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Calculation tools for determining the effects of digitalization of housing and utilities sector

This article discusses the digitalization of housing and utilities companies. The relevance and expediency of studying the digitalization of management companies at the present time, taking into account the definition of the effects of digitalization, was analyzed. The author proposed to calculate the economic performance indicators of the digitalization of the management company based on the calculation of transaction costs. Based on the analysis, the author gave the author's interpretation of the concept: transaction costs of the management company in the conditions of digitalization of housing and communal services. The classification of transaction costs of the management company by types was carried out, and their detailing was carried out taking into account the impact of digitalization and the types of cost savings of consumers were identified. The main indicators of savings of the management company as a result of reduction of transaction costs were determined. In addition, the author highlighted the main indicators of consumer cost savings as a result of digitalization of the management company. The author developed a calculation toolkit for determining the indicators for reducing transaction costs of the management company and consumer cost savings, which was applied in practice to calculate the efficiency of digitalization of the management company of Voronezh, LLC "Favorit". The developed calculation toolkit helps to determine not only the amount of cost savings of the management company for each selected type of transaction costs, but also the amount of total savings, taking into account the cost savings of residents. As a result of the calculations made for LLC "Favorit" according to the calculation tools developed by the author to calculate the indicators for reducing transaction costs of the management company and cost savings of residents, and allocating the main costs, it was concluded that digitalization of housing and utilities services is necessary and beneficial.

Keywords: *housing and utilities sector, digitalization, "Smart Housing and Utilities", transaction costs, savings of the management company, savings of consumers, "smart" meters*

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In the age of information technology, when there is a total digitalization of all spheres of life of the population, we can safely say that it is the widespread penetration of digital technologies into all spheres of the economy that determines the trajectory of the economic development of the entire country and society as a whole. However, here it is worth paying special attention to one of the most basic sectors of the economy, which has a huge impact on the standard of living of the entire population, satisfying the basic needs of people in comfortable housing, water, heat, electricity, gas, namely the housing and utilities sector.

Within the framework of the national programme "Digital Economy of the Russian Federation", the project of digitalization of the urban economy "Smart City" is being implemented, which highlights the standard "Smart Housing and Utilities"[1, 2].

"Smart Housing and Utilities" implies great prospects for the development of the housing and utilities sector, and despite the fact that the digitalization of the housing and utilities sector is only at the beginning of its development, we have all heard more than once that it will help make the housing and utilities sector more efficient, profitable, transparent, fair, economical [1–3].

The main economic indicators of the effectiveness of digitalization of the housing and utilities sector, for such participants as consumers and management companies (MC), can be distinguished as follows:

- time saving;
- cost savings.

The author of this article analyzed possible options for achieving cost and time savings of the MC and consumers of housing and utility services as a result of digitalization and proposed a calculation toolkit that can be used to assess the results of digital transformation and the efficiency of "Smart Housing and Utilities".

The author proposes to calculate economic indicators of digitalization performance for the MC based on the calculation of transaction costs, which are typical for any sphere of the economy, including housing and utilities sector.

In 1937, the English economist R.G. Coase, in his article "The Nature of the firm", for the first time defined the concept of transaction costs as "the costs of using the market mechanism" [4].

Currently, there are many different disputes among scientists regarding the content of the concept of transaction costs, but there is no single approach to their quantification assessment, which contributes to the emergence of uncertainties and inaccuracies in their definition and calculations [5, 6].

Organizations can determine their transaction costs at their discretion, which makes it necessary

1 Passport of the national project "National Program "Digital Economy of the Russian Federation" (approved by the Presidium of the Presidential Council for Strategic Development and National Projects, Protocol No. 7 dated 04.06.2019). URL: https://sudact.ru/law/pasport-natsionalnogo-proekta-natsionalnaia-programma-tsifrovaia-ekonomika (accessed: 11.04.2023).

2 "Basic and additional requirements for smart cities (Smart City standard)" (approved by the Ministry of Construction of Russia 04.03.2019). URL: http://www.minstroyrf.ru/upload/iblock/74f/Standart.pdf (accessed: 11.04.2023).

to allocate, classify and evaluate the transaction costs of the MC in order to manage them and accurately calculate.

The author of this article proposed the following interpretation of the concept: transaction costs of the MC in the conditions of digitalization of housing and utilities sector are the costs arising from solving issues related to contractual and analytical work, the functioning of the consumer interaction service and the MC on all issues (including emergencies), information collection, storage, processing and control services.

To determine the calculation tools for evaluating the results of the digitalization of the MC, the author carried out the classification of transaction costs of MC by type and their detailing, taking into account the impact of digitalization of housing and utilities sector and without, as well as the classification of consumer cost savings [7] (Table 1). In accordance with the selected classification, the toolkit for calculating the indicators for reducing transaction costs of the MC and cost savings of consumers were determined (Table 2).

Table 1. The impact of digitalization on the reduction of transaction costs of MC and cost savings of consumers (Source: compiled by the author)

Type of transaction costs of MC and consumer costs	Detailing transaction costs of the MC and consumer costs		Indicators saving of MC and consumer costs
	Before digitalization	After digitalization	
Costs of collecting information on meter readings	The costs of bypassing controllers and manual processing of meter readings, conducting analytical work	Automatic remote transmission, collection and processing of meter readings	• saving on wages ER_{zp}^{si}; • saving labour costs of engineering and technical workers E_t^{si}; • saving paper E_b^{si}; • saving consumables (stationery, shoe covers) E_r^{si}; • savings on transportation costs E_{tr}^{si}
Costs of interaction with consumers of housing and utility services	The costs of organizing reception on the appeals of owners, keeping records on appeals, receiving and registering calls from owners	Automatic remote service for receiving, registering and processing requests. Electronic remote communicative communication with consumers of housing and utility services	• saving labour costs of engineering and technical workers E_t^{vp}; • saving paper E_b^{vp}
The costs of emergencies, troubleshooting and unauthorized connections	The costs of eliminating the consequences of emergencies caused by MC (for example, flooding of neighbors), malfunctions, the costs of unscheduled repairs/replacement of communal property	Instant remote notification of accidents, malfunctions and unauthorized connections. Reducing the number of utility accidents caused by MC	• saving labour costs of engineering and technical workers E_t^a • saving damage from accidents E_a^a
The costs of accrual of receipts, accounting	The costs of conducting analytical work, manual calculation of charges for housing and utilities services. Visiting public service offices for reporting	Electronic document management, automatic generation of reports and receipts. Electronic access to public services, signing documents with a digital signature	• saving labour costs of engineering and technical workers E_t^o • savings on transportation costs E_{tr}^o
Costs of holding general meetings of owners	The costs of organizing general meetings (paper notifications, leaflets, minutes, working hours for a face-to-face meeting of owners and representatives of MC)	Electronic remote notification of the meeting and electronic voting	• saving labour costs of engineering and technical workers E_t^s; • saving paper E_b^s
The costs of consumers for payment of receipts for housing and communal services and utilities	Payment costs: for the consumption of municipal resources according to the standards; “extra lines” in receipts for housing and utilities services; additional unclaimed services	Payment for the consumption of utility resources by “smart” metering devices. Selection of necessary additional services and exclusion of “extra lines” from receipts for housing and utilities services at the electronic general meeting	• reduction of individual consumption of municipal resources R_{kr}; • exclusion of “extra lines” from receipts for housing and utilities services R_k; • reducing the cost of additional services R_D

Table 2. Calculated indicators of savings of MC and consumer costs (Source: compiled by the author)

Indicators	The formula for calculating the savings of MC and consumers	The formula for calculating the total savings
Costs of collecting information about meter readings		
E_{zp}^{si} — saving on wages; E_t^{si} — saving labour costs of engineering and technical workers; E_b^{si} — saving paper; E_r^{si} — saving consumables; E_{tr}^{si} — saving on transportation costs; j — number of groups of dismissed employees; ZP_j — average monthly salary of employees of the j-th group; C_j — number of dismissed employees of the j-th group; L — the number of engineering and technical employees of MC engaged in processing acts of circumvention; ZP_l — average monthly salary of engineering and technical employees of the position l; ΔT_l — saving of working time of engineering and technical employees of the position l as a result of digitalization; K_{es} — number of personal accounts allocated for crawling; $\overline{K}_b^{ud}$ — the amount of paper spent on circumvention acts for 1 personal account; $\overline{C}_b$ — average cost of paper; $\overline{C}_k^{ud}$ — the average cost of the office allocated for one crawler controller; Ch_k — number of dismissed crawler supervisors; $\overline{K}_{es}^{o}$ — number of personal accounts allocated for crawling; $\overline{C}_{ba}$ — the average cost of shoe covers; Ch_k — number of dismissed crawler supervisors; $\overline{\overline{CT}}_k^{ud}$ — the amount allocated for transportation costs per crawler controller	$E_{zp}^{si} = \sum_{j=1}^{j} C_j ZP_j$ $E_t^{si} = \sum_{l=1}^{L} (ZP_l - \Delta T_l ZP_l)$ $E_b^{si} = K_{es} \overline{K}_b^{ud} \overline{C}_b$ $E_r^{si} = \overline{C}_k^{ud} Ch_k + \overline{K}_{es}^{o} \overline{C}_{ba}$ $E_{tr}^{si} = Ch_k \overline{\overline{CT}}_k^{ud}$	$ER_u^{si} = E_{zp}^{si} + E_t^{si} + E_b^{si} + E_r^{si} + E_{tr}^{si}$
Costs of interaction with consumers of housing and utilities services		
E_t^{vp} — saving labour costs of engineering and technical workers; E_b^{vp} — saving paper; N — the number of MC engineering and technical workers engaged in interaction with consumers of housing and communal services; ZP_n — average monthly salary of engineering and technical employees of the position N; ΔT_n — saving of working time of engineering and technical employees of position N as a result of digitalization; $\overline{O}$ — average number of registered applications of housing and utilities services consumers in MC; $\overline{K}_{bo}^{ud}$ — the amount of paper spent on registration of registered appeals and responses; $\overline{C}_b$ — average cost of paper	$E_t^{vp} = \sum_{n=1}^{N} (ZP_n - \Delta T_n ZP_n)$ $E_b^{vp} = \overline{O}\ \overline{K}_{bo}^{ud}\ \overline{C}_b$	$ER_u^{vp} = E_t^{vp} + E_b^{vp}$
The costs of emergencies, troubleshooting and unauthorized connections		
E_t^a — saving labour costs of engineering and technical workers; E_a^a — saving damage from utility accidents; B — the number of engineering and technical workers involved in the elimination of municipal accidents; ZP_b — average monthly salary of engineering and technical employees of the position B; ΔT_b — saving the working time of engineering and technical staff of position B as a result of digitalization; $\overline{R}_{a1}$ — the average cost of eliminating accidents caused by MC before digitalization; $\overline{R}_{a2}$ — the average cost of eliminating accidents caused by MC after digitalization	$E_t^a = \sum_{b=1}^{B} (ZP_b - \Delta T_b ZP_b)$ $E_a^a = \overline{R}_{a1} - \overline{R}_{a2}$	$ER_u^a = E_t^a + E_a^a$

The costs of accrual of receipts, accounting		
E_t^o — saving labour costs of engineering and technical workers; E_{tr}^o — saving on transportation costs; D — number of MC engineering and technical employees engaged in accrual of receipts and accounting; ZP_D — number of MC engineering and technical employees engaged in accrual of receipts and accounting D; ΔT_D — saving the working time of engineering and technical staff of position D as a result of digitalization; Ch_B — number of accountants; $\overline{CT}_B^{ud}$ — the amount allocated for transportation costs per accountant	$E_t^o = \sum_{d=1}^{D} (ZP_D - \Delta T_D ZP_D)$ $E_{tr}^o = Ch_B \overline{CT}_B^{ud}$	$ER_u^o = E_t^o + E_{tr}^o$
Costs of holding general meetings of owners		
E_t^s — saving labour costs of engineering and technical workers; E_b^s — saving paper; V — number of MC engineering and technical employees engaged in accrual of receipts and accounting; ZP_v — average monthly salary of engineering and technical employees of the position V; ΔT_v — saving the working time of engineering and technical staff of position V as a result of digitalization; K_{es} — number of personal accounts participating in the general meeting of owners; $\overline{K}_{bb}^{ud}$ — the amount of paper spent on ballots for 1 personal account; $\overline{K}_b^s$ — average amount of paper spent on notifications/announcements of the general meeting and minutes; $\overline{C}_b$ — average cost of paper	$E_t^s = \sum_{v=1}^{V} (ZP_v - \Delta T_v ZP_v)$ $E_b^s = \left(K_{es} \overline{K}_{bb}^{ud} + \overline{K}_b^s\right) \overline{C}_b$	$ER_u^s = E_t^s + E_b^s$
Total savings of all transaction costs of MC		
ER_u^{si} — costs of collecting information about meter readings; ER_u^{vp} — costs of interaction with consumers of housing and communal services; ER_u^a — the costs of emergencies, troubleshooting and unauthorized connections; ER_u^o — the costs of accrual of receipts, accounting; ER_u^s — costs of holding general meetings of owners	–	$ER_u = ER_u^{si} + ER_u^{vp} + ER_u^a + ER_u^o + ER_u^s$
Costs of consumers for payment of receipts for housing and communal services and utilities		
R_{kr} — saving individual consumption of communal resources; R_k — saving on “extra lines”; R_D — savings on additional services; $\overline{R}_{ok}^D$ — average consumption for individual consumption of utility resources per consumer of housing and communal services before digitalization; $\overline{R}_{ok}^P$ — average expenditure on individual consumption of utility resources per consumer of housing and communal services after digitalization; K — number of housing and communal services consumers; R_{l1} — expenses for the payment of “extra lines” in receipts for housing and communal services; K_{es} — number of personal accounts in an apartment building; $\overline{R}_{Du}^D$ — average expenditure on additional services per consumer of housing and communal services before digitalization; $\overline{R}_{Du}^P$ — average expenditure on additional expenses per consumer of housing and communal services after digitalization; K_{es} — number of personal accounts in an apartment building	$R_{kr} = \left(\overline{R}_{kr}^D - \overline{R}_{kr}^P\right) K$ $R_k = \sum_{i=1}^{n} R_{l1} K_{es}$ $R_D = \left(\overline{R}_{Du}^D - \overline{R}_{Du}^P\right) K_{es}$	$ER_p = R_{kr} + R_k + R_D$
Total cost savings of MC and consumers of housing and utilities services		
ER_u — cost savings of MC; ER_p — saving the costs of housing and utilities services consumers	–	$E(EK) = ER_u + ER_p$

According to the proposed calculation tools (Table 2), in order to determine the effects of digitalization, the author made calculations of indicators for one of the MC, LLC "Favorit" in Voronezh[3].

All calculations were made for one house located at: Chelyuskintsev str., house No. 140 for one month, taking into account the operation of "smart" utility metering devices. The necessary data for calculations were provided by MC LLC "Favorit", taking into account the indicators before digitalization (December 2022) and after (February 2023). Also, data on tariffs and consumption standards for water and electric energy established in Voronezh[4, 5, 6] and calculatio.rules for the consumed utility resource were used to calculate consumer savings in the absence of individual meters[7]:

$$P_i = n_i \cdot N_j \cdot K_{inc} \cdot T^{kp},$$

where n_i — the number of registered consumers living in 1 residential building of an apartment building;

N_j — consumption standard;

K_{inc} — increasing coefficient (1.5);

T^{kp} — tariff[7].

As a result of the calculations carried out by the author, the following data were obtained:

the total cost savings of MC LLC "Favorit" is

$$ER_U = 121{,}811.60 \text{ rub;}$$

the total cost savings of housing and utility services consumers is

$$ER_P = 91{,}892.55 \text{ rub.}$$

Clearly, the total cost savings of MC LLC "Favorit" and consumers as a result of digitalization are shown in Fig. 1.

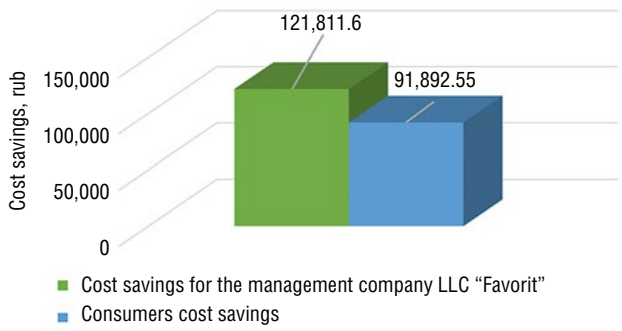

Fig. 1. Total cost savings of the LLC "Favorit" Management Company and consumers as a result of digitalization (Source: developed by the author)

Fig. 2. Total savings as a result of digitalization of the LLC "Favorit" Management Company (Source: developed by the author)

Having determined the amount of cost savings of the LLC "Favorit" Management Company and consumers, we will calculate the total cost savings, which will be:

$$E(EK) = 121{,}811.60 + 91{,}892.55 = 213{,}704.15 \text{ rub.}$$

Fig. 2 shows the total savings as a result of digitalization of the LLC "Favorit" Management Company.

As a result of the calculations made, it can be concluded that the tools developed by the author for calculating indicators for reducing transaction costs of the MC and cost savings of consumers make it possible to determine the amount of money savings of the MC and consumers. Looking at Fig. 1, we can conclude that as a result of digitalization, significant savings were obtained for the MC and consumers and these data for 1 month. Accordingly, the amount of savings for 1 year will increase significantly.

In addition, it is important to pay attention to the costs of the MC and consumers for digitalization. In accordance with the Decree of the Government of the Russian Federation dated June 29, 2020 No. 950, the service provider (in this case PJSC "TNS Energo Voronezh") has established from "Smart" electricity metering devices at its own expense[8].And consumers have installed "smart" individual metering devices for water supply at their own expense and the cost of such a device is approximately 5-7 thousan.rubles (according to consumers), respectively, the amount of savings is much higher than the costs. Which suggests that digitalization of housing and communal services is actually beneficial for the MC and consumers and gives us the opportunity to live more comfortably using "smart" technologies.

REFERENCES

1. Savvina I.S. Fundamentals of digitalization development in the sphere of housing and communal services. Tools for the effective development of modern science : Collection of materials of

3 Management company LLC "Favorit". URL: http://favorit36.ru (accessed: 10.04.2023).

4 On Establishing Long-term parameters for Regulating Activities and Tariffs for Drinking Water for LLC RVC-Voronezh, which provides cold water supply to consumers within the boundaries of the Voronezh City District, Yamenskoye Rural Settlement of Ramonsky Municipal District of the Voronezh Region, for the period 2020-2024 years : Order No. 69/164 dated 11/18/2022 on Amendments to the URT Order No. 56/30 dated 12.20.2019. URL: https://voronezh.rosvodokanal.ru/upload/voronezh/%D0%9F%D1%80%D0%B8%D0%BA%D0%B0%D0%B7%20%E2%84%96%2069-164%20%D0%A2%D0%B0%D1%80%D0%B8%D1%84%20%D0%BD%D0%B0%20%D0%B2%D0%BE%D0%B4%D0%BE%D1%81%D0%BD%D0%B0%-D0%B1%D0%B6%D0%B5%D0%BD%D0%B8%D0%B5%202023%20%D0%B3..pdf (accessed: 10.04.2023).

5 On Amendments to the Order of the Voronezh Region DGRT dated 11.28.2022 No. 72/18 "On the establishment of uniform (boiler) tariffs for services for the transmission of electric energy through the networks of the Voronezh Region for the period 2023-2027" : The Order of the Voronezh Region DGRT No.78/1 dated 12.22.2022. URL: https://voronezh.tns-e.ru/population/tariffs/tariff-documents (accessed: 10.04.2023).

6 "TNS energo Voronezh".URL: https://voronezh.tns-e.ru/population/tariffs/normative-table (accessed: 10.04.2023).

7 On the provision of utilities to owners and users of premises in apartment buildings and residential buildings" (together with the "Rules for the provision of utilities to owners and users of premises in apartment buildings and residential buildings") : Decree of the Government of the Russian Federation of 06.05.2011 No.354 (ed.of 16.11.2022).URL: https://www.consultant.ru/document/cons_doc_LAW_114247 (accessed: 09.04.2023).

8 On Amendments to Certain Acts of the Government of the Russian Federation on Improving the Organization of Electric Energy Accounting : Decree of the Government of the Russian Federation No. 950 dated 06.29.2020 . URL: https://www.consultant.ru/cons/cgi/online.cgi?req=doc&base=LAW&n=356090#9K94xbTIs6kWxhW2 (accessed: 10.04.2023).

the International scientific and practical Conference (Kemerovo, December 27, 2019). Kemerovo, 2019; 164-169. URL: https://elibrary.ru/item.asp?id=42322933 (rus).
2. Savvina I.S. The use of IoT technologies in the housing and communal services. Economics and entrepreneurship. 2020; 10(123):1077-1082. DOI: 10.34925/EIP.2020.123.10.214(rus).
3. Savvina I.S. Digitalization of housing and communal services as the main condition for the competitiveness of management companies. Agrarian economics through the eyes of a young specialist : Materials of an international online conference. (Maysky, April 20, 2021). Maysky, 2021; 45-47. (rus).
4. Kose R.G. The nature of the firm. ECO: Economics and organization of industrial production. 1993; 2:66-82. (rus).
5. North D. Institutes, institutional changes and functioning of the economy / Trans. from the English by A.N. Nesterenko; preface and scientific ed. by B.Z. Milner. Moscow, Foundation of the Economic Book "Beginnings", 1997; 180. URL: http://cee-moscow.com/doc/izd/North.pdf (accessed 10.04.2023). (rus).
6. Dalman S.J. The Problem of Externality. The Journal of Law and Economics. 1979; 22(1):141-162. URL: table/725216
7. Savvina I.S., Uvarova S.S. The influence of digitalization on the formation of receipts for housing and communal services. Digital and branch economy. 2020; 2(19):102-108. (rus).

Расчетный инструментарий для определения эффектов цифровизации ЖКХ

В данной статье была проанализирована актуальность и целесообразность изучения цифровизации управляющих компаний в настоящее время с учетом определения эффектов цифровизации. Расчет экономических показателей результативности цифровизации управляющей компании автором было предложено осуществлять, основываясь на расчете трансакционных издержек. На основе проведенного анализа была дана авторская трактовка понятия: трансакционные издержки управляющей компании в условиях цифровизации ЖКХ. Была проведена классификация трансакционных издержек управляющей компании по видам и их детализация с учетом влияния цифровизации, выделены виды экономии затрат потребителей. Были определены основные показатели экономии управляющей компании в результате сокращения трансакционных издержек. Кроме того, автором были выделены основные показатели экономии затрат потребителей в результате цифровизации управляющей компании. Был разработан расчетный инструментарий для определения показателей сокращения трансакционных издержек управляющей компании и экономии затрат потребителей, который был применен на практике для расчетов эффективности цифровизации управляющей компании г. Воронежа ООО «Фаворит». Разработанный расчетный инструментарий помогает определить не только размер экономии затрат управляющей компании по каждому выделенному виду трансакционных издержек, но и размер общей экономии с учетом экономии затрат жителей. В результате произведенных расчетов для ООО «Фаворит» по разработанному автором инструментарию расчета показателей сокращения трансакционных издержек управляющей компании и экономии затрат жителей и выделения основных затрат был сделан вывод о необходимости и выгоде цифровизации ЖКХ.

Ключевые слова: *ЖКХ, цифровизация, «Умное ЖКХ», трансакционные издержки, экономия управляющей компании, экономия потребителей, «умные» счетчики*

СПИСОК ИСТОЧНИКОВ

1. Саввина И.С. Основы развития цифровизации в сфере жилищно-коммунального хозяйства // Инструменты эффективного развития современной науки : сб. мат. Междунар. науч.-прак. конф. (г. Кемерово, 27 декабря 2019 г.). Кемерово, 2019. С. 164–169. URL: https://elibrary.ru/item.asp?id=42322933
2. Саввина И.С. Применение IoT технологий в сфере ЖКХ // Экономика и предпринимательство. 2020. № 10 (123). С. 1077–1082. DOI: 10.34925/EIP.2020.123.10.214
3. Саввина И.С. Цифровизация ЖКХ как основное условие конкурентоспособности управляющих компаний // Аграрная экономика глазами молодого специалиста : мат. Междунар. онлайн-конференции (г. Майский, 20 апреля 2021 г.). Майский, 2021. С. 45–47.
4. Коуз Р.Г. Природа фирмы // ЭКО: Экономика и организация промышленного производства. 1993. № 2. С. 66–82.
5. Норт Д. Институты, институциональные изменения и функционирование экономики / пер. с англ. А.Н. Нестеренко; предисл. и науч. ред. Б.З. Мильнера. М. : Фонд экономической книги «Начала», 1997. 180 с. URL: http://cee-moscow.com/doc/izd/North.pdf (дата обращения 10.04.2023).
6. Dalman C.J. The problem of externality // The Journal of Law and Economics. 1979. Vol. 22. No. 1. Pp. 141–162. URL: table/725216
7. Саввина И.С., Уварова С.С. Влияние цифровизации на формирование квитанций за ЖКХ // Цифровая и отраслевая экономика. 2020. № 2(19). С. 102–108.

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