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Article

Development and Improvement of the Effectiveness of Public Utilities

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Abstract: In this article, the author analyzed the current directions for developing and improving the efficiency of Public utilities. The main factors influencing the efficiency of the Public utilities system, such as the state of infrastructure, digitalization of management, financial stability, private sector participation, and public satisfaction, were studied in an integrated manner. He also gave suggestions and recommendations for the development of Public utilities. The results of the article serve as a basis for modernizing the public utilities system in practice and ensuring long-term sustainable development.

Keywords: Public Utilities, Efficiency, Development, Infrastructure, Digital Management, Investment, Service Quality, Urbanization, Financial Stability, Public-Private Partnership

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1. Introduction

Public utilities are one of the main infrastructure systems for ensuring the well-being of the population, and their stable operation is an important factor in the success of economic development and urbanization processes. The development of this sphere, improving the quality of services and increasing the efficiency of resource use, requires the introduction of modern digital technologies, optimization of management mechanisms, strengthening financial stability, and improving interaction with consumers. In particular, in 2023, about 92% of the world's population was provided with electricity, while 666 million people are still not provided with electricity and utilities [1]. Based on this, there is a need for further development of the activities of Public utilities providers. For this, first of all, modernization of communal infrastructure, reconstruction of outdated networks, replacement with energy-efficient equipment will increase the uninterruptedness of services and reduce losses. Also, the implementation of resource tracking and management systems based on "smart home" and "smart city" technologies will help to optimize the cost of services, ensuring accuracy in real time.

As a result of the socio-economic reforms carried out in our country recently, we can see that the volume of Public utilities is increasing. In particular, the Decree of the President of the Republic of Uzbekistan Sh.M.Mirziyoyev dated April 14, 2025 No. UP-66 "On Measures for the Effective Organization of State Control in the Sphere of Construction and Public utilities" defines a priority task, according to which "during the reconstruction and redevelopment of premises in apartment buildings, as well as basements, it is prohibited to make changes, demolish structural parts and retaining walls of apartment

buildings in violation of urban planning norms, as well as to carry out work that negatively affects the seismic resistance of the building" [2].

At the same time, the widespread use of public-private partnership (PPP) mechanisms in the management system will increase investment flows and bring competition to the services market, which will improve the balance of quality and price. For example, in February 2025, the CPI (Consumer Price Index) was measured using the following indicators: We can see that the index for "Water Supply and Other Services Related to Housing Maintenance" reached 123.9% [3]. In addition, the scientific substantiation of tariff policy, the introduction of flexible tariffs, taking into account the solvency of the population, will strengthen the financial stability of the industry. Protecting consumer interests, automating the system for handling appeals, and creating open data platforms will strengthen transparency and increase public trust in utilities. We also see that such pressing issues as increasing personnel potential, retraining of technical personnel, and the formation of modern managerial competencies serve the institutional development of the system. This, in turn, shows that the development and improvement of the efficiency of Public utilities is one of the important issues of today.

It is considered modern approaches to the development of Public utilities require a set of measures aimed at increasing economic efficiency, ensuring environmental sustainability, and raising the quality of services provided to the population to a new level.

Analysis of the literature on the topic. The future of the industry's operations depends on improving growth paths and boosting the effectiveness of housing and public services. In their scientific paper "System of quality indicators of the housing and communal service of the population," scientists Derbasova, E., Bialeckaia, E., Mukanov, R., and Svintsov, V. discussed the Russian and international experience of creating a system for tracking the efficacy of budget expenditures based on a system of indicators that permits a comparative analysis of expenditure areas. Within the context of different housing and community service areas, the system of indicators taken into consideration in the work characterizes the quantitatively measurable and significant values. As a consequence of the analysis carried out in this study, recommendations were made for the successful functioning of public control in the sphere of Public utilities [4].

Tusell, Maria Cisternas. In his paper "Affordable housing in Europe: Innovative public policies that can effectively address the housing crisis," he advanced the idea that the housing issue is a fundamental aspect of urban life. The author came to the conclusion that cities were invented to live in them. The second wave of territorial segregation in European cities highlighted the influence of municipalities on the circulation of world capital and their inability to slow down the process of urbanization [5].

A.V.Chechulin, S.I.Shelonaev, T.V.Smetanina in their scientific article "Smart City: Experience and Prosperity of Russian State Governance" discussed the general principles and models of "smart" governance and studied the existing foreign experience. An analysis of the regulatory framework and programs for the implementation of "Smart City" projects by the regions of the Russian Federation is presented. The article also proposes a classification of programs for horizontal and vertical models. The specific features of managing the implementation of "smart city" projects by regional entities are also highlighted [6].

In the scientific article "Building up a System of Indicators to Measure Social Housing Quality in Vietnam" by Vietnamese economists Lan Huong Le, Anh Dung Ta, and Hoang Quyen Danglar, in order to provide the population with housing, the authors investigated the relationship between quality and price and analyzed the mutual influence of these two indicators among the population. Researchers have shown the need to establish a system of quality indicators for measuring the quality of social housing. Through the evaluation system, it was shown that it is beneficial not only for investors and consultants to retain

their housing products, but also for ordinary citizens to make a better choice when buying an apartment for themselves [7].

In the textbook "Economics and Management of Public utilities" by V.Yodgorov, D.Butunov, the subject, theoretical and practical issues of the Public utilities system, the organizational structure and economic mechanism of the Public utilities sector of the republic are revealed. The textbook attempts to illuminate the ultimate goals of reforms and structural changes being carried out in the Public utilities sector of our republic under market economy conditions [8].

In the scientific article "Trends in the Development of the Housing Fund in Uzbekistan" by S.N.Normurodov, D.Kh.Mirzabekov, Kh.I.Shaymukhamadieva, N.O.Odilova, opinions are presented on the prospects for the development of public utilities, which are a link in the creation of public utilities. Also, reforms in the field of Public utilities, trends in Public utilities, and the housing stock were studied, and necessary proposals and recommendations were given [9].

Currently available literary sources identifies numerous advanced technologies, which change the entire scope of Public utilities. One major trend that is receiving much interest in urban studies is real-time resource management through smart city technologies [10]. A study by Huynh highlights the role of digital platforms in dissemination of smart water and energy meters and reducing losses in urban utilities through better service[11]. When applied to public housing, these digital innovations help manage energy services efficiently and enhance service-billing visibility. In addition, Li and Zhang reaffirm the important role of public private partnership (PPP), as this organization model has catalyzed lease of several significant housing infrastructure investments in China, particularly those related to energy-efficient technologies. This nicely corroborates results by researchers like Wang et al. PPP) advocate that PPPs can also be regulated to spur innovation in delivering infrastructure 18 E16.1 Molefe E16.2 2030, creativity stimulates the use of renewables and diffusion into infrastructure development, least carbon footprints [12].

Moreover, there is an emerging literature that calls for financial innovations for housing services. Flexible tariff systems, such as those discussed by Singh, have the potential to alleviate affordability issues by aligning prices with consumption habits and household income levels. It guarantees a viable financial future whilst also tackling the ongoing socio-economic imbalance in housing access [13].

Finally, adequate provision related to environmental sustainability in housing and communal services is timely in the Koppenjan and Klijn learning-by-doing context of consolidating adequate attention to green technologies and waste management systems in housing and research infrastructure design has helped to confirm global sustainability. There is also an increasing use of green building standards - including the Leadership in Energy and Environmental Design (LEED) system, which already provides a useful solution for the creation of sustainable housing complexes[14], [15].

2. Methodology

In the process of carrying out the research in this scientific article, a systematic approach to scientific knowledge, monographic observation, statistical abstract and logical thinking methods were widely used. Also, when conducting scientific research, based on the effective use of the factor analysis method, research was conducted on improving the directions of development and increasing the efficiency of Public utilities, and solutions to the problems were presented.

3. Results and Discussion

Modernization of the Public utilities system and increasing its efficiency depend on many structural factors, which cover economic, organizational, technological, and institutional areas. The development of the activities of Public utilities providers requires

multifaceted market principles, rational use of resources, and a continuous improvement in the quality of services provided to the population. Taking these processes into account, we systematically reflected the priority factors influencing the development of Public utilities and their resultant directions in Table 1 below, scientifically substantiated.

Table 1. Main factors for the development and improvement of the efficiency of Public utilities [13].

No	Priority factors and their resultant directions	Content	Expected result
1	Modernization of infrastructure	Renewal of networks, reconstruction of energy-saving equipment, heat and water supply lines	Service continuity increases, technical losses decrease
2	Digitalization and "smart management" systems	Remote monitoring, automation of management through a digital database	Control over the use of resources will be strengthened, costs will be optimized.
3	Public-Private Partnership (PPP)	Attracting private investment in the modernization of the industry, introducing market principles into the management process	Investment flows will increase, competition will form, and the quality of services will improve.
4	Improvement of tariff policy	Development of economically justified mechanisms corresponding to the solvency of the population	Financial stability is strengthened, and the cost of services is formed fairly.
5	Improvement of the consumer relations system	Electronic appeals, transparent data platforms, accessibility of the service delivery process	Public trust will increase, and mechanisms for assessing the quality of services will be formed.
6	Personnel capacity building	Retraining of technical and managerial personnel, formation of modern competencies	Institutional stability of the system will be strengthened
7	Strengthening environmental sustainability measures	Resource-saving technologies, optimization of waste management	The impact on the environment will decrease, the principles of a green economy will be accelerated.

The Public utilities system has a complex economic and organizational mechanism, the effectiveness of which is directly determined by the state of infrastructure, the modernity of management, the balance between the price and quality of services, and the level of public satisfaction with services. Factors that are stated in the table are strongly interdependent, and they affect the general evolution of the Public utilities sector in various ways.

To begin with, the process of modernizing infrastructure can be justified by the necessity to revamp energy and utility infrastructure that is characterized by a high rate of depreciation over a long period of time. Absence of technical network updates results in

sustained service provision, loss of resources, and rise in the operation expenses. That is why modernization represents an important element of the investment projects implementation the realization of which has a direct impact on the economic efficiency of the whole system [7].

Second, with the advent of digitalization and intelligent management technologies, real-time monitoring, effective control, and forecasting of services are available opportunities. Digital analysis platforms, which are online payment systems, will create a new management culture in the market of the utilities sector, eliminate subjective errors, and guarantee the transparency of the services. The consumers also have their resources efficiently utilized with the help of this process.

Thirdly, the growth of public-privacy relations will enhance the involvement of the private funds in the industrial restructuring and partially decrease the costs of investments on the state. The practice helps to create competition, enhance the quality of service and price determination using market principles. In most nations, the PPP projects are regarded as one of the most depreciative means of enhancing the performance of Public utilities.

Fourth, the tariff policy is enhanced, i.e. mechanisms are introduced, coordinated with the development of prices that are economically justified and the solvability of the population. One of the benefits of fair tariff system is that it helps to secure financial stability and increase the opportunities of service enterprises to invest.

Fifthly, the enhancement of the system of collaboration with consumers can be regarded as one of the most urgent in the context of the sphere of the public utilities. Consumer complaints can be resolved on a timely basis by introducing electronic appeals, open information platforms, and evaluation systems on the quality of the services. This enhances the trust of people to the system and helps in the proper development of market relations.

Sixthly, personnel potential enhancement can only be directly connected to highly qualified specialists in the technically complicated Public utilities system. The control over the modern technologies, the work with the new generation tools, and the profound knowledge of the postulates of the digital management contribute to the rise of the efficiency of the system.

Seventhly, ensuring environmental sustainability, in harmony with today's global challenges and the concept of a green economy, requires resource saving and reducing the impact of Public utilities on the environment [5]. Waste recycling and the introduction of water and energy-saving technologies will allow for the implementation of the principles of equal development.

In our opinion, the results of the analysis show that increasing the efficiency of Public utilities requires a comprehensive approach, that is, the harmonious development of infrastructure, management, investment, environmental, and human capital factors. The systematic implementation of these processes will contribute to the sustainable development of the industry, improving the quality of services provided to the population, and accelerating urbanization processes.

A deep analysis of the identified factors for the modernization and improvement of the efficiency of Public utilities will allow for the formation of a number of priority areas for the development of the industry. First of all, it is necessary to expand state-investment programs aimed at implementing a comprehensive technical policy for the reconstruction and modernization of infrastructure facilities, reducing the level of network depreciation, and minimizing losses in energy and water supply [10]. At the same time, it is necessary to ensure the rational use of resources by accelerating digitalization processes, implementing online monitoring platforms and automated management systems, and increasing analytical accuracy in service delivery processes.

In addition, the implementation of modernization projects based on public-private partnerships, the simplification of mechanisms for attracting private investment, and the strengthening of a competitive environment in the services market are important conditions for the sustainable economic development of the industry. Financial stability can be strengthened through the scientific substantiation of tariff policy, the application of economically justified methods in price formation, and the use of differentiated tariffs that take into account the solvency of the population.

At the same time, it is advisable to strengthen the mechanisms for assessing the quality of services, strengthen public trust and participation in the system of working with consumers by expanding transparency, the practice of open data, and the use of electronic communication channels. Advanced training courses to improve personnel potential, the development of digital skills, and the revision of technical personnel training based on modern requirements are important factors in increasing the institutional stability of the system. In the direction of ensuring environmental sustainability, it is necessary to widely implement the principles of a green economy through the widespread use of resource-saving technologies, modernization of waste management and water treatment systems.

Thus, the main directions of the development of the Public utilities system should be aimed at harmonizing technical renewal, modern management, economic stability, human capital, and environmental security as a single system. This will ensure the provision of quality services to the population and the long-term sustainable development of the industry in the context of accelerating urbanization. At the same time, at the stages of implementing these directions in the republic, we can further develop Public utilities, see Figure 1.

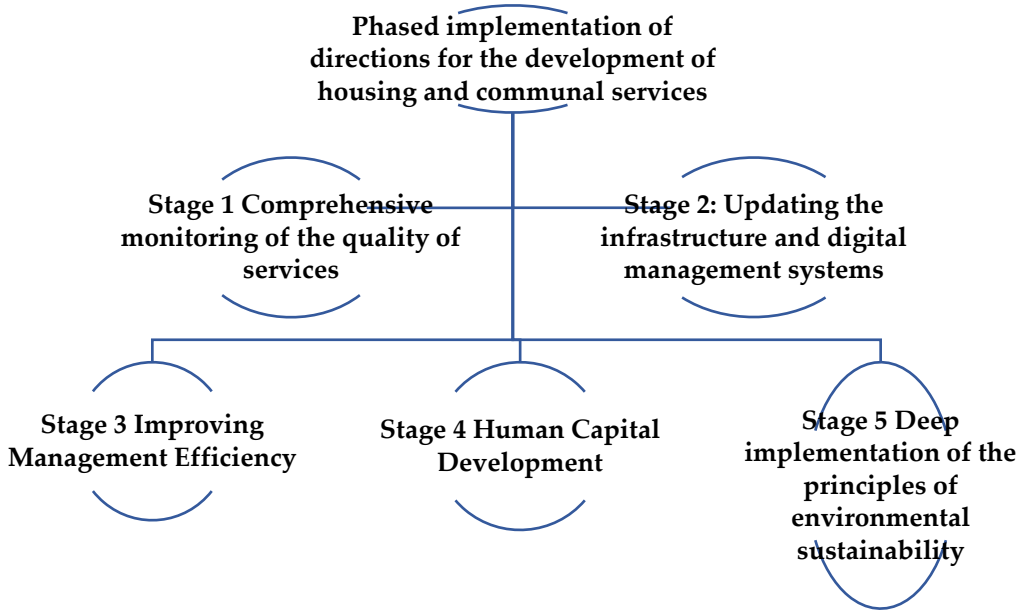

Figure 1. Ways of phased implementation of Public utilities development directions [13].

Based on the data presented in Figure 1, we can implement the main directions for the development and improvement of the efficiency of Public utilities in the republic in five stages.

At the same time, the implementation of the recommended factors for modernizing the Public utilities system requires a consistent and phased approach. At the initial stage,

it is necessary to form a comprehensive monitoring system for diagnosing the current state of the system, existing infrastructure capacities, the level of technical obsolescence of networks, the state of financial resources, and the quality of services. At the same time, preparation for digitalization, creation of a database, identification of regions where smart meters will be implemented, and determination of investment-attractive areas for PPP are considered primary tasks.

In the second stage, the modernization of infrastructure and the implementation of digital management systems are of paramount importance. At this stage, it is necessary to carry out phased reconstruction of heating, water supply, and sewerage networks, install energy-saving equipment, implement smart monitoring devices, and establish remote monitoring of services [8]. Also, the implementation of modernization projects based on public-private partnerships, the revision of tariff policy, and the introduction of economically sound pricing mechanisms will strengthen the industry financially.

At the third stage, it is necessary to increase the effectiveness of management, expand public control over the quality of services, automate work with public appeals, and strengthen consumer participation through the creation of transparent information platforms. At this stage, the introduction of modern management standards at service enterprises and the implementation of rating systems for assessing the level of quality are also important.

At the fourth stage, it is planned to ensure the institutional stability of the system through the development of human capital, retraining and advanced training of specialists, and training employees to work with digital technologies. In this process, the expansion of mechanisms for exchanging experience in cooperation with research institutes, higher educational institutions, and international organizations is of great importance.

At the fifth stage, systemic measures will be implemented to ensure the long-term sustainability of the industry through the deep implementation of the principles of environmental sustainability, the widespread introduction of waste processing, water purification and reuse technologies, and the development of green energy projects. At this stage, an urgent task will be the certification based on environmental standards, the introduction of energy efficiency indicators, and the improvement of monitoring systems.

In our opinion, the direction of phased implementation will serve the consistent organization of the modernization of the Public utilities system, the simultaneous development of infrastructure and management, and a stable increase in economic efficiency and the quality of services. This makes it possible to meet the needs of the population and ensure the competitiveness of the industry in the context of accelerated urbanization processes.

In our opinion, there is a need to develop a mechanism for the process of implementing the directions of phased implementation of the directions of Public utilities development, which is of great importance in the implementation of the above-mentioned stages, see Figure 2.

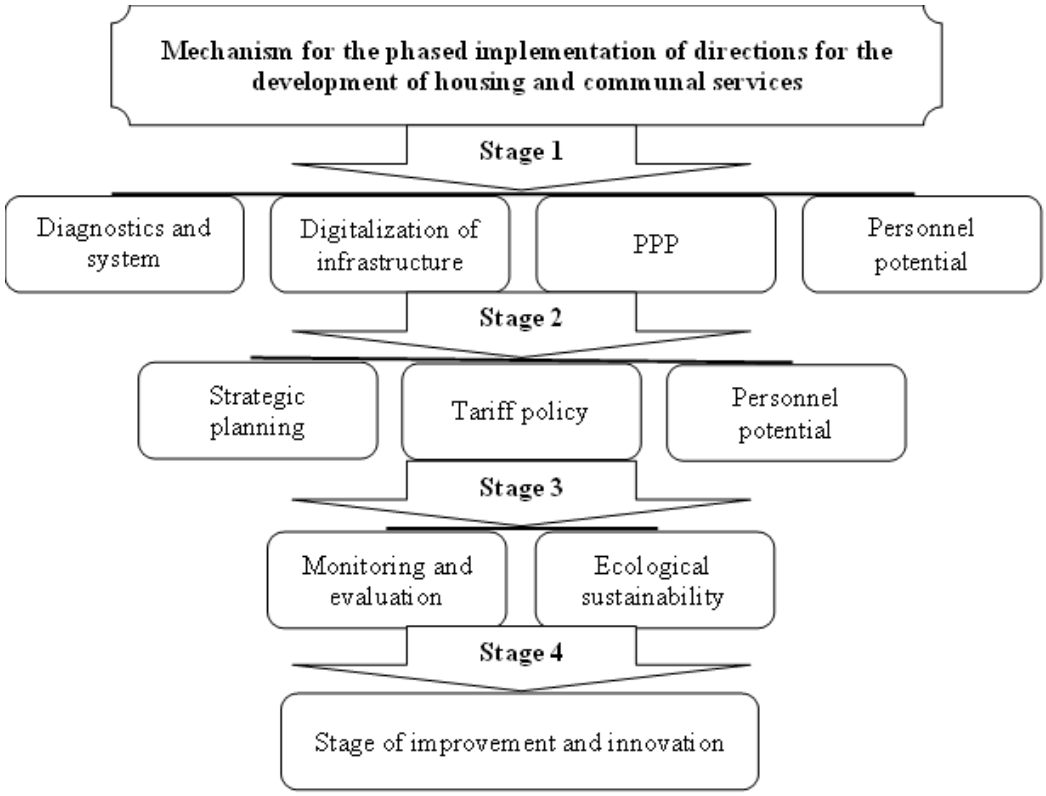

Figure 2. Mechanism for the phased implementation of directions for the development of Public utilities [13].

From Figure 2 above, it can be seen that the mechanism for the development of Public utilities is formed at the state level as a unified system, and its main task is to improve the quality of services, improve the standard of living of the population, and ensure the effective use of resources in this area. This mechanism is based on a comprehensive approach, combining regulatory, economic, technological, and social factors. Specifically:

Firstly, the goals and strategic objectives set by the state will be clearly indicated, and national standards and requirements in the service sector will be created, which will form a solid legal and institutional basis for sustainable development.

Secondly, investments will be attracted through economic and financial mechanisms, tariff policy will be optimized, and systems aimed at saving resources and increasing competitiveness will be introduced. At the same time, technological modernization and digitalization processes allow for improving the quality of service, automated monitoring, and performance evaluation through databases.

The mechanism is also aimed at continuously improving personnel potential, forming a culture of citizens' use of services, and developing a system for assessing the quality of services. Thus, all elements work complementarily, resulting in an efficient, transparent, and adapted service system to the real needs of the population, which serves to significantly improve the overall quality of life [9].

In our opinion, this integrated approach to the mechanism ensures sustainable development and allows for the continuous improvement of processes in the industry, and is also aimed at further improving the quality of services through the introduction of international experience and the application of innovative solutions.

4. Conclusion

In our opinion, as a result of researching the main directions for the development and improvement of the efficiency of Public utilities, we have developed proposals and recommendations aimed at increasing the efficiency of the system's activities. These are:

Firstly, the widespread introduction of digital management systems is required, since the quality, continuity of services and the ability to monitor consumer requests in real time significantly increase efficiency; therefore, it is advisable to create a system of indicators for calculations, operational warning of emergencies, energy consumption monitoring, and assessment of the activities of service organizations through a single digital platform.

Secondly, it is necessary to ensure financial and technical stability, while forming effective mechanisms for attracting investments, taking into account the level of obsolescence of utility networks, expanding public-private partnerships, and transferring tariff policy to an economically sound, transparent system; this will increase investment interest in the sector and ensure long-term stability of services.

Thirdly, the process of phased modernization of infrastructure should be carried out on the basis of scientifically based priorities, that is, it is necessary to create a system for diagnosing the state of networks, identifying areas with the largest losses, introducing energy-saving technologies, and measuring the effectiveness of modernization; this process will reduce operating costs in the long term.

Fourthly, the development of human capital and service culture is a priority, and it is necessary to attract qualified specialists to the industry, regular training programs for employees, service management trainings, and strengthen communication mechanisms that increase public awareness of services, since the quality of service is closely related not only to technical processes, but also to the human factor.

Analysis of the development and improvement of the efficiency of Public utilities shows that the sustainable development of the system should be carried out through several integrated directions. Through the implementation of digital management systems, it will be possible to establish effective control over the quality, continuity, and consumption of resources of services. To ensure financial and technical stability, it is necessary to attract investments, expand public-private partnerships, and form a fair tariff policy. In addition, the phased modernization of infrastructure, the introduction of energy-saving technologies, and the development of a system for determining regional priorities will significantly increase the efficiency of services. Finally, the development of human capital and improvement of service culture, the introduction of mechanisms for improving the skills of employees and increasing public satisfaction with services will ensure the long-term sustainability of the system. Thus, the implementation of a comprehensive and phased approach in the field of Public utilities will not only improve the quality of services, but will also allow for the effective satisfaction of the population's needs in urbanization processes and ensure competitiveness in the sector.

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