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The Process Model of Digital Transformation of a Resource-Supplying Organization

O.V. Ustinov
St. Petersburg State University of Architecture and Civil Engineering, Saint Petersburg, Russian Federation

ABSTRACT

The digital transformation of resource-supplying organizations in Russia is becoming a key element in ensuring the sustainable development of the public utilities sector. In the context of increasing demand for energy efficiency, automation, and transparency of business processes, companies are progressively implementing advanced technologies ranging from smart metering systems and remote monitoring to big data analytics and artificial intelligence. These solutions enable organizations to optimize operating costs, reduce resource losses, improve forecasting accuracy, and enhance the quality of customer service. The **objective** of this study is to develop a process-based model of digital transformation for a resource-supplying organization. The **relevance** of the research is determined, on the one hand, by the need to ensure both the sustainable development of public utility enterprises and the accessibility of their services to the population, and, on the other hand, by the necessity to align with national regulatory priorities and state policy. In particular, this includes achieving the objectives of the national project "Digital Economy" and the ministerial project "Smart City" implemented by the Ministry of Construction of the Russian Federation. The article presents an analysis of the impact of methodological and practical approaches to the implementation of innovative technologies, modern services, and digital platforms on managerial decision-making processes. The study employs such research methods as comparative and logical analysis, including a review of academic literature. The **findings** may be of practical relevance to resource-supplying organizations and to the academic community in the development of effective approaches to managing public utility infrastructure.

Keywords: public utility infrastructure; digitalization; smart housing and utilities; innovative technologies; digital solutions

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INTRODUCTION

In recent years, the utilities sector — particularly water supply, district heating, and other municipal services — has witnessed active implementation of digital technologies. A notable example is the "Digital Water Utility" project developed by Rosatom Infrastructure Solutions (RIS JSC[1]), implemented in Glazov (Udmurt Republic). Digitalization in this case enabled a reduction in network losses by 11%, a decrease in electricity consumption by 20%, and a 60% increase in labor productivity. These results demonstrate the significant potential of such technological solutions for improving operational efficiency and reducing costs. Another relevant case is the digital transformation experience of Nizhny Novgorod Vodokanal.

Government support for the digitalization of the housing and utilities sector has further contributed to its development. Within the framework of the national projects "Digital Economy" and "Housing and Urban Environment," the "Smart City[2]" initiative was launched, with federal budget funding exceeding 800 million RUB in 2019–2024. Large-scale digitalization of urban infrastructure has included methodological support for the development and implementation of standards and solutions, as well as the creation of a repository of best practices.[3]

However, despite the positive outcomes achieved, the level of digitalization expenditure among resource-supplying organizations (RSOs) remains relatively low. According to a study conducted by researchers at the Higher School of Economics (HSE), telecommunications companies, the financial sector, and manufacturing industries rank highest in terms of digital technology spending. Energy supply organizations occupy 11th place, while water supply and wastewater management organizations rank only 18th.[4] The primary reason for this situation is the lack of sufficient financial resources for infrastructure maintenance and renewal, driven by high asset depreciation, payment collection issues, and tariff regulation constraints. As a result, automation is not a strategic priority for these organizations.

In the context of limited resources, it is essential to understand the specifics of digital solution implementation in RSOs in order to ensure an optimal balance between costs and achieved outcomes.

GENERAL MODEL FOR IMPLEMENTING INNOVATIVE TECHNOLOGIES IN ORGANIZATIONS

At present, the academic literature extensively addresses innovation management. Among the diversity of approaches to innovation adoption, a universal model can be identified, which includes the following key stages of the innovation process[5] [1]:

- defining objectives and generating an idea;
- developing an innovation program and its feasibility study;
- allocating responsibilities and making decisions on the innovation program among all participating stakeholders;
- implementing the innovation program;
- monitoring the execution of the innovation program;
- analyzing and evaluating the effectiveness of the innovation program;
- adjusting the innovation program.

Any innovation process — whether process optimization, the development of a new product, or service quality improvement — begins with setting objectives that reflect the strategic priorities of the organization.

An idea is then generated, drawing on both internal sources (employees, management) and external stakeholders (customers, partners, com-

[1] JSC "Rosatom Infrastructure Solutions" (official website). URL: https://www.rusatom-utilities.ru/activities/tsifrovye-tekhnologii/dlya-goroda-i-regiona/smart/informatsionnaya-sistema-tsifrovoy-vodokanal-alternativnoe-nazvanie-programmnyy-kompleks-tsifrovoe-teo-detail/

[2] Ministry of Construction of Russia (official website). URL: https://minstroyrf.gov.ru/trades/gorodskaya-sreda/proekt-tsifrovizatsii-gorodskogo-khozyaystva-umnyy-gorod/; "Smart City" Project. URL: https://gorodsreda.ru/smartcity

[3] Ministry of Digital Development, Communications and Mass Media of the Russian Federation (official website). URL: https://digital.gov.ru

[4] Expenditures on the Development of the Digital Economy in 2023. Institute for Statistical Studies and Economics of Knowledge, HSE University.URL https://issek.hse.ru/news/984068213.html (date of access: 03.06.2025).

[5] Beynar I. A. Innovation Management. Study guide. Kursk: Universitetskaya Kniga; 2021. 80 p.

petitors). Analytical and creative methods are used for idea generation, including the MECE principle (Mutually Exclusive, Collectively Exhaustive) [2], which ensures logical completeness and the absence of overlap in decision-tree structuring. This tool enables a systematic approach to selecting innovation directions by evaluating alternatives in terms of benefits, costs, and probability of success.

Next, based on the idea, a structured implementation plan is developed — an innovation program.

In parallel, a feasibility study (techno-economic justification) [3] is conducted, during which the technological feasibility of the idea is assessed, required investment volumes are specified, risks are evaluated, and expected returns are forecasted. The feasibility study plays a critical role in the decision-making process regarding project initiation and the selection among alternative options.

For the successful implementation of an innovation program, changes in the organizational structure of resource-supplying organizations (RSOs) are required, along with the allocation of responsibilities among participants [4]. This involves the formation of a project team or working group, as well as the establishment of accountability systems, interaction mechanisms, and communication channels. At the same time, it is important to ensure a balance between centralized management and the involvement of all stakeholders — from top management to operational staff.

At the implementation stage of innovation, particular attention is paid to the management of timelines, budgets, and quality, as well as to the timely response to emerging changes [5]. In parallel, the execution of the program is monitored and key performance indicators are continuously tracked.

Following the pilot implementation of innovations, an evaluation of the achieved results is conducted in terms of:

- quantitative indicators (increase in profit, reduction in costs, productivity growth);
- qualitative effects (improvement of customer experience, increased organizational flexibility, development of an innovation-oriented culture);
- social and environmental factors (where applicable).

Within the assessment framework, the degree of achievement of the set objectives, the level of deviation from the original plan, and the efficiency of resource utilization are determined.

Based on the analysis of project effectiveness, one of the following decisions is made:

- refinement of the innovation;
- introduction of additional solutions (adjustment);
- scaling of successful practices to other departments or processes;
- closure of the project in case of low effectiveness.

The adjustment stage is a crucial feedback mechanism, enabling the transition from a one-time innovation project to a continuous organizational development process.

In contemporary conditions, among various directions of enterprise innovation, digital transformation (DT) is gaining particular importance. It not only meets the requirements of technological progress but also serves as a key factor in enhancing the sustainability, transparency, and efficiency of organizations, particularly in the resource supply sector.

EXISTING THEORETICAL AND PRACTICAL APPROACHES TO DIGITAL TRANSFORMATION OF A RESOURCE-SUPPLYING ORGANIZATION

As part of the analysis of practical approaches to the digital transformation (DT) of resource-supplying organizations (RSOs), this study examines the experience of Nizhny Novgorod Vodokanal and Rosatom Infrastructure Solutions.

Case Study: Nizhny Novgorod Vodokanal[6]

As the foundation for its digital transformation initiatives, the company adopted the domestic back-

[6] How Digital Technologies Transformed Nizhny Novgorod Vodokanal. Delovoy Kvartal. 2023. URL: https://nn.dk.ru/news/237186010; URL: https://vodanews.info/upravlenie-it-proektami-opyt-ao-nizhegorodskij-vodokanal/

office personnel management system "Gandiva," a software platform that provides functionality for communication management, user support (Service Desk), electronic document management, and project management.

The implementation of this system was initiated by the IT department, as its employees possess the highest level of competence in mastering and applying new digital tools. Moreover, effective interaction between IT specialists and other departments was identified as a key factor determining the success of the organization's digital transformation.

The implementation of the "Gandiva" system followed several stages:

- approval of the decision to implement the information system through an executive order issued by top management;
- establishment of a digital transformation working group (Digital Transformation Office), which included representatives of all organizational units where business processes were subject to change. Within the Digital Transformation Office, technical specialists were tasked either with selecting appropriate solutions from other industries or with developing them independently. In practice, the first approach was applied, drawing on best practices from banking, IT companies, telecommunications operators, car dealerships, and other sectors;
- initial employee training and communication of the benefits of the innovation;
- system implementation;
- provision of user support and assistance in working with the new system.

The main objectives of automation and digitalization at Nizhny Novgorod Vodokanal included optimizing customer interaction processes, increasing transparency of business processes across all management levels, and improving the organization of production activities aimed at cost reduction.

A wide range of information systems was introduced at the enterprise, each implemented as a separate innovation project: 10 solutions in 2019, 12 in 2020, and 14 in both 2021 and 2022.

Tables 1 and *2* provide a brief description of the most significant digital systems and services.[7]

The key challenges of digital transformation faced by the enterprise are presented in *Table 3*.[8]

Overall, based on the analysis of the experience of Nizhny Novgorod Vodokanal, the following stages of digital transformation can be identified (*Table 4*[9]).

When implementing digital systems at Nizhny Novgorod Vodokanal, the following principles were applied:

- Systems approach: integration of all projects into a unified digital development strategy.
- Customer orientation: focus on improving interaction with customers and enhancing service quality.
- Information security: special attention to data protection and compliance with regulatory requirements.
- Training and professional development: improvement of employees' digital literacy and training in new technologies.

Case Study: Rosatom Infrastructure Solutions

Rosatom Infrastructure Solutions is gradually implementing a platform-based hardware and software complex in small cities across its facilities to automate core business processes of resource-supplying organizations, known as the "Digital Water Utility" system.

The primary objective of this initiative is to create a unified information environment for:

- resource management based on big data;
- digital monitoring of measurable performance indicators;
- improving the efficiency and transparency of processes;
- establishing high-tech workplaces with increased productivity.

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[7] How Digital Technologies Transformed Nizhny Novgorod Vodokanal. Delovoy Kvartal. 2023. https://nn.dk.ru/news/237186010

[8] KODA NEW. URL: https://vodanews.info/upravlenie-it-proektami-opyt-ao-nizhegorodskij-vodokanal/

[9] How Digital Technologies Transformed Nizhny Novgorod Vodokanal. Delovoy Kvartal. 2023. https://nn.dk.ru/news/237186010

Table 1

Production Services

Service Name	Year of Implementation	Functionality	Effects
Production Resource Management	2020	Request tracking, task execution control, reporting statistics, and GIS-based mapping analysis	Improved efficiency of maintenance operations; reduced reporting time
Legal Digital Platform	2020	Case management, template documentation, integration with electronic document management systems, the State Automated System "Justice," and Outlook	Increased efficiency and transparency of litigation and claims management processes
Information Security Systems	2021	Prevention of data leaks and information security threats	Strengthened enterprise information security
Employee Telegram Bot	2021	Notifications about emergencies, outages, and service requests	Reduced SMS costs and improved information delivery
Address Storage and Barcode System	2022	Inventory accounting, real-time material tracking, terminal-based search and issuance, automated resource planning	Optimization of warehouse operations without the need for desktop computers
Business Intelligence (BI) Visualization Systems	2022	Real-time monitoring of key performance indicators of equipment, units, workload, and service requests	Integration of monitoring into real-time operational processes; optimization of equipment performance and staff workload
Automated Process Control System (APCS)	2022	Management of technological equipment, automated data collection from flow meters, control of smooth start-up of units, pressure regulation systems, metering, automation, etc.	Automation and real-time remote control; increased operational reliability
IP Telephony (Yeastar IP PBX)	2022	Monitoring system and transition to IP-based telephony	Faster response to incidents
Centralized Data Exchange (Datareon ESB)	2023	Integration of all enterprise information systems	Data centralization and synchronization
Digital Literacy Enhancement	Ongoing	Professional development programs, email-based practical guidance	Improved employees' IT competencies
Cisco HyperFlex Edge (Core of Updated IT Infrastructure)	2019	Servers, data storage system, and virtualization platform	Increased performance of core enterprise services and rapid deployment of new services

Source: compiled by the author.

Таблица 2 / Table 2

Customer Services

Service Name	Year of Implementation	Functionality	Effects
Mobile Inspector	2020	Automation of repair team operations, route optimization, and monitoring of customer service requests	Threefold increase in processed requests; reduced service time
Customer's Personal Account	2020	Submission of meter readings, bill payment, service requests, reconciliation reports, inspector call requests, and contract conclusion	Online access to services; improved convenience for both legal entities and individuals
Electronic Queue System	2020	Appointment scheduling for the customer service center	Improved service convenience and reduced waiting times
Unified Contact Center	2020	Web telephony, call registration, communication history tracking	Improved service quality; increased payment collection rates
Telegram Bot for Customers and Email Notifications	2021	Notifications on service outages, debts, and accrued penalties; answers to standard customer inquiries	Reduced operator workload; elimination of SMS notification costs
Automatic Meter Reading Recognition	2022	Recognition of utility meter data from photographs	Reduced manual labor; improved user convenience
Voice Robot (Aimylogic)	2023	IVR-based notifications about cold water supply interruptions	46% of customer inquiries automated

Source: compiled by the author.

Table 3

Challenges of Digital Transformation

Problem	Description
Increasing number of information systems	Systems overlap with each other, unintentionally reducing employee productivity
Cultural change	Natural human resistance to change creates implementation difficulties
Lack of top management support	Insufficiently defined digital transformation governance framework, including the absence of a unified digital development unit
Security	Successful digital transformation requires strong attention to cybersecurity and data protection
Excessive workload	Increased workload for employees during the adaptation period and introduction of new systems and services
Lack of competencies	Insufficient knowledge and skills in modern digital solutions among employees

Source: compiled by the author.

Table 4

Digital Transformation Scheme of JSC Nizhny Novgorod Vodokanal

2019	2020	2021	2022–2025
Initiation	**Development**	**Infrastructure**	**Integration**
Establishment of a Digital Transformation Office with a development unit; launch of pilot projects	Integration of IT and technical support functions; launch of key digital services	Modernization of server and network infrastructure; creation of a data processing center	Development of IT infrastructure, information security systems, APCS (Automated Process Control Systems), and business applications

Source: compiled by the author.

Table 5

Key Components of the Digital Water Utility complex

Component Name	Description
Component 1	Infrastructure for collecting and transmitting data on water consumption, pressure, resource usage, and other operational parameters
Component 2	Software suite designed for the collection, processing, storage, and visualization of data received from monitoring facilities
Component 3	Functional modules enabling adjustment of equipment operating modes and facilitating faster detection and elimination of energy and resource losses

Source: compiled by the author.

The key components of the “Digital Water Utility” system are presented in *Table 5*.[10]

The architectural modules of the “Digital Water Utility” system are presented in *Table 6*.[11]

The implementation of the “Digital Water Utility” system led to the following outcomes[12]:

- a reduction in repeated failures by up to 17%;
- an increase in labor productivity of up to 20%;
- a decrease in network losses of up to 45%.

The high effectiveness of modern information solutions is achieved due to:

- increased labor productivity and optimization of payroll costs through the creation of skilled jobs and the enhancement of production staff competencies;
- reduced failure rates, leading to a significant improvement in the quality of utility services while minimizing losses and repair costs;
- increased useful output, revenue, and actual payment collection rates;
- substantial reduction in energy resource costs.

For the implementation of the “Digital Water Utility” system at Rosatom Infrastructure Solutions, a Digital Transformation Competence Center for the housing and utilities sector (HUS) was established. Its staff included specialists responsible for the development and deployment of software modules, installation of sensors, employee training, preliminary analysis of digital maturity levels, and other related functions.

At the initiation stage of the “Digital Water Utility” project, an executive order was issued at

[10] JSC “Rosatom Infrastructure Solutions” (official website). URL: https://www.rusatom-utilities.ru/activities/tsifrovye-tekhnologii/dlya-goroda-i-regiona/smart/informatsionnaya-sistema-tsifrovoy-vodokanal-alternativnoe-nazvanie-programmnyy-kompleks-tsifrovoe-teo-detail/

[11] Ibid.

[12] JSC “Rosatom Infrastructure Solutions” (official website). URL: https://www.rusatom-utilities.ru/activities/tsifrovye-tekhnologii/dlya-goroda-i-regiona/smart/informatsionnaya-sistema-tsifrovoy-vodokanal-alternativnoe-nazvanie-programmnyy-kompleks-tsifrovoe-teo-detail/

Table 6

Architectural Modules of the "Digital Water Utility"

Module	Short description
Central Dashboard	Responsible for collecting, storing, processing, and visualizing large volumes of data. Used for building BI content (analytical reports and forecasts, preliminary managerial decisions based on machine learning). Enables evaluation of key performance indicators and process costs
Mode Analysis	Identifies and maintains optimal operating parameters of technological facilities using advanced process control (APC) technologies. The resulting data are transmitted to the control and dispatching system
Work Orders	Provides centralized management of service requests, enabling more efficient organization of repair works and optimized use of equipment and transport resources
Inspector Module	Increases the efficiency of the sales unit by automating field inspections, optimizing staff workload, and detecting cases of unauthorized water consumption using mobile technologies and AI
Balance Analysis	Reduces water losses through the analysis of data from multiple systems and the generation of recommendations for detecting abnormal consumption patterns
Third-Party Software Components	Include software solutions used in combination with the enterprise's internal systems
Low-Level Equipment	Hardware layer that ensures the operation of automated control systems and data acquisition systems

Source: compiled by the author.

the enterprise, including a detailed implementation schedule for digital transformation. Responsible personnel from all involved structural units were assigned. Project progress monitoring was carried out using Microsoft Project within a dedicated information platform of Rosatom.

In analyzing theoretical approaches to the digital transformation (DT) of resource-supplying organizations, the present study refers to the work of E.G. Evseev [9], in which, based on a review of existing research, the key stages of digitalization of heat supply organizations (HSOs) are identified:

1) assessment of the current level of digital maturity of the organization (technical, software, and human resources);

2) definition of digitalization objectives (automation of data collection, storage, processing, and analysis);

3) formulation of system requirements aligned with digitalization goals (functional, technical, and other requirements);

4) development of a digitalization plan (assessment of equipment needs, staff training, and financing; risk assessment; and task allocation);

5) implementation of the digitalization plan (installation of equipment, personnel training, software deployment, and evaluation of results).

Furthermore, E.G. Evseev proposes implementing digital transformation in HSOs using a spiral life-cycle model of information systems, in which development begins with a prototype that is progressively refined and expanded during implementation until the required outcome is achieved.

A number of authors [7–9] also consider a process similar to the one described above for the digital transformation of a utility enterprise, identifying priority areas for business process automation:

- Management processes (including economics and finance, revenue generation, and investment activities);
- Operational activities (covering quality control, supply of utility resources, operation of engineering systems, production monitoring and management, customer interaction, handling of requests, management of emergencies and incidents, as well as routine and capital repairs);
- Support activities (including construction, reconstruction, modernization, management of the

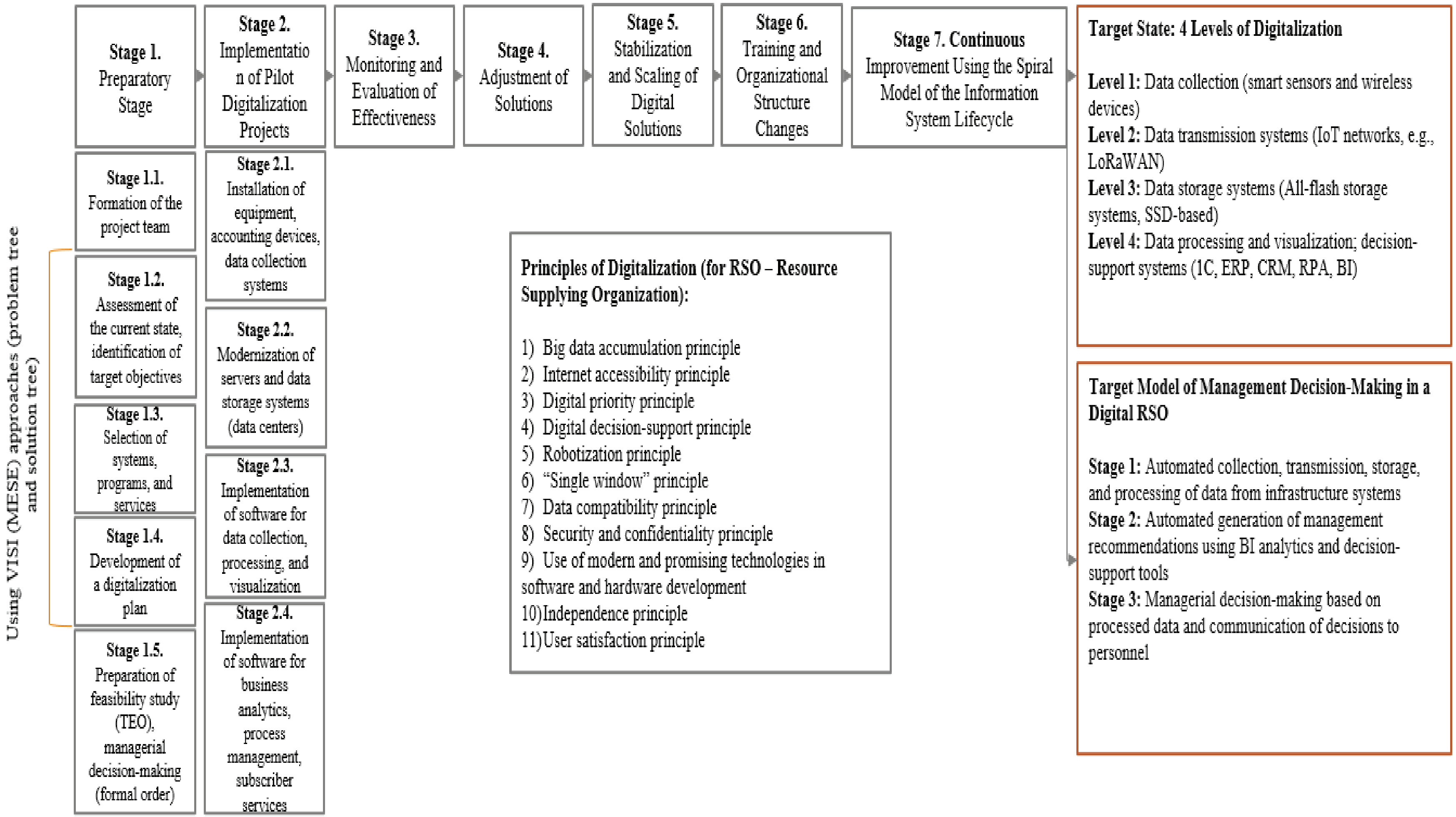

Fig. **Process Model of Digital Transformation of the RSO**

Source: compiled by the author.

energy complex, vehicle fleet management, contractual work, and procurement).

Based on the analysis of the theoretical foundations of innovation management, practical experience of digital transformation (DT) in resource-supplying organizations (RSOs), and academic research on the digitalization of utility enterprises, the author has developed a process model of digital transformation for RSOs (see *figure*).

Within this model, the author proposes to:

- implement a seven-stage digital transformation process for RSOs;
- apply the WISY (MECE) approach at the preparatory stage;
- use the digitalization principles previously developed by the author [10] during the implementation of the specified stages;
- ensure the achievement of the target level of digital maturity and the relevant stages of managerial decision-making.

FINDINGS

The study analyzed practical experience of digital transformation in RSOs based on the cases of Nizhny Novgorod Vodokanal and Rosatom Infrastructure Solutions. Both companies applied a systematic approach to digitalization, established dedicated working groups, and implemented a wide range of IT solutions aimed at improving both internal operational efficiency and customer service quality.

Nizhny Novgorod Vodokanal demonstrated steady development of its digital infrastructure from 2019 to 2022, implementing more than 30 innovation projects. The introduction of systems such as production resource management, BI analytics, IP telephony, Telegram bots, voice assistants, and automated customer accounting and service platforms significantly improved business process transparency, reduced costs, and increased labor productivity.

Rosatom Infrastructure Solutions implemented the “Digital Water Utility” platform, focused on automating key business processes in small cities. The platform includes both software and hardware modules for data collection and analysis, equipment management, and resource optimization. As a result, significant effects were achieved, including reduced losses and increased labor productivity.

The analysis of these cases demonstrates that digital transformation requires not only technological resources but also organizational maturity: the presence of a competence center, strong involvement of top management, continuous employee training, and the development of corporate culture. In addition, a monitoring and project control system plays a crucial role.

Theoretical approaches presented in the reviewed literature confirm the relevance of a phased implementation of digitalization, including the assessment of digital maturity, formulation of objectives, development of a digital transformation program, and its execution using a spiral model.

Based on the analysis of both theory and practice, the author proposes a process model of digital transformation for municipal RSOs, aimed at achieving the target level of digital maturity and supporting data-driven managerial decision-making. This makes the model applicable to a wide range of organizations in the sector. Special attention is given to the MECE methodology, which is used in the formation of innovative ideas. This approach helps avoid duplication and omissions in analysis, ensuring completeness and logical consistency of possible options.

CONCLUSION

A distinctive feature of the process model presented in this article is the synthesis of classical stages of the innovation process with the sector-specific characteristics of the utility industry. The model formalizes the target state of digital maturity in resource-supplying organizations (RSOs) and the stages of managerial decision-making under process automation conditions. This enables a transition from fragmented initiatives to a coherent, integrated digital transformation strategy for utility enterprises.

The practical significance of the study’s findings lies in providing RSO managers with a structured toolkit for planning and implementing corporate digital transformation. The proposed model serves as a basis for developing action plans and allows for the optimization of the balance between implementation costs and achieved operational effects.

Further research is expected to focus on testing the model across different RSOs and developing methodological guidelines based on it to overcome "digital noise" and organizational-cultural barriers. This, in turn, will create opportunities for scaling best practices and improving the overall efficiency of the utility sector.

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ABOUT THE AUTHOR

Oleg V. Ustinov — Postgraduate student, St. Petersburg State University of Architecture and Civil Engineering, Saint Petersburg, Russian Federation; Head of Sales, Cryogas JSC, Saint Petersburg, Russian Federation
http://orcid.org/0009-0001-0311-6661
gr.ustinov@gmail.com

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