. The methodic of usage of different approximation dependences of formation of expenses over the life cycle of product of engineering enterprises is implemented. Coefficient of optimization cost of resources is presented. Matrices of optimization value of resources on the various stages of the product life cycle are developed. Formula of total economic effect of investment in resource saving technologies for renewal fixed assets per unit costs on all stages of the product life cycle is proposed.*

Keywords: *investment, pre-investment and investment phase, matrix of optimization cost of resources, coefficient of optimizing cost of resources, the overall economic effect of investment in resource saving technologies.*

1. INTRODUCTION

Statistical observations of recent years show that at the present stage of economic development of our country arise the task of introducing resource-saving technologies, primarily for the machine building industry, with objective to enhance competitiveness in the external market, obtaining a competitive advantage in the domestic market, diversify production, development of machine building industry and improvement an amount of balance of trade balance of country [1]. The absence of an effective mechanism to attract investments in resource saving projects, depreciation of fixed assets on the domestic machine-building enterprises, leading to curb development machine-building industry. Moreover, given the resource problems, as a result of an increase volume of domestic machine-building production during the last years, urgency is got coupled with implementation of resource-saving technologies reduction the magnitude of full resource consuming of product, taking into account the full cycle of stages of the product life cycle. The main direction of solving these problems is the use of new approaches to formation the

cost of resources and assessment of the economic effect of investment in resource saving technologies for renewal of fixed assets per unit costs in economic activities of machine building enterprises. Substantiation of implementing such approaches proves by lower investment costs on resource saving measures compared with higher economic effect per unit cost. Given the limited funding that is a feature of most domestic machine building enterprises, exactly the implementing new approaches, will lead to reduce production costs of resources and saving financial resources for further modernization of outdated material and technological base of machine building production based on resource saving. Enterprises that carry out an investment activity in sphere resource saving technologies for renewal of fixed assets are the most effective. Introducing innovations in resource conservation, enterprise develops production and receives additional income.

The publications of domestic and foreign scientists and economists are devoted to the problem of renewal of fixed assets OO Tsohla in her works explored the realization Diversification of activity enterprise through capital construction [2]. N.V. Dyatlov developed substantiation introduction of resource saving equipment at the enterprise [3]. Emelyanov O.Y. created methodological foundations of economic efficiency evaluation of the implementation of resource-saving technologies in industrial enterprises [4]. Noting the significant contribution of scientists should be noted that insufficient investigated order of substantiation of decisions of investment of resource saving technologies relative renewal of fixed assets machine-building companies on the basis of various schemes of realization of pre-investment and investment phases.

The target of article is create order of substantiation decisions of investment of resource saving technologies concerning renewal of fixed assets of machine building enterprises based on different circuits of implementing pre-investment and investment phase for providing of raising level of resource saving on machine-building enterprises.

2.   METHODOLOGICAL PART

First of all enterprise requires definition a scheme of investment in resource saving technologies: modernization or reconstruction.

The first scheme – reconstruction (extensive form of reproduction) - used for maintenance of fixed assets of enterprises: the replacement of obsolete and worn fixed assets, change profile use of existing equipment by the new appointment, and also repair of existing fixed assets with the restoration or improvement of operational performance, at the expense of this passes restoring fixed assets in equal volume with the same level of quality, but production capacity remains unchanged. Reconstruction of fixed assets allows you to maintain the current level of resource saving or improve it thanks to conserve resources, that can be determined by the following criteria: decline the energy intensity of product, decreasing proportion of use raw material , lowering the proportion of using waste in composition of product, reducing the proportion of rejections, an increase worker productivity.

The second scheme - modernization (intensive form of reproduction) - used for the development of fixed assets through the expansion and improvement: occurs quantitative and qualitative renewal of fixed assets, passes a intensification of production, increase production capacity and increased performance levels of equipment. Modernization of fixed assets allows increase the level of resource saving due to the fact that the growth rate

of spending less than the growth rate of profit, that can be determined by the following criteria: significantly reduced level of energy intensity of product, raw material used in the same volume allows receive more produced output, share of waste in composition of norm use of resources for manufacturing product becomes is much lower, decline the expenses for the defective goods.

Modernization of fixed assets of enterprise should be based on the following principles: ensuring high economic efficiency of production, orientation to create added value and eliminate wasteful processes and loss, realization of flexibility and variability producing and management processes. At the core providing economic efficiency of production by modernization must be laid down the principles that provide the opportunity to organization of production to influence on the level of function of the production system. That is, high economic efficiency of production should not be based only on lowering production costs and also beside with resource conservation to orientate on achieving sustainable work of enterprise, output the production of high quality, speed up production processes of manufacturing of products. Increased efficiency of production important to consider as a means of expanding presence on the market enterprise. Resource saving as a means of ensuring high economic efficiency should be directed on allotment the most important factors that determine the expenses of production.

An important requirement of modernization is providing flexibility of production processes. Modern machine building production must quickly and without significant costs to respond to changing market demand. Production processes, equipment, premises structure should be applied to adjustment in the event of production needs in new type of products and taking into account the demand on the sales market. High flexibility should also have all the elements of organization of production.

An important aspect of modernization of production processes is consistency of economic and organizational issues. In addressing these issues, must take into account that not all enterprises have many opportunities for purchase the most modern equipment. Therefore, decision of the question of purchase of such equipment must precede substantiation, namely:

- purchase equipment only in those cases where without this equipment impossible get the product of high quality or exhausted all sources increase of efficiency;
- when selecting equipment necessary to resolve the issue of its full load;
- in modern terms modernization is effective subject to the restoration of equipment throughout the product life cycle – from purchase of resources to utilization.

May be various options of forming the cost of resources involved to a process of investing in resource saving technologies for renewal of fixed assets of machine building enterprises and costs during the life cycle of products will be calculated by the formula:

$$V_{L.C.P.} = (V^{I} + V^{I} + V^{III} + V^{IV} + V^{V}) \times \hat{E}_{DISK.} \quad (1)$$

where V^{I} – the total present value of resources, formed in stage I, UAH;

V^{II} – the total present value of resources, formed in stage II, UAH;

V^{III} – the total present value of resources, formed in stage III, UAH;

V^{VI} – the total present value of resources, formed in stage IV, UAH;

V^{V} – the total present value of resources, formed in stage V, UAH;

K_{DISK} – coefficient of discounting.

Usage of this methodics was processed at PJSC "Energomashspetsstal" and PJSC "Novokramatorsky Mashinostroitelny Zavod" The situation of investment in resource saving technologies at PJSC "Energomashspetsstal" characterized by exponential and logarithmic dependence of forming costs over the life cycle (Figure 1). The feature of the first part of this graphics is exponential dependence, showing a gradual increase of speed of growth of spending in time. This acceleration is necessary to maintain product at the stage of the life cycle - consumption to avoid the threat of decline of volume sales. The result of this support will be increasing of volume sales in the future, owing to high-quality after-sales service, intensification of advertising company, promotion. Bifurcation point (A) shows the change speed in the growth rate of spending. Tactical decision entity of economic management shows that it is not incline to a risk, therefore it chooses a scheme in which the maximum volume of usage of resources occur on the final stage of the life cycle.
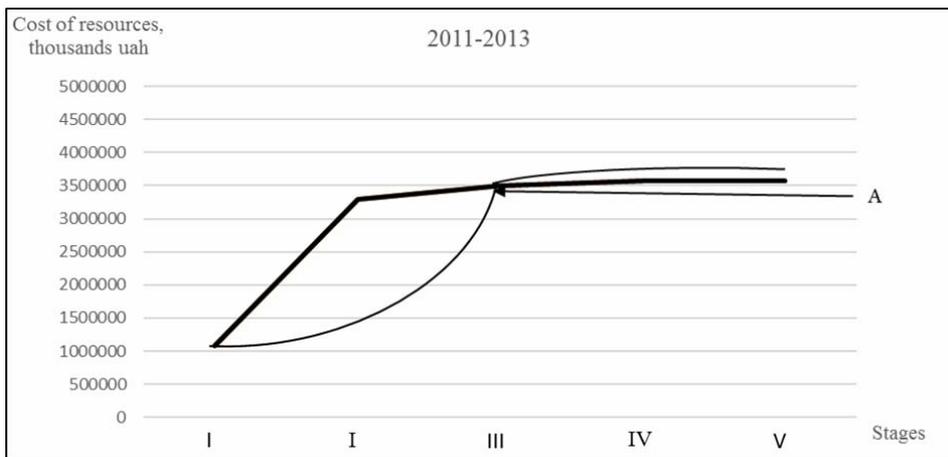

Figure 1: Variant of formation of value of resources over a life cycle of product PJSC «Energomashspetsstal», Ukraine

The expenses to investment in resource saving projects PJSC «Novokramatorsky Machine Works» form a combination of exponential and logarithmic approximating of function of the cost of resources (Figure 2).

In the first stage of the life cycle is a maximum speed of growth of costs, due to the implementation of investment costs in the early life cycle. In the next stages of life cycle the speed of growth of expenses slows down, due to the formation of the current transportation costs, installation of equipment, accompanying investments etc. Such costs are intended to compensate for resources consumed in production processes and product consumption. They are calculated for the entire life cycle of products, given the nature of change of certain types of expenses. Also slowdown caused by the use of a large proportion of resource-saving technologies in production, by the availability of high-tech innovative equipment in production processes, what decrease direct costs of resources, by low price of raw materials and materials by bringing in waste as secondary raw materials. Bifurcation point shows that the subjective aspect of decision-making economic entity on the selection procedure of formation of the cost of resources caused by its propensity and desire to maximize the volumes of use resources during the initial stages of the project life cycle.
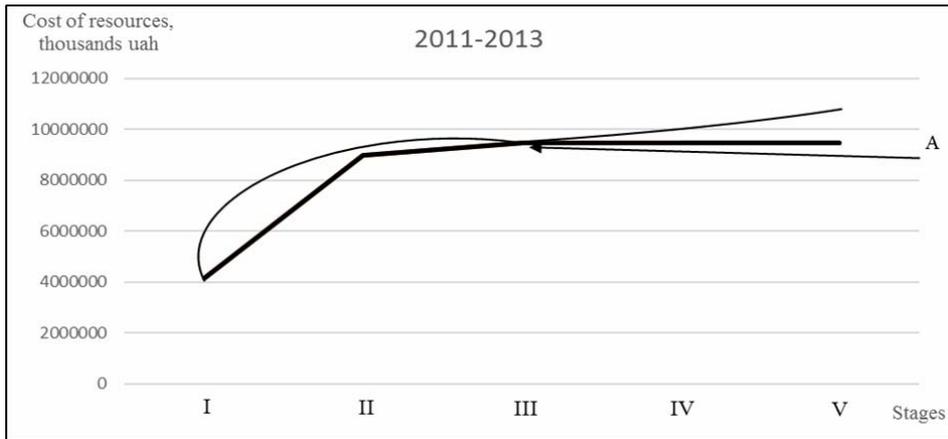
Figure 2: Variant of formation of value of resources over a life cycle of product PJSC «Novokramatorsky Machine Works», Ukraine

The method what will lead to reduce the cost of production resources consist in build of optimization matrix of resources cost for different stages of the product life cycle. This provides opportunities for decrease resource consuming throughout the life cycle of implementation of resource-saving technologies. The essence of method is to distinguish different stages of the product life cycle for calculate the cost of resources at different stages of the product life cycle in order to further optimize the expenses of this resources.

Herewith the coefficient of optimizing cost of resources reporting period to base period of i-th resource on j-th stage of the product life cycle is calculated by formula:

$$\hat{E}_{OPTIM.COS.L.C.P.} = \frac{V_{Rij} - V_{Bij} \times I_{P.P.}}{V_{L.C.P.}} \qquad (2)$$

where V_{Rij} and V_{Bij} – expenditure respectively the reporting period and the base period of i-th resource on j-th stage of the product life cycle, thousand UAH;

$V_{L.C.P.}$ – costs throughout the product life cycle, thousand UAH;

$I_{P.P.}$ – index of manufacturing product.

In Table 1 and Table 2 are entered data on coefficients optimize of cost of resources reporting period to the base period for the different stages of the product life cycle.

Table 1: Coefficients optimize of cost of resources on PJSC «Energomashspetsstal», Ukraine

Years	Stages of the product life cycle				
	I	II	III	IV	V
2011	-0,0161	0,0289	0,0016	-0,0342	-0,0001
2012	0,0218	0,0707	0,0059	-0,0009	0,0004
2013	-0,0173	-0,0388	0,0091	0,00001	-0,0001

Table 2: Coefficients optimize of cost of resources on PJSC « Novokramatorsky Machine Works», Ukraine

Years	Stages of the product life cycle				
	I	II	III	IV	V
2011	-0,0076	-0,0084	0,0128	0,0004	0,0004
2012	-0,0073	0,0021	0,0047	-0,0008	-0,0008
2013	-0,0485	-0,0402	-0,0009	-0,0007	-0,0007

PJSC «Energomashspetsstal» has a more worse coefficients of optimization the cost of resources than PJSC « Novokramatorsky Machine Works» and requires activities for the study of contemporary experience of modernization machine-building enterprises. PJSC « Novokramatorsky Machine Works» has a good coefficients and full optimization of overall economic effect of investment in resource saving technologies for renewal of fixed assets per unit cost which requires a strategy to maintain and improve the results of industrial activity.

Criteria of selection of investment solutions concerning optimize resource consuming machine building products of enterprise considering spreadsheet resource consuming on different stages of the product life cycle will consist of the following: analyzing various variants of forming resource consuming of machine building products, it is advisable to choose one that provides the maximum value of cost optimization. If $K_{OPTIM.COS.L.C.P.} < 0$ variant of optimizing resources consuming is effective, because that reduces specific resource consumption compared with the base period is include in the list of options to choose the most effective one. If $K_{OPTIM.COS.L.C.P.} = 0$ variant formation of resource consuming equal to the base period, does not decrease and does not increase resource consuming, may be included in the list of options to choose the most effective of these when this variant is suitable for the enterprise. If $K_{OPTIM.COS.L.C.P.} > 0$ variant of forming resource consuming is unprofitable, the decision can be made on the basis of minimum losses, it may be in different cases, for example, a decision is made concerning production of socially significant products, products needed to support the enterprise image, product at the stage of entering the market.

Criteria of selection investment decisions (formula 2) expedient use when on the enterprise enough investment resources to implement appropriate measures. However, this situation is rare, especially on domestic machine building enterprises, which requires additional comparison not only results of optimize the cost of resources to the previous period at different stages of the product life cycle, but the overall economic effect of resource saving technologies per unit cost.

The overall economic effect of investment in resource saving technologies for renewal of fixed assets per unit cost for all stages of the product life cycle will be calculated by the formula:

$$\mathring{A}_{TOT.PER.N\ .COS.} = \frac{|\ddot{A}R| \times D_{P.R.}}{INV_{FIX.ASS.}} = \frac{\left| \dfrac{V_{L.C.P.R.}}{D_{P.R.}} - \dfrac{V_{L.C.P.B.}}{D_{P.E.}} \right| \times D_{P.R.}}{INV_{FIX.ASS.}} \tag{3}$$

where ΔR – size of resource saving, UAH/UAH;

$D_{P.R.}$ and $D_{P.E.}$ – profit respectively with resource saving and existing technologies, thousand UAH.;

$INV_{FIX.ASS.}$ – investment in fixed assets, thousand UAH;

$V_{L.C.P.R.}$ and $V_{L.C.P.B..}$ – expenses throughout the product life cycle respectively the accounting and the base period, thousand UAH.

Data on overall economic effect of resource saving technologies per unit cost is recorded in Table 3 and Table 4.

Table 3: Overall economic effect per unit cost on PJSC «Energomashspetsstal»

Indicators	Years		
	2011	2012	2013
Overall economic effect per unit cost	0,1312	-0,3289	0,0978

Table 4: Overall economic effect per unit cost on PJSC « Novokramatorsky Machine Works»

Indicators	Years		
	2011	2012	2013
Overall economic effect per unit cost	0,1503	1,1658	2,3869

The negative sign indicates the inefficiency of resource saving and a positive sign shows effective expenses on resource saving.

Choice the best variant of implementing resource-saving technologies, aimed at reducing the total resource consuming of products must perform taking into account criterion of maximizing of the overall economic effect of resource saving technologies per unit cost. Increasing the economic effect of this indicator, however, not doing increase economic effects for each resource and at every stage of the product life cycle. However, this criterion is optimal because a selected variant of resource-saving technologies will be based on the optimization of all components of the expenses of the resources of product that will lead to a synergistic effect of resource saving.

3. CONCLUSION

The importance of evaluating the effectiveness on these stages conditioned of this circumstance that the implementation of these phases is accompanied by formation of investment costs, magnitude of which forms the next current costs and revenues for phase of the exploitation of the investment object. Depending on the ratio of investment costs, current income and current expenditures defined expected level of efficiency realization projects of reconstruction or modernization of the fixed assets of enterprise. Final decision on the choice project of reconstruction or modernization based on an assessment of the costs generated in the investment phase, and their comparison with the expected winnings in the form of income and the savings of expenditures at the expense of improvement of indicators of resource saving the enterprise. The proposed approach will enable the practical application of the full optimization of resource consuming machine building products through the introduction of resource-saving technologies at all stages of the product life cycle. Using the coefficients of cost optimization reporting period to base period shows a causal link between the introduction of resource-saving technologies at different stages

of the product life cycle and change of total resource consuming of products. Optimizing of magnitude of full resource consuming machine building products on the basis of the proposed indicators provides efficient formation of costs of resources of product life cycle, thus obtained a minimum consumption of resources and maximum effect of resource saving. Calculation of change total resource consuming of lifecycle machine building products increases the validity of decisions on investment of resource saving technologies in machine-building enterprises.

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