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Efficiency of investment projects to modernize facilities housing and communal services (case of Kazakhstan)

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Abstract. The article presents the results of evaluating the economic efficiency of four investment projects for the modernization of housing and communal services. To get the results presented, the authors have previously collected a large database of investment projects for the modernization of housing and utilities. The projects have been prepared for various regions and cities of Kazakhstan, on the basis of which business plans have been developed for more than 30 projects aimed at using innovative technologies in heating, electricity, water and other utilities provided to apartment buildings. The economic evaluation of investment projects was carried out in the framework of digitalization, construction of "smart homes", construction of new non-traditional sources of electricity, introduction of green economy in housing and utilities, expansion of solid waste disposal, application of innovative materials in the construction of residential buildings, use of mechanisms for financing investment projects through public-private partnership. "Catalog of industrial and innovative projects for the modernization of housing and communal services" and "Methods of economic evaluation of investment projects of housing and communal services" were published based on the research results. Individual results of scientific research carried out within the framework of the grant project are presented mainly in tables.

1. Introduction

Housing and communal services is one of the problematic sectors in the Kazakhstani national economy. It determines the level of country's welfare, the use of renewable energy sources, environmental innovation technologies, and is a vital and socially necessary sphere of society's existence. Utilities include maintenance of housing stock, city, water, heat, electricity, gas projects, road construction, farming, gardening, landscaping, etc.

Many scientists have deeply studied the problems of functioning and substantiation of the economy of housing and communal services. Thus, Professor Chernyak characterizes the main development directions of communal utilities, identifies "characteristic features of the existing economic mechanism of functioning of housing and communal services" [1]. Modernization of housing and communal services is often interrelated with its innovation, which are disclosed in the scientific studies of Larin, Savostina [2, 3]. The development of housing and communal services sectors is taking place through new technologies, local issues of modernization of housing and communal services, improvement of utilities such as electricity, heating, water supply, repair and modernization of residential buildings and other services. This evidence can be found in the scientific works of Staniūnas, Medineckienė, Zavadskas, Kalibatas, Nowotarski, Milwicz, and Baliabina [4, 5, 6]. Detailed methods of economic evaluation of investment projects are specified in section 2 of this



report "Clarification of economic indicators and tools for developing a methodology for evaluating the investment effectiveness in innovative housing and utilities projects". Evaluating the investments effectiveness in various housing and utilities projects is more widely disclosed in section 3 of the report "Creating a catalog of industrial and innovative projects for the modernization of housing and utilities and urban services". Section 5 "Conducting economic and mathematical calculations to evaluate the effectiveness of investment projects in the development of housing and utilities infrastructure" provides an example of mathematical calculations of economic criteria for an investment project to modernize energy supply.

2. Methods

One of the main elements of economic analysis of an investment project is the use of various methods for evaluating its effectiveness. In Economics, there are often discrepancies between the project and actual achievements (indicators) of the effectiveness of investment projects.

Methods for evaluating the effectiveness of investment projects can be standardized. Finally, in practice, it is difficult to apply uniform evaluation methods for all projects. Each project has its own specific features, depending on the industry, goals, scale, and timing of implementation.

During the implementation of the research, business plans were drawn up for 30 investment projects to modernize housing and communal services in various regions and cities of Kazakhstan [7]. A unified methodology for evaluating investment projects in housing and utilities has been developed to evaluate economic efficiency. We used static and dynamic methods of evaluation performance criteria of the project: method of evaluation of profits, determination of payback period static (RR) and dynamic method (DPP), cash flow discounting, the method of dynamic estimation of investment project efficiency quantitative indicator of the net present value (NPV) method of dynamic estimation of the internal rate of return (IRR) method of estimation of the index of profitability of investments (PI).

3. Results

To assess the economic efficiency of investment projects of housing and communal services, working business plans were previously developed, which calculated the performance indicators of projects depending on the goals and objectives of investment. For each project, the main performance criteria are defined: investment cost, financial indicators, net discounted value, internal rate of return, profitability index, discounted payback period, break-even point, budget efficiency [7]. The results of economic evaluation of investment projects for the modernization of housing and utilities facilities are presented in various areas: modernization of residential buildings, technological changes in the provision of infrastructure services for electricity, heat, digitalization of management of life support systems of residential buildings, water disposal, infrastructure modernization programs in the housing and utilities system [8].

3.1. Investment project "Production of alternative portable heating system for residential buildings"

The use of modern equipment and high-quality raw materials will allow the project initiator to organize assembling of portable wind generators, alternative heating systems for residential buildings that meet modern requirements and international standards.

The advantages of the investment project is a wide range of products and custom design heating systems for houses and other buildings; expanding the range of products by introducing new production technologies; the use of modern equipment for the production of quality products; the availability of contracts with major consumers of these products, guaranteeing the full load of production capacities and the regular marketing of products; high quality products at a reasonable price; effective positioning strategy in the market; uniqueness and environmental safety of products.

Economic objectives of the project envisages the formation of the economic foundations of providing a guaranteed return of spent funds; development of production of wind turbines at the expense of profit obtained during the operation of the investment project; increasing profitability of the enterprise

in the process of further development. The project is expected to be financed from grant sources of local Executive bodies, borrowed and own funds. The investment cost of the project is 13.8 million tenge. Implementation of the future production is planned for 4 years.

The authors of the project carried out economic and mathematical calculations to determine the main criteria for the economic efficiency of this investment project. All payments were made in the national currency of Kazakhstan in tenge. (**Table 1**).

Table 1. Investment project performance indicators^a.

Indicators	The years of project implementation				Total
	1	2	3	4	
Revenue from sales of products, thousand tenge	51200	50820	51630	52540	206190
Expenses of the period, thousand tenge	36772	5880	4442	3464	22986
Profit before taxes, thousand tenge	75079	44940	47188	49076	283204
Income tax (3%), thousand tenge	1536	1524.6	1548.9	1576.2	6185.7
Net profit, thousand tenge	23264	22627.4	22681	22680.1	171459
Discount factor	0.453	0.89	0.79	0.71	0.63
Net present value (NPV), thousand tenge	404460	35952	33975.36	31408.64	141782
Return on investment index (PI)	1.05	1.05	1.05	1.05	1.05

^aCompiled by the authors based on calculations

3.2. Investment project "Modernization of a residential building"

The purpose of the investment project is to modernize a residential building in Nur-Sultan, located in the district of Almaty on Abay Avenue. The area of the building for modernization is 2.7 thousand square meters. The residential building is located in a densely populated area of the city with housing and utilities infrastructure. Initial investment in residential building modernization is attracted in the form of second-tier Bank loans at 13% (the loan period is 84 months). Economic indicators of the project implementation performance are given in **Table 2**.

Table 2. Investment project performance indicators^a.

Performance indicators	Value
Net present value (NPV), million tenge	128.8
Internal rate of return (IRR), %	73%
Return on investment index (PI)	3
Discounted payback period (DPP), year	3
Simple payback period (PP), year	4

^aCompiled by the authors based on calculations

3.3. Investment project "installation of surface drainage system from residential buildings"

The purpose of the project is to organize production for installation of surface drainage systems from residential buildings by manufacturing and installing concrete trays (ditches). The system includes drainage ditches located from residential buildings in places of critical, eroding water velocity with drainage trays, which are also equipped with artificial structures. The investment cost of the project is 40.3 million tenge (of which own funds-98.7%, borrowed funds-2.3%). The authors of the project calculated the main indicators of an effective project (**Table 3**).

Table 3. Investment project performance indicators^a.

	Discount rate:	Not represented
Simple payback period (PP), months		24
Discounted payback period (DPP), months		28
Net discounted value (NPV), tenge		80000000
Internal rate of return (IRR), %		42.3%
Project profitability index (PI)		1.4
Initial investment (IC), tenge		40300000
Planning horizon (TP), month		30
Break-even point (BEP), month		3.00
Budget efficiency (BE), tenge		60203700

^aCompiled by the authors based on calculations

Important criteria for the economic performance of an investment project are profitability (**Table 4**) and break-even of the project (**Table 5**).

Table 4. Investment project performance indicators^a.

Indicators	2018	2019	2020	2021	2022	2023
Gross profit margin ratio (GPM), %	1	1	1	1	1	1
Net profit ratio (NPM), %	-20	6	6	6	6	6
Return on investment (ROI), %	-185	70	41	29	23	19
Return on equity (ROE), %	-209	80	44	31	23	20
Fund profitability, %	-197	78	84	90	98	106

^aCompiled by the authors based on calculations

Table 5. Break-even analysis of the investment project, tenge.

Indicators	2018	2019	2020	2021	2022	2023
Profit	9000000	36000000	36000000	36000000	36000000	21000000
Fixed costs	9419667	23310667	28310667	28310667	28310667	16514556
Variable costs	1350000	5400000	5400000	5400000	5400000	1350000
Sales income	-1769667	2289333	2289333	2289333	2289333	1335444
Breakeven point	8326667	33306667	33306667	33306667	33306667	19428889
Financial safety margin	673333	2693333	2693333	2693333	2693333	1571111
Financial safety margin, %	7	7	7	7	7	7

^aCompiled by the authors based on calculations

3.4. Investment project "Installation of the smart home system"

The creation of a service organization for the implementation of "Smart home" projects involves solving social and business problems. These include meeting the needs of citizens in creating comfortable living conditions that meet modern requirements; creating new jobs for specialists of various specialties involved in this type of activity; replenishing the local budget with tax revenues from the activities of a highly profitable enterprise; making a profit. The investment cost of the project is 1092.72 thousand tenge (including own funds -50%, borrowed funds-50%). The forecast of expenses for the production and sale of services is based on the initial statement that the cost of elements of the "Smart home" system differs slightly and, on average, is equal to 18.000 tenge. per sq. m. the average area of the premises where these elements will be installed is 200 sq. m. (**Table 6**).

Table 6. Production costs for the estimated periods of financing and the value of the sales price.

Indicators	1st period	2nd period	3rd period	4th period
Production and sales expenses, thousand tenge	62559498	84069006	117980436	172035306
Sales volume, quantity	13	19	28	43
Production and sales costs per unit of production, thousand tenge	4812270	4424682	4213590	4000824
The ratio of trade margins	0.050	0.050	0.100	0.130
Price without VAT, thousand tenge	5052882	4645914	4634952	4520934
Selling price, thousand tenge	5659228	5203423	5191146	5063446

^aCompiled by the authors based on calculations

4. Discussion

The choice of the most attractive option for an investment project for housing and utilities modernization can be implemented using different methods of economic assessment. Projects that meet one or more performance criteria are considered effective. Thus, for the simple and discounted payback period- $PP > \min$ and $DPP > \min$; for the indicator of profitability of the investment project- $ARR > 0$; for net discounted income- $NPV > 0$; for the internal rate of return - $IRR > WACC$; for the profitability index - $PI > 1$. Using various methods of evaluating investment projects allows you to choose the most attractive housing and communal services.

In addition to external factors, the evaluation is influenced by internal factors, which make it difficult to accurately determine future cash flows from the project. Investment projects for modernization of housing and utilities, in addition to quantitative, must meet all quality criteria assessment. Among them are the modernization of housing and utilities facilities should be carried out in accordance with the requirements of ensuring safety, reliability and quality; the need to modernize the utility infrastructure; the use of modern technologies and highly efficient (energy-intensive) materials in the design of the object for the modernization of housing and utilities; tariff policy. A number of problems were identified that hinder the effective practical implementation of investment projects for the modernization of housing and communal services, based on their analysis and evaluation. Among them were significant payback periods, instability and inaccuracy of tariffs for housing and utilities, high wear and tear of the capacity of housing and utilities enterprises, etc.

5. Summary

Evaluating the effectiveness of an investment project when upgrading housing and utilities facilities is the main tool for selecting one of the project options, project solutions, or investment programs with minimal risks. When evaluating the effectiveness of investments in small projects, simple static methods of evaluating performance are used, while larger-scale projects with large investment investments require the use of complex economic and mathematical calculations with clarification of

the applicable method for evaluating the effectiveness of the project. Large-scale projects have a implementation period of several years, and cash flows are distributed over certain periods. Project implementation over a long period of time is usually more susceptible to various economic risks. The main purpose of any investment project is to achieve an effect in the form of profit.

6. References

- [1] Chernyak V Z 2014 *Housing and communal services: development, management, economy*. Moscow: KNORUS
- [2] Larin SN 2016 *Development of innovative potential of housing and communal services in the region as a condition for its comprehensive modernization* (Scientific Journal of the Kuban State Agrarian University) **116 (2)** 1–15
- [3] Savotina V S 2013 *Reforming housing and communal services in the concept of innovative development and attracting investment* (Internet-j. "Science studies": Institute of Public administration, law and innovative technologies) **6** 3–5
- [4] Staniūnas M, Medineckienė M, Zavadskas EK and Kalibatas D 2013 *To modernize or not: Ecological–economical assessment of multi-dwelling houses modernization* (Archives of Civil and Mechanical Engineering) **13(1)** 88–98 <http://dx.doi.org/10.1016/j.acme.2012.11.003>
- [5] Nowotarski P, Milwicz R 2015 *Management of electrical modernization in construction with the comparison between standard and flexible approach in the economic aspects* (Procedia Engineering) **122** 196–203 <http://dx.doi.org/10.1016/j.proeng.2015.10.025>
- [6] Baliabina A A 2011 *Tools for organizing innovative activities on energy saving in housing and communal services* Moscow: Moscow Power Engineering Institute (Technical University)
- [7] Shalbolova U Zh, Ryspekova M O, Tlessova E, Yegemberdiyeva S M and Kenzhegaliyeva Z Zh 2019 *Catalog of industrial and innovative projects for the modernization of housing and communal services* Nur-Sultan: L. N. Gumilyov ENU
- [8] Shalbolova U Zh, Yegemberdiyeva S M, Kenzhegaliyeva Z Zh, Tlessova E B 2019 *Methods of economic evaluation of investment projects of housing and communal services* Nur-Sultan: L. N. Gumilyov ENU