Alternative model of project management at the stages of R&D

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Alternative model of project management at the stages of R&D

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Abstract. The purpose of the work is to cover the practical application of innovative project management mechanisms using the principles of Target costing in the field of engineering. The approaches and requirements for the application of tools in practice are identified. Mechanisms for applying approaches based on the Target Costing concept in the development and updating of the technical and economic model are proposed.

1. Introduction Nowadays the development of an economy based on innovation requires organizations to own the entire spectrum of management tools, taking into account an understanding of their role and degree of influence on the economic result. Of course, project innovation has always been a high-risk area of investment, considering the multifactorial nature of forecasting and a high degree of uncertainty about the attainability of the set targets. We previously studied various methods and approaches in comparison analyzing project management and evaluating their effectiveness [1-4].

The most objective assessment of a new product before making a decision on investing should be given by a technical and economic model that justifies the economic feasibility of development and market competitiveness. But often, an excellent technical and economic model is destroyed already at the stage of an idea and even a concept in the process of forming design stages for reasons of technical unrealizability at the appropriate time with a planned volume of investments and a deviation in cost, after the start of production. Economic analysis when designing a new product gives positive and negative feedback regarding the presence of deviations from the target cost levels set at the concept stage. Thus, controllability and completeness of data is created for making an informed decision, both for a specific change and for the product as a whole.

2. Aim of Research
Developing and proposing an alternative model for project management at the stages of R&D.

3. Research Results and Discussion
To implement an assessment of the impact of design and technological changes during product development, the authors propose an algorithm for updating the initial data on the feasibility study, stated at the concept stage. Elements of the algorithm are applied [5].

This algorithm (Figure 1) generally reflects the recommendations of the methodology based on the principles of Target Costing at the top level in terms of updating the financial model of the product, taking into account the factors of the investment component during the development and implementation of a new product.

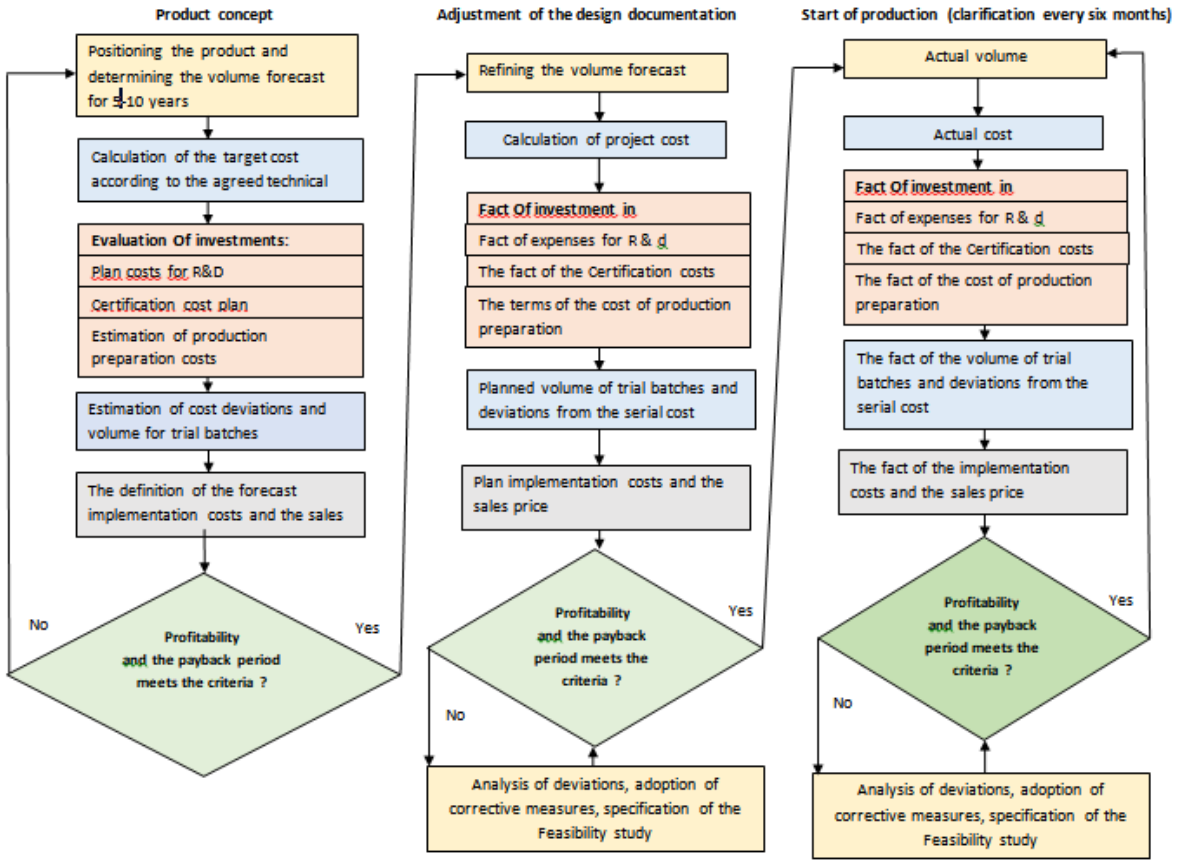

Figure 1 – The algorithm of updating the technical and economic model

This algorithm involves three iterations of the formation and updating of the technical and economic model, taking into account the current revaluation of the economic parameters of the product itself, as well as investment parameters based on actual or updated forecast data. This model for evaluating the effectiveness can be considered as a lever for monitoring and innovation management for the project manager or the organization's leadership in product or portfolio investment.

The proposed model covers the key indicators of investment and product efficiency: price positioning, sales volume, cost of production, investment assessment at all stages of the project (R & D costs, certification costs, costs of project's mechanic training, selling costs). Also in the model are elements for predicting permissible deviations from the target serial cost for reasons of rising prices for the period before development, taking into account serial technologies (increased cost of pilot batches of mastered components manufactured by bypass technologies).

An example of filling out a feasibility model is presented in Figure 2.

Economic justification of product sales prices	96537
alternative design changes for the base product	96635

			Stage of the development Task	The stage of issuance of design documentation		The stage of serial production	
№	Name	Unit of measure	The new model (estimated FCA)	Project cost	Deviations	Standard cost price	Deviations
1	Sales volume (approximate) total	pieces	100	95	-5	142	42
2	Total cost of the chassis	rub	3 237 552	3 239 552	-2 000	3 593 683	-356 131
3	Direct chassis costs	rub	2 504 899	2 504 999	-100	2 805 487	-300 588
4	Conditionally variable expenses	%	0,0%	0,0%		0,0%	
5	Cost of the add-on (including installation and transport costs)	rub	671 297	687 398		687 398	
6	Estimated price (EXW)	rub	3 683 634	3 683 634		3 683 634	
7	Delivery costs (under the terms of the contract)	rub	262 240	262 240		262 240	
8	Contract price without VAT (calculated) minimum	rub	4 617 171	4 633 272		4 633 272	
9	Contract price without VAT (offer)	rub	4 617 171	4 633 272		4 633 272	
10	The profit margin on the units chassis	rub	1 178 735	1 178 635		878 147	
11	Marginal profitability of the chassis	%	32%	32%		24%	
12	Profit (oss)	rub	446 082	444 082		89 951	
13	Profitability of sales of the chassis	%	12%	12%		2%	
14	R & d expenses excluding VAT	rub	5 493 783	5 467 128		814 400	
15	The cost of certification	rub	679 200	0		0	
16	Costs of technological preparation of production	rub	1 050 000	1 050 000		250 000	
17	Total investment	rub	7 222 983	6 517 128		1 064 400	
18	The profit margin of the contract with the cost of R & d	rub	112 379 717	106 503 197		123 882 474	11 502 757

Figure 2 - The example of technical and economic model being updated

Almost all the elements of the technical and economic model at the concept stage are formed on the basis of functional-cost analysis data, rough expert estimates on market expectations, and if the assessment is given by an experienced expert, the indicators include promotion risks taking into account changes in the market situation. The same uncertainty factor in forecasting can be attributed to cost parameters and investment cost estimates. These initial overestimations can be considered as elements of risky suboptimization of subdivision indicators to ensure their attainability. In this way, at the first stage the technical and economic model is distorted by the excessive probability of deviations from normal expectations. Carrying out the current updating of the model, it is possible to track unrealized embedded deviations that improve performance indicators. If some of the elements worsen the model, then it is necessary to determine the cause, this may be a forecast error due to poor study of the forecasting area, an event with a low probability of expectation, force majeure, etc.

Using the economic analysis tool (Cash-Flow) and sample input from different stages of the model give an opportunity to provide an updated payback forecast considering current deviations from the baseline scenario (Figure 3).

The stage of serial production											
Indicator	0 year	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10 year
CASH FLOW											
Investments, thousand rubles	**1 064,40**										
The volumes of all pieces.		10	30	50	10	7	7	7	7	7	7
- the same cumulative total, PCs.	0	10	40	90	100	107	114	121	128	135	142
The stage of serial production	**1 064,40**	10	30	50	10	7	7	7	7	7	7
Total adjusted profit, thousand rubles		**899,51**	**2 698,53**	**4 497,55**	**899,51**	**629,66**	**629,66**	**629,66**	**629,66**	**629,66**	**629,66**
Total profit, thousand rubles		899,51	2 698,53	4 497,55	899,51	629,66	629,66	629,66	629,66	629,66	629,66
including per unit:											
The stage of serial production	**89,95**	90	90	90	90	90	90	90	90	90	90
Net cash flow, thousand rubles	-1 064,40	899,51	2 698,53	4 497,55	899,51	629,66	629,66	629,66	629,66	629,66	629,66
- the same cumulative total, thousand rubles.	-1 064,40	-164,89	2 533,64	7 031,18	7 930,69	8 560,35	9 190,00	9 819,66	10 449,32	11 078,97	11 708,63
Discount rate (comparison rate), %	12,00	12,00	12,00	12,00	12,00	12,00	12,00	12,00	12,00	12,00	12,00
Discounted cash flow, thousand rubles	-1 064,40	803,13	2 151,25	3 201,26	571,65	357,28	319,00	284,82	254,31	227,06	202,73
- the same cumulative total, thousand rubles.	-1 064,40	-261,27	1 889,98	5 091,25	5 662,90	6 020,18	6 339,19	6 624,01	6 878,32	7 105,38	7 308,11
PAYBACK											
Simple payback period, years	**1,06**										
Discounted payback period, years	**1,12**										
NPV, thousand rubles.	**7 308**										
return on investment ROI	**6,866**										
IRR, %	**155,7%**										

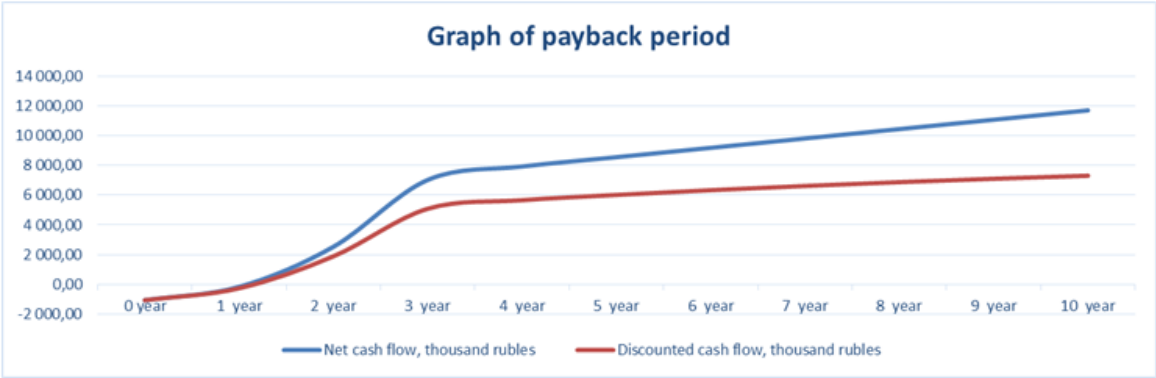

Figure 3 – Assessment of efficiency of technical and economic model being updated

For managing effectively the project progress, the data entered into the technical and economic model at the early stage of the concept are updated twice - for the first time at the stage of completion of the design documentation with an estimate of the project's mechanic training volumes and for the second time based on the results of the project's mechanic training and the generation of evidence. For the goal-setting of indicators in the implementation of all types of work within each stage, it is necessary to structure the indicators into components and evaluate their attainability at the lower level at the time of making decisions on the investment components of costs or the design and technological model of the cost of the product.

4. Conclusion

Thus, the offered algorithm will allow providing timely and adequate assessment of risks of decisions being taken and give a clear forecast of the impact of deviations on the technical and economic model.

The organization need to have a certain level of development in following fields to put into practice offered actualized technical and economic model:

1. It is required to possess methodology of calculation of design cost of the product at different stages of development with an increase of the reliability level as the structure, composition and updating of data on the technology of manufacturing individual bundles, the cost of purchased components.

2. It is necessary to have elements of project data management for investment and financial flows, forecasting the timing of exploitation and the start of production.

3. It is required to organize storage aggregation information and data processing systems for technical and economic model.

4. It is necessary to have competent personnel who are able to adequately predict and evaluate risks, motivated to escalate them in a timely manner before making decisions, digitize these risks and clearly follow certain criteria of appropriateness.

Execution of requirements for the organization of work with using the proposed algorithm in innovative projects seriously reduces the risk of exploration the start of production of an unprofitable or non-competitive product. The using of the proposed algorithm for updating the technical and economic model will allow creating additional analytical tools for prompt management of the project at the R&D stages, getting up-to-date forecast on the reachability of primary estimates and a clear understanding of the reasons for deviations The updated model allows to accumulate and analyze the change in input data at different stages of the project and build a digital model of the innovative business process to find ways to optimize.

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