Technical and Economic Indicators of Strategic Management Accounting in the Development Companies Based on the Life Cycle of the Produce

Ainur A. Akhmetzianov* and Andrew Y. Sokolov

Department of Accounting, Analysis and Audit, Institute of Management, Economics and Finance, Kazan Federal University, Kazan, Russia

Abstract: This article discusses the issues of technical and economic indicators of strategic management of a development company and the application of modern management accounting methods. We have analyzed various scientific studies of scientists in the field of product life cycle management and it was found that now this area is very popular and there is a demand for it from modern companies. In that reason for effective control and project planning, it has been proposed to use the Life Cycle Costing method, which can be successfully applied to development. This system was supplemented by the method of Target Costing, which is used for the target cost management. Using this method, the target price was determined, which was used to determine the acceptable margin of the development project at the planning stage. An interaction scheme of responsibility centers was proposed in order to achieve the implementation and effective operation of these systems, which allowed to reduce costs and accelerate sales. Using this proposal, it was possible to reduce design errors that led to significant additional costs.

Keywords: Management accounting, Life cycle costing, Target costing, Direct costing, Development, Costs, Sales, Control.

1. INTRODUCTION

Strategic management accounting in the current economic conditions can be used by companies as an effective management and control tool at all stages of the product life cycle, as it integrates planning, accounting and cost analysis by types, locations and calculation objects into a single system.

Using data of strategic accounting a company can effectively form a pricing policy taking into account the necessary rate of return. Thus, to control the profitability of product sales at each stage of the life cycle. For strategic management, companies need to identify several key indicators that can pre-warn about the need to respond to changing conditions in the production and sale of the product.

In the development business, the company produces and sells a product, for example, an apartment building, for a long period. Therefore, the development of strategic management accounting in such companies is an important factor that affects its competitiveness. Analysis of product profitability in the long term has absolute strategic importance as a critical success factor for any strategic initiative in favor of its focus on the products and services that can bring maximum profit organization in the long run. An analysis of the product profitability at each stage of construction represents a fundamentally important area of strategic management accounting and internal analysis of the entire system. In other words, in order to conduct an adequate analysis of product profitability in strategic management accounting product costing must meet the demands of today's competitive environment and focus on the long term.

For the successful implementation of construction products, it is vital to ensure the lowest possible costs for the development of a new product, its promotion, production, and operation. Significant benefits for achieving this goal of the organization can bring use in the framework of strategic management accounting the idea of calculating the cost of the product life cycle (Life-Cycle Costing, LCC). This system allows you to evaluate the composition and volume of not only the costs incurred in the production process (which, with varying degrees of certainty, allow traditional costing methods to be implemented), but also the costs that arise at the stage of designing a new product, as well as after-sales service.

For example, the effectiveness of using the LCC method to assess long-term assets of civilian infrastructure was demonstrated in an article by scientists (Van den Boomen *et al*. 2018), using the method of discounted cash flows, they evaluate objects throughout the entire period of operation. Other

*Address correspondence to this author at the Department of Accounting, Analysis and Audit, Institute of Management, Economics and Finance, Kazan Federal University, Kazan, Russia; Tel: +7-965-607-56-54;
E-mail: amirgendyal@yahoo.com

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scientists (Miah *et al*. 2017; Lee *et al*., 2017) demonstrate LCC as a flexible and changing accounting system that can be adapted to any type of activity or any accounting system, as a confirmation they develop 6 different methods of LCC assessment. Using the LCC method, scientists (Weldu and Assefa 2017) conducted a search for the most cost-effective way to achieve the status of environmental sustainability of electricity production in Canada; the results were obtained on the analysis basis of various scenarios and cost-effectiveness assessment and achieved a cost reduction of 22-45%. Using LCC Scientists (Kovacic *et al*. 2016; Buana 2020) estimated the costs during the operation phase of various types of facade solutions for buildings, namely steel lining, steel sandwich panels, and wooden laminated panels. They found that despite the fact that initially, the cost of building these facade systems differed up to 27%, however, after 35 years, the difference in costs at the stage of building life cycle operation between these types of facade solutions began to differ by only 6%. This tool has great potential for implementation as a relatively easy and applicable decision-making tool for designers and investors in the study and determination of sustainable building systems and facades, improving the traditional decision-making process, still based on the choice of the cheapest design, that is, you need to take into account and operational costs. The scientist suggests using the LCC method to evaluate the external effects of production and the impact of various factors on the environment, and the damage in the form of future costs for eliminating the problems caused by these influences (Deif 2011). Thus, he emphasizes the importance of the product design stage and the consideration of environmental costs, thereby developing the direction of "green" production. Other scientists suggest that environmental impacts be considered in decision-making (Allacker *et al*. 2013). In their study, they focus on the environmental impacts on the life cycle and the costs of alternative heating and ventilation options for homes in Belgium. They found that smart energy efficiency solutions have a positive effect on reducing negative environmental impacts and costs throughout the life of buildings. Scientists emphasize that significant maintenance costs can accrue over the life of the infrastructure, economic policy and total quality management (Enggartyasti and Caraka, 2017), in world size events such as COVID-19,(Caraka *et al*., 2020), Disaster (Caraka *et al*., 2021; Kaban *et al*., 2019; Heitel *et al*. 2008). Therefore, the choice of construction options should be made not only at the purchase price, but also taking into account the expected subsequent costs, using the LCC method. Scientists using the LCC method, they achieved a reduction in CO2 emissions into the environment (Feiz *et al*. 2015). The problem of "green" construction is raised by various scientists who offer tools for life-cycle-based design, and its general criteria defined for practical use, including the scope of methods, as well as scalability a compared to production, construction, use, cleaning, maintenance, repair and recycling / waste cycles of the building and its components (Martinez-Sanchez *et al*. 2015). After analyzing many works devoted to the problem of the calculating the life cycle method of the product's costs, we came to the conclusion that using it to assess the profitability and control the processes of the development business is relevant. Since the calculation of the life cycle is carried out from the moment of design to the operation stage, this tool is extremely important in the strategic management of the development business, which allows you to evaluate not only current costs but also future ones, as well as their impact on the entire operation phase.

2. METHODS

Cost-accounting throughout the life cycle covers the types of activities and resources that are required to implement a new product project from the time it is developed to the product's withdrawal from the market. This analysis, provided it is of a comparative nature, can even at the initial stages of product design reveal its strategic non-competitiveness, which will determine the need for a general reduction in project costs. Information about the costs at each stage of the life cycle determines which types of activities need optimization and what impact such optimization will have on the unit costs of the product. The key to the success of this approach is, on the one hand, the estimating the duration accuracy of the life cycle itself, and on the other hand, the costs arising at its individual stages. In the framework of strategic management accounting, from the point of view of estimating the costs of a product during its life cycle, the following stages can be distinguished (stages) in Table **1**:

The first two stages (S1, S2) of calculating the life of the project apply to all houses located on the land, and the data are evaluated as a whole. The calculation of the remaining stages is made for each house separately.

To calculate the project life cycle, both financial and non-financial indicators are used (Corona *et al*. 2016).

Table 1: Stages of the Life Cycle of the Project

No. Stage	Stage Name	Brief Description
S1	Applying for the purchase of land (Research & Development);	To obtain permission to purchase the land necessary to prepare the calculation, this will be presented the main provisions of the acquired plot of land and make a preliminary calculation of the investments efficiency in the project.
S2	Prepare a sketch of the project (design)	Preparation of a draft design is an important step in the life cycle of the product. At this stage, constructive design solutions that give a general idea of the work principle are developed, a feasibility study is calculated.
S3	Start of project construction	The start of construction is given when performing important criteria that describe the current and future profitability of projects.
S4	End of construction	The completion of construction is completed by obtaining a permit for commissioning the project.
S5	Service after the handover of the project.	Service after the delivery of the project is carried out by two parties: the construction company, in terms of warranty works, and the service company, in the part of servicing the house.

It presents groups of calculations that are divided into certain elements. It presents groups of calculations that are divided into certain elements. From the point of methodology view for implementing the process of calculating the costs of the product life cycle, the most general sequence of actions can be represented as follows:

1. Planning the total production of this product in the organization throughout its life cycle (Naves *et al*. 2018). Designing technical and economic indicators of the land plot / projects, calculating the approximate selling area, and determining the distribution base. The distribution of indirect (total) costs is done based on the selling area of apartments (Table **2**).
2. Preliminary assessment of the total life cycle of the product (Table **3**).
3. Planning the sales volume and determining the average selling price per m2 (Table **4**).

Table 2: The Planned Value of the Total Project Output

Stage		S1, S2			S3, S4, S5		
Date of Preparation	**Date of Application / Date of Approval**	**01.12.2014**			**01.07.2017**		
Design / volume	Land area, m2	16 500			16 500		
	The sellable area of apartments, m2, pcs., m2 / pcs.	17 820	371	48	9 052	182	50
	Sales area of commercial apartments, m2, pcs., m2 / pcs.	404	7	61	840	12	73
	Total sellable area	18 224			9		

Table 3: Planned Project Life Cycle

Timing	S1, S2		S3, S4, S5	
	m / y	**Duration**	**m / y**	**Duration**
First payment date	12/14		12/14	
Start date of construction works	09/15	9	03/17	27
Sales start date	10/15	10	05/17	29
Date of receipt of the permit for commissioning	05/17	29	07/18	43
Sales end date	09/17	33	12/18	49
Date of the last payment	10/17	35	01/19	50

Table 4: Planned Sales Volume and Selling Price Assessment

Sales	S1, S2		S3, S4, S5	
	rub. / m2	kRUB	rub. / m2	kRUB
Initial sale price, apartments	75 504	1 345 481	81 840	740 807
Initial sale price, commercial. premises	71 066	28 728	79 200	66 516
Initial sale price, others			86 328	3 337
Initial sale price, parking				
Allowance for change in the selling price	5 823	106 116	3 125	30 916
SALES TOTAL		1 480 326		841 576

4. Accounting and assessment of the research total costs, development, design, launching the product into production, as well as its after-sales service and disposal. The distribution of costs for the entire planned volume of product production throughout the life cycle (paragraph 1) and determining the incremental costs per unit of product (m2) (Table **5**).
5. Monitoring costs per unit of product at the stage of construction of its life cycle, making adjustments in case of changes in the planned volume of production or identifying additional costs (for example, associated with after-sales service and disposal of the product) (Table **6**).
6. The calculation of the profitability of the product is made in Table **7**.

Table 5: The Planned Value of the Acquisition Cost, Development and Management of Land

Costs for the Acquisition and Development of Land	S1, S2 (to the Whole Land Plot)		S3, S4, S5 (to a Specific Project)	
	rub. / m2	kRUB	rub. / m2	kRUB
Costs for the purchase of land	8 834	161 000	8 138	80 500
Other costs of acquiring a land plot				909
Total costs for the acquisition of the site	8 834	161 000	8 138	81 409
Infrastructure costs	0	0	0	0
Connection costs to networks	6 614	120 527	3 120	30 859
Off-site network connections	0	0		
Payments for connection to networks of electricity, heat, water, sewage, etc.	5 879	107 134	3 120	30 859
Provision for price change for interconnection	735	13 393		
Resettlement costs				
Costs for dismantling	379	6 900	597	5 904
Design costs	1 470	26 784	1 630	16 128
Expenses on sales and marketing	359	6 544	331	3 273
Other development costs	379	6 900	39	389
Total costs for the development of the site	9 199	167 654	5 717	56 552
Total cost for the acquisition and development of land area	18 034	328 654	13 947	137 961
Construction management costs	363	6 617	2 467	24 403
Construction site costs	115	2 100	329	3 250
VAT	1 692	30 840	3 862	38 200
Total construction management costs and taxes	2 171	39 557	6 657	65 853
Total cost for the purchase, development of the land plot and management	20 204	368 211	20 604	203 814

Table 6: Planned Value of Construction Costs

Construction Costs	S1, S2 (to the Whole Land Plot)		S3, S4, S5 (to a Specific Project)	
	rub. / m2	kRUB	rub. / m2	kRUB
Excavation	2 218	40 421	2 431	24 051
Foundations	4 052	73 853	4 443	43 945
Frame, fencing and roofing structures	16 736	305 002	18 347	181 484
Internal components of the structure	2 819	51 383	3 091	30 574
Internal surface structures	4 841	88 232	5 307	52 500
Inside furniture and equipment				
Plumbing, ventilation and electrical engineering systems	9 589	174 744	10 512	103 977
Direct costs of the construction site	40 256	755 635	44 131	436 531
Coefficients of increase of expenses		38 533		11 510
Provision for warranty	436	7 942	492	4 864
Construction costs	42 806	780 110	45 786	452 905
Provision for risks		29 877	844	8 345
Construction costs (incl. risks)	44 446	809 987	46 630	461 250
Total cost of the project	64 650	1 178 198	67 234	665 064

Table 7: Assessment of Project Performance

Profitability	S1. S2 (to the Whole Land Plot)		S3. S4. S5 (to a Specific Project)	
	rub. / m2	kRUB	rub. / m2	kRUB
Gross profit (initial price)	10 756	196 012	14 719	145 596
Gross profit (includes provision for price change)	16 578	302 128	17 844	176 512
Profitability. ROS		20.41%		20.97%
Interest costs before construction	481	8 760	1 681	16 632
Interest expenses during construction	2 367	43 138	2 359	23 339
Interest costs after construction				3 454
Net profit (includes reserve for change in price)	13 371	250 231	13 454	133 088
Profitability		16.90%		15.81%
Fixed costs	4 874	88 820		50 495
Operating profit	10.90%	161 411	9.81%	82 593
Yield of capital invested in the project.%. ROI		32.96%		9.61%

Determining the cost of production is a key objective of the financial services of any enterprise. In turn, the cost of production is completely determined by the cost grouping scheme, which the economists of the enterprise use to determine prices. It is almost impossible to accurately calculate the cost of an individual product, since the calculation includes indirect costs. Indirect costs that do not correlate with the volume of the enterprise's output cannot be accurately attributed to each type of product. The main method currently used to determine indirect costs is by distribution basis.

The cost classification we proposed earlier is convenient for using the method of cost allocation and calculating the cost of direct costing (for partial costs). Its advantage is that fixed costs that do not affect production are written off in the period in which they arise. Thus, forming a more reliable result, compared with the absorption-bone method (at full cost). In general, these two systems can be represented in the form of a diagram (Figure **1**):

It should be said that in our classification, the variable indirect costs are divided into the costs of

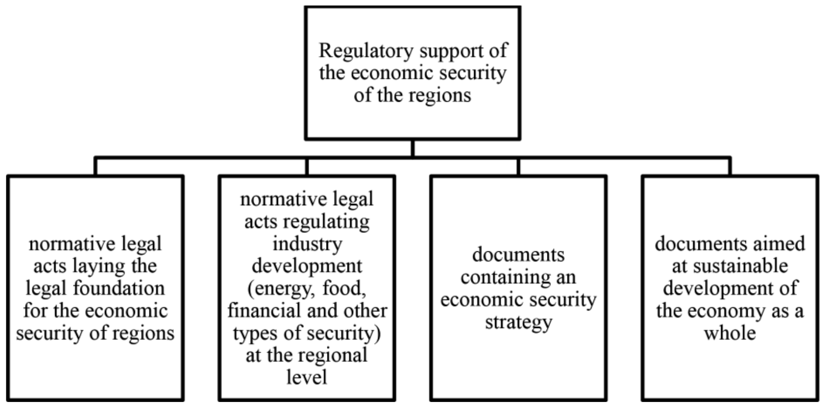

Figure 1: Comparison of cost allocation methods for AC and DC.

construction management and the costs of the acquisition and development of the land (area costs). Construction management costs are allocated to projects as they arise according to the distribution base per square meter. The cost of acquiring a land plot is distributed at the purchase time of the land plot for all projects that will be located on this plot in proportion to square meters.

Land development costs are called area costs. To account for the costs of developing a land plot, a certain technique is used. Its essence lies in the fact that area costs are distributed in proportion to square meters as they arise, but according to the stages of construction. This is done so that, for example, the costs of external networks are allocated to the first project, and then to the others in turn, since the construction time is long, and there can be many objects on one land plot, and, accordingly, the first object can be completed, although the rest are still under construction (Ghisellini *et al*. 2018I Biancone *et al*., 2020). Therefore, it is important that by the time the project is completed, the main area costs have already been allocated.

Area costs should be understood as indirect variable costs. Similar costs can arise when several projects are implemented in one large area. In such cases, it could be assumed that certain costs work in favor of several projects and therefore they are considered area costs. Further, these projects are not necessarily carried out at the same time, and some may be completed before the start of others. Area costs do not arise if only one project is implemented in the area, since all costs can be attributed to this project. All costs that cannot be directly attributed to a specific project are considered area. The area may contain up to 50% of the total cost structure of the project.

For the successful use of DC, a developed system of cost classification is needed to assign costs to the corresponding codes, which will then be distributed to products by m2.

In order to strategically manage the cost of the project, and therefore its profitability, complementing and expanding the calculating the cost idea of the product life cycle - LCC, is strategic management accounting for the target level of costs for development projects - Target-costing (TC). Today, many companies that are primarily focused on production processes, and not on market strategies, use the traditional pricing system, which is based on the well-known pricing principle (1) for a newly developed product:

Cost + Profit = Price (1);

The main idea of calculating the target cost level is to convert the classic pricing formula (1) to the form:

Price - Profit = Cost (2);

A similar approach to determining the target cost allows you to align engineering solutions with market requirements. The general algorithm for applying the target cost accounting methodology in an organization can be represented as follows:

1. Determination of the actual expected market price of a new product through ongoing marketing research;
2. the target level costs calculation for the product by subtracting from the expected market price the costs of marketing and promotion of this product, as well as the target profit;
3. Comparison of the target and estimated cost of the product to determine the value of the necessary (target) cost reduction;

4. Redesigning the product and at the same time making improvements to the production process to achieve targeted cost reductions without compromising quality.

3. RESULTS

To improve the planning processes and the management of product profitability, it was proposed to use target costing for strategic cost management in the product life cycle. In order to implement this accounting system, it was proposed to build processes within the development company as follows (Figure **2**).

The introduction of this scheme of interaction between responsibility centers allows the use of the target-costing system when planning the product life cycle. Using this scheme, we were able to bring the selling price of m2 to the market price, thereby speeding up sales and stimulating departments to search for cheaper solutions that do not reduce quality. The quality does not decrease, because the architect was included in the interaction process, that is, he will not be a priori interested in the deterioration of the project, in contrast to the estimated contract department or the planning and economic department.

Since initially planning was done on the basis of a certain level of costs and profit margins (formula 1), the sale price somewhat distorted the market situation in the market and made the product uncompetitive. But now, after the introduction of target costing and optimization of the interaction of responsibility centers, it has been possible to qualitatively improve the product's performance indicators. These activities and their impact on key indicators we presented in Table **8**.

The results from using the LCC, TC, and DC systems together show good results for accounting, planning, and controlling project values.

4. CONCLUSION

Several methods of the strategic management accounting system have analyzed: product life cycle accounting, target costing, absorption costing, and direct costing. It is also tried to combine these techniques into a single whole, which gave additional

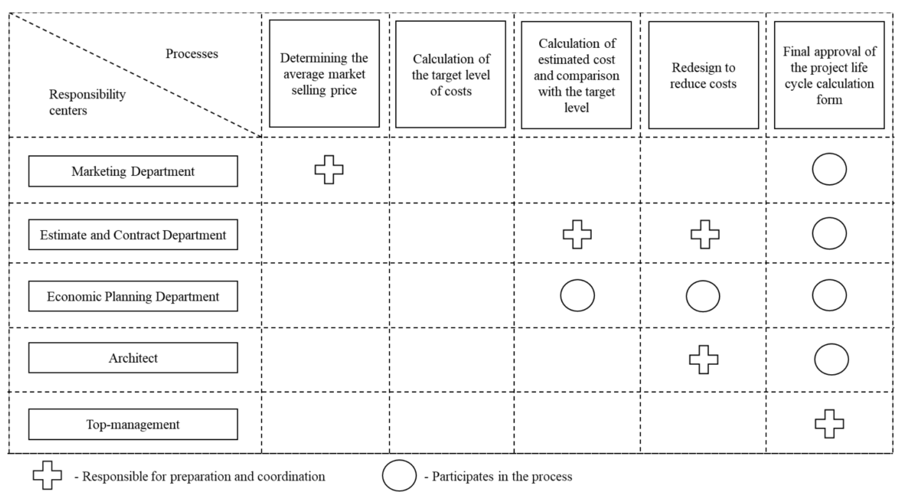

Figure 2: Interaction of responsibility centers to manage product profitability.

Table 8: Assessment of the Impact of Proposed Activities on Key Project Indicators

Object	Actual Value	Previous Value	Deviation
Initial sale price. apartments	73 504 RUB / m2	75 504 RUB / m2	- 2 000 RUB / m2
Sales end date	06/17	09/17	- 3 months
Total project costs	1 140 198 kRUB	1 178 198 kRUB	-38 000 kRUB
Operating profit	165 910 kRUB	161 411 kRUB	+4 499 kRUB
Profitability of sales. ROS	21.08%	20.41%	+0.67 p. p.
Yield of capital invested in the project. %. ROI	32.96%	38.36%	+5.4 p. p.

advantages for improving the efficiency of managing the development business. As a result, combining all these methods, it is concluded that together these accounting systems provide more opportunities for analysis and management than we would use them separately. And that they can be quite successfully implemented in the real business processes of the company, and even improve them using these techniques. In general, it should be noted that profitability management based on calculating the product life cycle using the TC concept for strategic cost management allows to plan a target rate of profitability at an early stage of the project and provide follow-up control. Such a strategic accounting system allows the developer to imagine the sum of costs and sales throughout the project, and to ensure the necessary profitability. The DC methodology used in development is an excellent solution for allocating indirect costs to projects and determining reliable cost.

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