
EFFICIENT MANAGEMENT TOOLS IN THE SOCIAL SPHERE: METHODS AND MODELS OF CALCULATION OF PRICES AND TARIFFS¹

Zamotajlova Daria Aleksandrovna, Cand. Sc. (Econ.), Assoc. Prof.

Velikanova Larisa Olegovna, Cand. Sc. (Econ.), Assoc. Prof.

Gorkavoj Petr Georgievich, M.A.

Stepovik Anastasija Nikolaevna, M.A.

Kuban State Agrarian University named after I.T. Trubilin, Kalinina st., 13, Krasnodar, Russia, 350044; e-mail: idalia@mail.ru; velikanovalarisa@rambler.com; gorkavoi.petya@yandex.ru; stepovik.anastasiya@mail.ru

Purpose: the paper is devoted to the development of tools for managing pricing and tariff setting in social spheres, taking into account their focus and the need to use non-traditional approaches in determining the most effective trajectory of their development. *Discussion:* the peculiarities of the functioning of social sectors do not allow to effectively use standard methods and models for calculating prices and tariffs in them. In this regard, there is a need to develop a toolkit, the use of which in practice will make it possible to calculate optimal prices and tariffs, taking into account social demand. *Results:* the authors proposed an approach to the calculation of compromise prices and tariffs for the services of the housing and communal sector, medicine and the sphere of passenger transportation, which have a social character. The concept of social demand and the possibility of taking it into account when calculating prices and tariffs has been clarified; scenarios of its satisfaction are considered. An approach to the selection of an optimal service provider based on the method of multicriteria analysis of the TOPSIS alternatives is proposed.

Keywords: pricing, tariff setting, trade-off analysis, social spheres, analysis of alternatives.

DOI: 10.17308/meps.2020.12/2495

Introduction

The problems of social spheres in Russia, as well as throughout the world, are quite acute: it is impossible to ensure a high quality of life without maintaining these spheres in an optimal state. At the same time, it should be clearly understood that the «optimality» of the functioning means not just break-even or stability of these spheres, but also the satisfaction of consumers with both the quality of services and their prices [2, 3].

1 The work was supported by RFBR grant no. 20-010-00391a

Social spheres are considered to be those that ensure human life: housing and communal services, medicine, education, etc. However, in current situation, the authors see it as possible to add public transport services to this list.

People cannot completely refuse social services, since they are life-supporting. In this regard, a large number of questions arise related to the legal regulation of the functioning of these areas, the relationship between consumers and service providers. It is obvious that the classical methods used in the market economy cannot be used in their pure form in the social spheres, and therefore the questions of developing customized ones arise.

A common and one of the biggest problems in social spheres is the lack of effective economic and mathematical tools for calculating and analyzing prices and tariffs. It is obvious that prices and tariffs for «social» services should not be calculated using the «cost plus» method, which is classic for the housing and communal and transport industries. It involves a simple addition of a profit-generating premium to the cost of a service; within its framework, it is impossible to take into account social demand. In this regard, it is advisable to develop a comprehensive methodology for calculating and analyzing prices and tariffs, taking into account the above-mentioned feature of social spheres and the presence in them of the so-called social demand.

Research methodology

In order to develop an effective regulatory framework and methodology for calculating and analyzing prices and tariffs in social spheres, it is necessary to clarify the concept of social demand.

The concept of «social demand» is rather unexplored; in the literature, the following definition is widespread: social demand is that part of demand that is caused by the consumer's desire to meet certain social criteria. It is obvious that this definition is not comprehensive and applicable for this study. Let's formulate the definition of social demand by considering its content.

In order to determine the social demand for services, it is necessary to define which consumers in the market can be considered solvent and which cannot. At the price of goods in the consumer market $P^Y = P$, those consumers for whom the minimum required amount of service consumption is less than or equal to the amount of money that they are able to allocate for their purchase will be considered solvent ($Y_{Hk}P \leq d_k$). Thus, according to information about the amount of funds that consumers are able to allocate for the purchase of a service, a fixed price P will differentiate all of them into solvent and insolvent. Moreover, the number of those and others is determined by the level of the fixed price. Consumers can be considered solvent if:

$$d_k \geq PY_{Hk}, k = 1, 2, \dots, N_1(P). \quad (1)$$

Insolvent consumers are those for whom:

$$d_k \leq PY_{Hk}, k = N_1(P) + 1, \dots, N. \quad (2)$$

The total amount of regulatory needs of all insolvent consumers:

$$\widehat{Y}(P) = \sum_{k=N_1(P)+1}^N Y_{Hk}, \quad (3)$$

The total amount of means of payment that consumers have to present this product on the market:

$$D_2(P) = \sum_{k=N_1(P)+1}^N d_k. \quad (4)$$

With a fixed price P , solvent consumers can be defined as a set of N_1 consumers who are ready to pay $D_1(P) = \sum_{k=1}^{N_1} d_k$. Insolvent consumers are included in the aggregate $N - N_1$ and are ready to pay $D_2(P)$. Solvent and insolvent consumers will present money in the following amount:

$$D' = \sum_{k=1}^N d_k. \quad (5)$$

The total volume of market and non-market demand will be:

$$Y_F(P^*) = Y^*(P^*) + Y_S(P^*) = \frac{D_1(P^*)}{P^*} + \widehat{Y}(P^*). \quad (6)$$

Covering social demand is possible only through government regulation. The required budgetary allocation to cover this demand can be determined as follows. From formula (7), one can obtain the amount of necessary means of payment in a situation where the compromise volume of purchase and sale is $Y^0 = Y_F(P^*)$:

$$D = D_H \frac{(1 + \sqrt{1 + 4 \frac{Y^0 c}{D_H}})^2}{4}; \quad (7)$$

$$D(P^*) = D_H \frac{1}{4} (1 + \sqrt{1 + 4 \frac{Y_{\text{общ}}(P^*) c(P^*)}{D_H}})^2. \quad (8)$$

In this case, the amount required for financing from the budget to cover social demand for services will be:

$$\Delta D = D(P^*) - D'. \quad (9)$$

It was noted that the calculation of prices and tariffs for the services of social spheres cannot be effectively implemented within the framework of the «cost-plus» methodology. Based on the multicriteria of the problem being solved, we consider it possible to use compromise analysis as a basis for a new methodology.

Market trade-off model between aggregate demand and aggregate supply:

$$P^{XY} = P^*(P) = \max \left\{ \arg \max_P \left(\frac{D'}{P} - \frac{D_H(P)}{P - c(P)}; \frac{D'}{Y^1(P)} \right) \right\}. \quad (10)$$

The allocation of subsidies to cover social demand can destabilize the market equilibrium. There may even be situations in which the demand for services exceeds the supply. The equilibrium can only be restored by the state through the introduction of various levers, which once again emphasizes the need to work out the legal framework for the interaction of all participants in social-

market relations. However, the issue of legal regulation is beyond the scope of this study.

It should be clarified how the market equilibrium can be restored. State levers of influence are selected in accordance with the identified «model» of behavior of service providers. Like consumers, enterprises can be divided into two large groups: competitive and non-competitive.

For competitive enterprises, the compromise price [6] is considered acceptable, in connection with which they will be able to cover the surplus demand, and, therefore, restore equilibrium by activating additional production capacity. This is the first scenario of rebalancing, which does not require any additional state regulation.

The second scenario, on the one hand, is more pessimistic. It allows application of two approaches, depending on the situation.

The first approach involves attracting non-competitive enterprises by increasing the attractiveness of a particular industry (through direct subsidies). In this case, the surplus demand is covered by the use of their production capacity.

The second approach can be applied only if the production capacity of both competitive and non-competitive producers is insufficient to meet the surplus demand. The only solution in this situation is to create new production facilities.

The discussion of the results

It is obvious that in addition to the large number of consumers, a large number of service providers are represented in social spheres.

In this regard, the apparatus for calculating a compromise price or tariff for a service cannot be the only component of an effective management toolkit in social spheres. Social demand can be fully and most effectively satisfied only if there is a mechanism for the effective selection of the most suitable service provider. Such a selection is possible within the framework of TOPSIS method [7]. The basic concept of this method is that of the compared alternatives, the alternative with the smallest distance from the best option and the largest distance from the worst option will be recognized as the best.

TOPSIS implies an expert assessment of all available alternatives according to a list of criteria. Further, finding the optimal alternative is carried out in the following stages:

- calculation of the normalized decision matrix;
- calculation of a weighted normalized decision matrix;
- definition of «ideal positive» and «ideal negative» solutions;
- calculation of the separation metric;
- calculation of the relative proximity to the «ideal positive» solution;
- ranking of alternatives.

Taking into account the fact that the examination of alternatives can be carried out by specialists of various profiles, as well as simply interested persons,

one of the directions of adaptation of the classic TOPSIS method is to supplement it with a stage, within which the competence of experts will be taken into account []. Another change in the classic TOPSIS method can be to provide the possibility not only of a standard fuzzy assessment of alternatives, but also the use of linguistic variables for this purpose. The linguistic variables can then be converted to triangular or trapezoidal numbers, allowing the normal execution of all TOPSIS steps.

The presence of a criteria system for each social sphere, taking into account the characteristics of specific services and the adaptation of the classic TOPSIS method, will ensure the most correct selection of a service provider to consumers.

Let's consider lists of criteria that can be used to assess alternatives in each of the previously identified areas. A priori is the consent of the enterprise to provide the service for the calculated compromise price.

The housing and communal sector is characterized by the presence of enterprises of two types: housing and communal. In general, both types of enterprises can be assessed according to the following list of criteria: profit from activities (k_1); consumer debt for services (k_2); organization's debt to resource providers (k_3); amount of raised funds (k_4); average cost of performed works (provided services) (k_5); collection of funds for performed works (provided services) (k_6); receipt of claims for the quality of performed work (provided services) (k_7).

This list is certainly not exhaustive. A list of criteria for housing enterprises can be made more clearly due to the specifics of their work; also they can be divided into categories.

1. Scope of activity: management income (k_{11}); utility income (k_{12}); total area of houses under management (k_{13}); number of houses under management (k_{14}); number of staff (k_{15});

2. Financial stability: profit from management activities (k_{21}); consumers' debts for maintenance and current repair of common property services (k_{22}); residents' debts for the provided utilities (k_{23}); organization's debt to resource providers (k_{24});

3. Performance efficiency: financing of maintenance works (k_{31}); amount of funds raised for repairs, modernization and improvement (k_{32}); average cost of performed works (provided services) for the maintenance and repair of common property in an apartment building (k_{33}); holding general meetings of owners of premises in an apartment building (k_{34}); use of common property of owners of premises (k_{35}); collection of funds of owners for the performed works (provided services) for the maintenance and repair of common property in an apartment building, other services related to achieving the goals of managing an apartment building in the reporting period (k_{36}); collection of funds of owners for the provided utilities in the reporting period (k_{37});

4. Reputation: average management period (k_{41}); change in the number

of houses under management (k_{42}); receipt of claims for the quality of performed works (provided services) (k_{43}); receipt of claims for the quality of the provided utilities (k_{44}); bringing organizations, partnerships, cooperatives, officials of these organizations, partnerships, cooperatives to administrative responsibility for violations in the management of apartment buildings (k_{45}).

For enterprises providing passenger transportation services, we can preliminarily generate the following list of criteria: safety (k_1); availability (k_2); sociality (k_3); travel time (k_4); regularity (k_5); filling (k_6); comfort (k_7); direct route (k_8); route network density (k_9); additional services (k_{10}); service culture (k_{11}); warranty (k_{12}); passenger complaints about the service (k_{13}); environmental friendliness (k_{14}).

It is also important to note that the calculation of the optimal cost of passenger transportation requires a preliminary analysis of each route in order to determine its belonging to a specific «cluster». More details about this are described in [5].

The most difficult, in the opinion of the authors, is the definition of criteria for medical organizations. At this stage of the study, the following ones can be included in the list of criteria for evaluating alternatives: discrepancy in diagnoses (k_1); average daily number of doctor calls (k_2); repeated calls to the doctor during the day (k_3); availability of comments from the management (k_4); existence of well-founded complaints (k_5); average length of patient's stay in the hospital (k_6); discrepancies between clinical and pathoanatomical diagnoses (k_7); death of the patient, not expected upon admission (k_8); unplanned readmission (k_9); patient satisfaction with the treatment and diagnostic process (k_{10}); introduction of modern methods in the medical and diagnostic process (k_{11}); the presence of complications due to the work of medical personnel (k_{12}); compliance with the sanitary and epidemic regime (k_{13}); timeliness of medical prescriptions (k_{14}).

Of course, the presented lists of criteria require clarification and additions to ensure in the future to obtain the most accurate calculation results.

Conclusion

The development and further implementation in social spheres of an effective toolkit for calculating and analyzing compromise prices and tariffs for services will not only fill the existing gaps in theory, but also improve the quality of functioning of these areas in practice.

Calculation of prices and tariffs according to the proposed method will allow obtaining a compromise value, taking into account all the features of social spheres, including the presence of social demand in them.

The use of the adapted TOPSIS method for the selection of the most suitable services' provider will allow the most accurate formulation of requirements for enterprises and minimize the possibility of subjective assessment during the expertise.

The toolkit can also be supplemented by a third component – a two-piece

analytical apparatus. Within the first part an analysis of time series of prices and tariffs for social services should be implemented in order to determine the presence of persistence in them; it will make it possible to predict their value with greater accuracy [8, 9, 10, 11, 12]. The second part should be a mechanism for assessing the optimal price and tariff for a specific service.

It should also be noted that almost every industry is currently being digitalized [1, 4]. Moreover, it is clear that enterprises wishing to develop and improve in the future cannot ignore the introduction of various information technologies and systems into their work. In this regard, the implementation of digital elements is also promising within the framework of the proposed toolkit.

References

1. Alikov A.D. Sotsialno-pravovye aspekty «tsifrovizatsii» sotsialnoi sfery v rossiiskoi federatsii [Social and legal aspects of "digitalization" of the social sphere in the Russian Federation]. *Modern Science*, 2019, no. 12-1, pp. 267-271. (In Russ.)
2. Baranovskaya T.P., Popova E.V., Zamotailova D.A. [Approaches to multi-criteria analysis of the activities of management organizations of housing and communal complex]. *Materialy mezhdunarodnoi nauchno-prakticheskoi konferentsii «Natsionalnye ekonomiki v usloviyah globalnykh i lokalnykh transformatsii» 2018* [Proceedings of the international scientific and practical conference "National economies in the context of global and local transformations"], pp. 10-14. (In Russ.)
3. Gorkavoi P.G., Zamotailova D.A. [Features of forecasting and multi-criteria analysis in social spheres]. *Materialy 75-j nauch.-prakt. konf. studentov po itogam NIR za 2019 god «Nauchnoe obespechenie agropromyshlennogo kompleksa»* [Materials of the 75th scientific and practical conference of students on the results of research for 2019 "Scientific support of the agro-industrial complex"]. Krasnodar, 2020, pp. 653-655. (In Russ.)
4. Zamotailova D.A., Gorkavoi P.G., Stepovik A.N. [Directions of digital-ization of the housing and utilities sector]. *Materialy XVI Vseros. nauch.-prakt. konf. «Jelektronnyj biznes: problemy, razvitie i perspektivy»* [Materials of the XVI all-Russian scientific and practical conference "Electronic business: problems, development and prospects"]. Voronezh, 2020, pp. 119-121. (In Russ.)
5. Zamotailova D.A., Kurnosova N.S., Reznikov V.V. Podhody k analizu passazhiropotoka obshhestvennogo transporta [Approaches to the analysis of public transport passenger traffic]. *Trudy Kubanskogo gosudarstvennogo agrarnogo universiteta*, 2017, no. 65, pp. 17-24. (In Russ.)
6. Kardash V.A. *Konflikty i kompromissy v rynochnoj jekonomike* [Conflicts and compromises in the market economy]. Moscow, Nauka, 2006. (In Russ.)
7. Kolyada V.V. [Knowledge Management: TOPSIS and entropy methods]. *Materialy 73-j nauchno-prakticheskoi konferentsii studentov po itogam NIR za 2017 god «Nauchnoe obespechenie agropromyshlennogo kompleksa»* [Materials of the 73rd scientific and practical conference of students on the results of research in 2017 "Scientific support of the agro-industrial complex"]. Krasnodar, 2018, pp. 560-562. (In Russ.)
8. Kumratova A.M. Kontseptualnaya osnova polucheniya i issledovaniya maksimalnogo vremeni prognoza s zaranee zadannoi tochnostyu [Conceptual framework to obtain and study the maximum time of prediction with the predetermined accuracy]. *Sovremennaya ekonomika: problemy i resheniya*, 2017, no. 6 (90), pp. 23-31. (In Russ.)
9. Kumratova A.M., Popova E.V., Kurnosova N.S., Popova M.I. Snizhenie ekonomicheskogo riska na baze predprognoznogo analiza [Economic risk reduction based on pre-forecast analysis]. *Sovremennaya ekonomika: problemy i resheniya*, 2015, no. 3 (63), pp. 18-28. (In Russ.)

10. Kumratova A.M., Popova E.V., Savinskaja D.N., Kurnosova N.S. Kompleksnaya metodika analiza ekonomicheskikh vremennyh ryadov meto-dami neli-neinoi dinamiki [Complex method of analysis of economic time series by methods of nonlinear dynamics]. *Sovremennaya ekonomika: problemy i resheniya*, 2015, no. 8 (68), pp. 35-43. (In Russ.)

11. Savinskaya D.N. Sovremennoe sostoyanie rynka HOD. Osobennosti rascheta strahovyh zasposov [Current

state of the HOD market. Features of calculating insurance stocks]. *Sovremennaya ekonomika: problemy i resheniya*, 2011, no. 9 (21), pp. 155-167. (In Russ.)

12. Savinskaya D.N., Nedogonova T.A. Predprognoznyi analiz logisticheskikh vremennyh ryadov na osnovanii pokazatelya Hersta [Pre-forecast analysis of logistics time series based on the Hearst indicator]. *Sovremennaya ekonomika: problemy i resheniya*, 2019, no. 9 (117), pp. 18-26. (In Russ.)

ЭФФЕКТИВНЫЙ ИНСТРУМЕНТАРИЙ УПРАВЛЕНИЯ В СОЦИАЛЬНЫХ СФЕРАХ: МЕТОДЫ И МОДЕЛИ РАСЧЕТА ЦЕН И ТАРИФОВ¹

Замотайлова Дарья Александровна, канд. экон. наук, доц.

Великанова Лариса Олеговна, канд. экон. наук, доц.

Горкавой Петр Георгиевич, маг.

Степовик Анастасия Николаевна, маг.

Кубанский государственный аграрный университет им. И.Т. Трубилина, ул. Калинина, 13, Краснодар, Россия, 350044; e-mail: idalia@mail.ru; velikanovalarisa@rambler.com; gorkavoi.petya@yandex.ru; stepovik.anastasiya@mail.ru

Цель: статья посвящена вопросам разработки инструментария управления цено- и тарифообразованием в социальных сферах, учитывающего их направленность и необходимость применения нетрадиционных подходов при определении максимально эффективной траектории их развития. *Обсуждение:* особенности функционирования социальных отраслей не позволяют эффективно использовать для расчета цен и тарифов в них стандартные методы и модели. В связи с этим возникает необходимость разработки инструментария, использование которого на практике позволит производить расчет оптимальных цен и тарифов, в том числе с учетом социального спроса. *Результаты:* авторами предложен подход к расчету компромиссных цен и тарифов на услуги жилищно-коммунальной отрасли, медицины и сферы пассажирских перевозок, имеющих ярко выраженный социальный характер. Уточнено понятие социального спроса и возможность его учета при расчете цен и тарифов; рассмотрены сценарии его удовлетворения. Предложен подход к подбору оптимального поставщика услуг, базирующийся на методе многокритериального анализа альтернатив TOPSIS.

Ключевые слова: ценообразование, тарифообразование, компромиссный анализ, социальные сферы, анализ альтернатив.

Список источников

1. Аликов А.Д. Социально-правовые аспекты «цифровизации» социальной сферы в Российской Федерации // *Modern Science*, 2019, no. 12-1, с. 267-271.
2. Барановская Т.П., Попова Е.В., Замотайлова Д.А. Подходы к многокритериальному анализу деятельности управляющих организаций жилищно-коммунального комплекса // *Материалы Международной научно-практической конференции «Национальные экономики в условиях глобальных и локальных трансформаций»*, 2018, с. 10-14.

¹ Работа выполнена при поддержке РФФИ грант № 20-010-00391а.

3. Горкавой П.Г., Замотайлова Д.А. Особенности прогнозирования и многокритериального анализа в социальных сферах // *Материалы 75-й науч.-практ. конф. студентов по итогам НИР за 2019 год «Научное обеспечение агропромышленного комплекса»*. Краснодар, 2020, с. 653-655.
4. Замотайлова Д.А., Горкавой П.Г., Степовик А.Н. Направления цифровизации сферы ЖКХ // *Материалы XVI Всерос. науч.-практ. конф. «Электронный бизнес: проблемы, развитие и перспективы»*. Воронеж, 2020, с. 119-121.
5. Замотайлова Д.А., Курносова Н.С., Резников В.В. Подходы к анализу пассажиропотока общественного транспорта // *Труды Кубанского государственного аграрного университета*, 2017, по. 65, с. 17-24.
6. Кардаш В.А. *Конфликты и компромиссы в рыночной экономике*. Москва, Наука, 2006.
7. Коляда В.В. Управление знаниями: методы TOPSIS и энтропии // *Материалы 73-й научно-практической конференции студентов по итогам НИР за 2017 год «Научное обеспечение агропромышленного комплекса»*. Краснодар, 2018, с. 560-562.
8. Кумратова А.М. Концептуальная основа получения и исследования максимального времени прогноза с заранее заданной точностью // *Современная экономика: проблемы и решения*, 2017, по. 6 (90), с. 23-31.
9. Кумратова А.М., Попова Е.В., Курносова Н.С., Попова М.И. Снижение экономического риска на базе предпрогнозного анализа // *Современная экономика: проблемы и решения*, 2015, по. 3 (63), с. 18-28.
10. Кумратова А.М., Попова Е.В., Савинская Д.Н., Курносова Н.С. Комплексная методика анализа экономических временных рядов методами нелинейной динамики // *Современная экономика: проблемы и решения*, 2015, по. 8 (68), с. 35-43.
11. Савинская Д.Н. Современное состояние рынка НОД. Особенности расчета страховых запасов // *Современная экономика: проблемы и решения*, 2011, по. 9 (21), с. 155-167.
12. Савинская Д.Н., Недогонова Т.А. Предпрогнозный анализ логистических временных рядов на основании показателя Херста // *Современная экономика: проблемы и решения*, 2019, по. 9 (117), с. 18-26.