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# Pricing Management in Social Industries: Algorithms and Models & Methods

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## Abstract

The paper is devoted to an overview of the research results on developing practical tools for managing pricing and tariff formation in social spheres. The authors' algorithms, methods, and models are described in detail and tested on actual data. The possibility of flexible customization of the developed toolkit makes it possible to take into account all the features of the functioning of social industries (both in general and for each sector under consideration separately), and also makes the process of calculating prices and tariffs transparent for all participants in social market transactions. The method of compromise pricing, which is the basis for calculating expenses and tariffs, allows not only to obtain a "fair" price (tax) for a service but also to determine the volume of social demand, which cannot be estimated within the framework of the currently applied methods. A vital development feature is also the ability to select optimal buyer-seller pairs using the adapted TOPSIS method.

**Disciplinary**: Computer Technologies, Information Systems.



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# 1 Introduction

Previous studies have led to the conclusion that the management of social sectors is associated with the need to take into account social demand and calculate compromise prices (tariffs) for goods and services (Hummel et al., 2021; Mutuc et al., 2019; Vasilieva et al., 2018;

Vergara et al., 2019); the social nature of the industries under consideration (housing and communal services, public transport and medical) makes it almost entirely impossible for consumers to refuse their services (Ismoilova and Qizi, 2019; Kinash et al., 2019; Momot et al., 2020). Still, the price (tariff) at which they are sold may be unaffordable or critical. In such a situation, the purchase of social goods and the provision of social services becomes possible for certain groups of the population only with the use of the mechanism of subsidies and subsidies; in some cases, it is possible to identify critical situations, the way out of which will be a recalculation of prices (tariffs) for social services for all groups of the population and setting them at a compromise level (Khudoyberdiev et al., 2020). For implementing these measures, an exact algorithm and practical tools are required based on the methods of compromise modeling (in particular, the implementation of social and market compromises), a description of which will be given below.

The general algorithm for managing social sectors in terms of pricing and tariff setting can be determined by the following steps:

1) pre-forecast analysis of prices (tariffs) for a specific service (product) in one of the social spheres (Fuentes et al., 2020; Ugurlu et al., 2018);

2) calculation of a compromise price (tariff) for a specific service (product) (Dai et al., 2014; Nwaubani et al., 2020);

3) selection of the optimal "buyer-seller" ("consumer-supplier") pair using multi-criteria analysis (Broniewicz and Ogrodnik, 2020; Dean, 2020; Lode et al., 2021).

The pre-forecast analysis of prices (tariffs) for services (goods) of social sectors is optional. When working with specific services, it cannot be guaranteed that there is sufficient initial data for analysis. In general, it should be noted that when working with the values of prices and tariffs for social goods and services, the researcher deals with short time series; this is primarily because such prices (taxes) are regulated at the state level (through the establishment of limit values or clear definition of the size) a maximum of several times a year.

The obvious fact is the possibility of a pre-forecast analysis of tariffs for utilities and housing services since their values are set (adjusted) twice a year; thus, the researcher has enough data to work with. On the other hand, the public transport industry and medical pre-predictive analysis are possible only in individual cases.

## 2 Materials and methods

The pre-predictive analysis (predictive processing) is performed by the method of the normalized Hurst range; its results enable the researcher to reveal the persistence in the considered time series (Bekar et al., 2020; Sarker et al., 2020; Tao et al., 2018). Obtaining this information does not provide apparent advantages in managing pricing and tariff setting from a financial point of view. Still, it makes it possible with a high probability to determine the possibility of the emergence of an insolvent and partially insolvent group of the population in the future and, therefore, to begin work on finding a social market compromise.

Figure 1 shows a block diagram of the pre-predictive analysis algorithm.

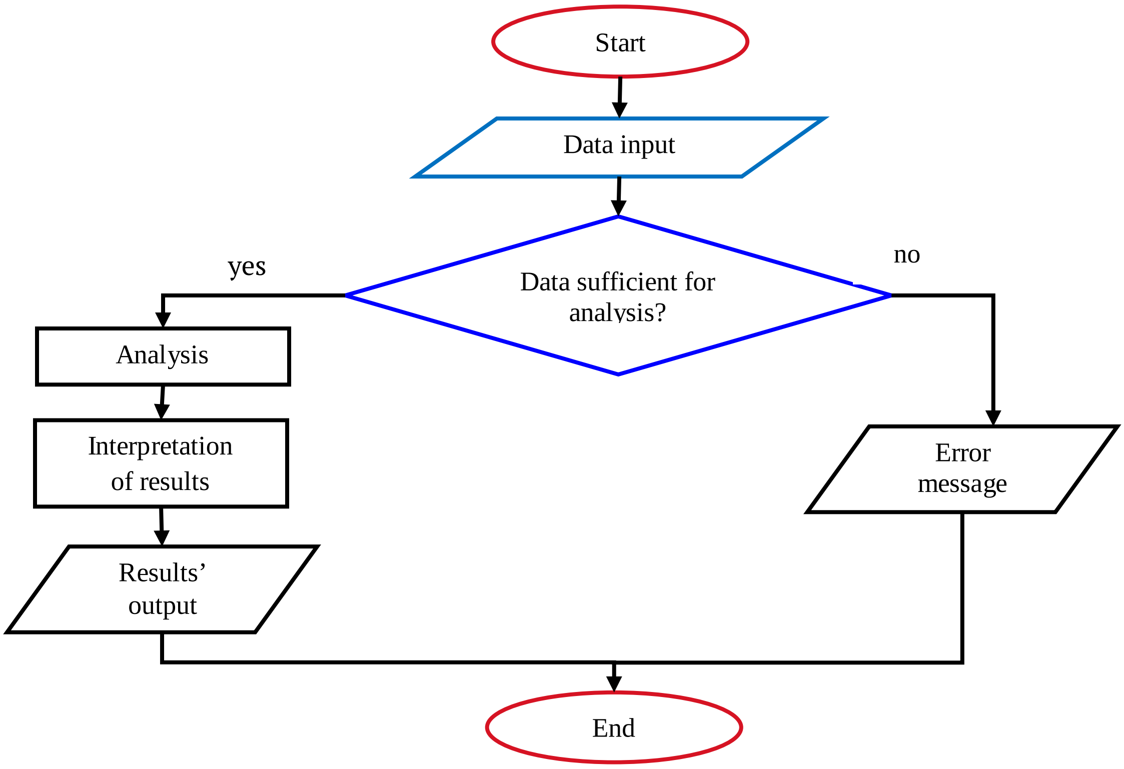


**Figure 1:** Block diagram of the pre-predictive analysis algorithm

At the second step of the implementation of the algorithm, a compromise price (tariff) is calculated for a specific social service (product), taking into account all the identified features of the industry in question; one of the key elements of this step is to determine whether there is social demand and to estimate its size.

The input data for the implementation of this step are the following values:

- maximum of the buyer's (consumer's) funds;

- the amount of excess income of the seller (manufacturer);

- the cost of the service (product).

Buyers (consumers) are divided into corresponding clusters following the amount of money that they are willing to allocate for the purchase of goods (payment for services), sellers (manufacturers) - by the amount of excess income they plan to receive.

Figure 2 shows a block diagram of the algorithm for calculating a compromise price (tariff).

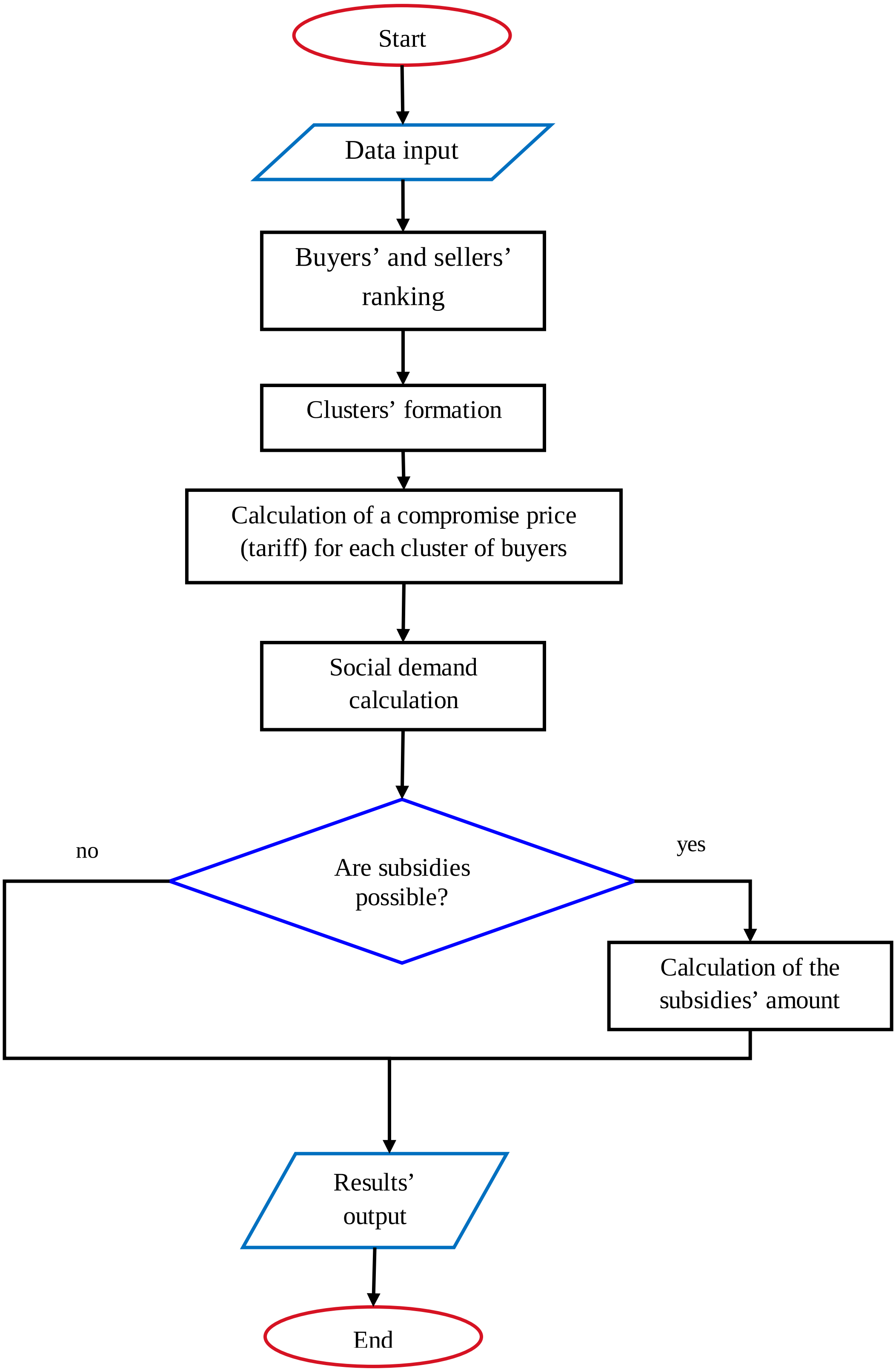


**Figure 2:** Block diagram of the algorithm for calculating the compromise price (tariff)

The third step of the algorithm is the most complex and time-consuming: the process of evaluating the alternatives for selecting the optimal "consumer-supplier" ("buyer-seller") pair; within its framework, an adapted TOPSIS method is implemented, which requires the selection of criteria for evaluating alternatives, placing the coefficients of the importance of the requirements, directly carrying out a multi-criteria assessment of other options, adjusting the estimates obtained taking into account the competence of the experts involved (optional), ranking alternatives (Chen, 2019; García-Cascales and Lamata, 2012; Muslihudin et al., 2019; Rouyendegh et al., 2020).

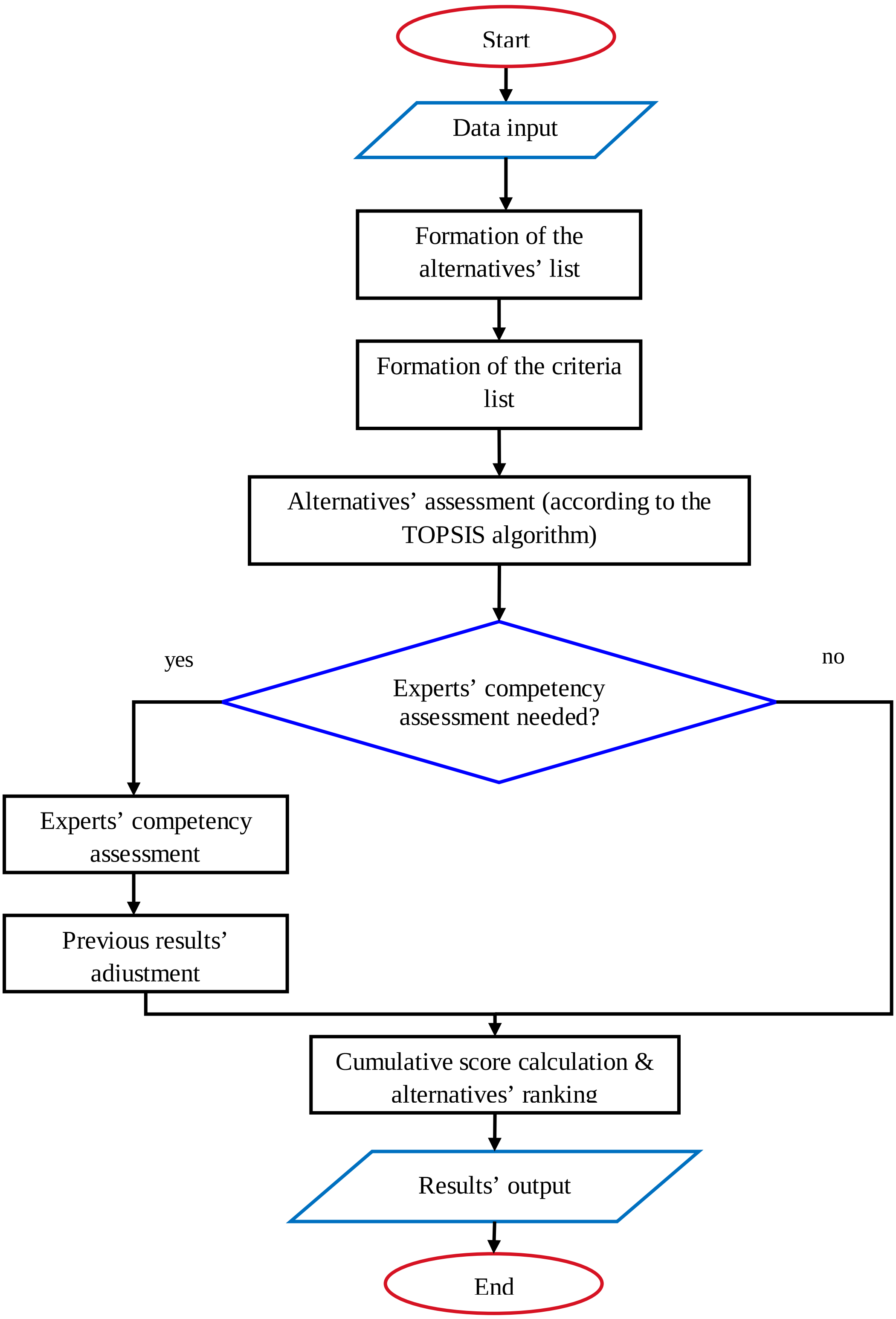


**Figure 3:** Flowchart of the algorithm for evaluating alternatives

An essential element of this step is the formation of a list of available alternatives. As alternatives, there are enterprises of the corresponding industry that sell a specific product or provide a particular service, for which a compromise price (tariff) has already been calculated. It is evident that already at the step of calculating the compromise prices, enterprises for which the resulting size is unacceptable are “weeded out”; thus, the list of alternatives is formed from enterprises for which the condition for the amount of excess income will be fulfilled.

Evaluation of alternatives is carried out according to a list of criteria, which is not fixed and can be reduced or supplemented. Therefore, it is advisable to combine the criteria into groups and, at each subsequent check, provide the researcher with the complete list of them for each.

The list of criteria is formed separately for each social sector; the choice of criteria, the setting of weights for groups of criteria, and particular criteria are carried out by the interested person, which makes it possible to consider the peculiarities of each case under consideration. Further assessment of alternatives is carried out by a group of independent experts, which makes it possible to increase the efficiency and objectivity of the evaluation; if necessary, the competence of each expert can be additionally assessed. A block diagram of the alternatives assessment algorithm, based on the adapted TOPSIS method (Pei et al., 2019; Xu et al., 2018; Yang, 2020), is in Figure 3.

# 3 Result and Discussion

Table 1 shows the intermediate stages of calculating the Hurst exponent for the "Coldwater supply" time series.

**Table 1**: Intermediate calculations for calculating the value of R/S at n = 2 for the time series "Coldwater supply"

| Tariff, rubles | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9" | "10" |
|---|---|---|---|---|---|---|---|---|---|---|
| 10.9 | | | | | | | | | | |
| 10.9 | 1 | 0 | 0.045648 | -0.04565 | -0.04565 | -0.04565 | -0.0913 | 0.045648 | 0.045648 | 1 |
| 13.45 | 1.233945 | 0.091296 | | 0.045648 | -0.0913 | | | | | |
| 16.24 | 1.207435 | 0.081864 | 0.051628 | 0.030235 | -0.12153 | -0.0913 | -0.12153 | 0.030235 | 0.030235 | 1 |
| 17.06 | 1.050493 | 0.021393 | | -0.03024 | -0.0913 | | | | | |
| 17.06 | 1 | 0 | 0.0227 | -0.0227 | -0.0686 | -0.0686 | -0.0913 | 0.0227 | 0.0227 | 1 |
| 18.94 | 1.110199 | 0.045401 | | 0.0227 | -0.0913 | | | | | |
| 18.94 | 1 | 0 | 0.012367 | -0.01237 | -0.07893 | -0.07893 | -0.0913 | 0.012367 | 0.012367 | 1 |
| 20.05 | 1.058606 | 0.024734 | | 0.012367 | -0.0913 | | | | | |
| 21.14 | 1.054364 | 0.022991 | 0.011495 | 0.011495 | -0.10279 | -0.0913 | -0.10279 | 0.011495 | 0.011495 | 1 |
| 21.14 | 1 | 0 | | -0.0115 | -0.0913 | | | | | |
| 23.1 | 1.092715 | 0.038507 | 0.019253 | 0.019253 | -0.11055 | -0.0913 | -0.11055 | 0.019253 | 0.019253 | 1 |
| 23.1 | 1 | 0 | | -0.01925 | -0.0913 | | | | | |
| 23.93 | 1.035931 | 0.015331 | 0.007665 | 0.015331 | -0.10663 | -0.09896 | -0.10663 | 0.007665 | 0.01212 | 0.632456 |
| 23.93 | 1 | 0 | | -0.00767 | -0.09896 | | | | | |
| 28.85 | 1.193063 | 0.076663 | 0.038332 | 0.038332 | -0.13729 | -0.09896 | -0.13729 | 0.038332 | 0.038332 | 1 |
| 28.85 | 1 | 0 | | -0.03833 | -0.09896 | | | | | |
| 32.27 | 1.130298 | 0.053193 | 0.024432 | 0.053193 | -0.15215 | -0.12339 | -0.15215 | 0.02876 | 0.042759 | 0.67262 |
| 31.95 | 0.990084 | -0.00433 | | -0.02876 | -0.12339 | | | | | |
| 32.26 | 1.009703 | 0.004194 | -0.00845 | 0.012648 | -0.13604 | -0.12339 | -0.13604 | 0.012648 | 0.012648 | 1 |
| 30.73 | 0.952573 | -0.0211 | | -0.01265 | -0.12339 | | | | | |
| 38.71 | 1.259681 | 0.100261 | 0.05013 | 0.05013 | -0.17352 | -0.12339 | -0.17352 | 0.05013 | 0.05013 | 1 |
| 38.71 | 1 | 0 | | -0.05013 | -0.12339 | | | | | |
| 38.71 | 1 | 0 | 0 | 0 | -0.12339 | -0.12339 | -0.12339 | 0 | 0 | 0 |
| 38.71 | 1 | 0 | | 0 | -0.12339 | | | | | |
| 38.71 | 1 | 0 | 0 | 0 | -0.12339 | -0.12339 | -0.12339 | 0 | 0 | 0 |
| 38.71 | 1 | 0 | | 0 | -0.12339 | | | | | |

To carry out predictor processing at the first stage, the time series $Z = \langle z_i \rangle, i = 1,2,\ldots,N$, where $N$ is the number of observations, is transformed into a time series of the following form:

$$Y = \langle y_i \rangle, i = 1,2,\ldots,N-1, \quad (1),$$

Where $y_i = \log\left(\frac{z_{i+1}}{z_i}\right)$.

The results of this stage are shown in columns "1" and "2" of Table 1.

Next, a suitable integer value $\Delta \geq 1$ is selected, after which sequences of lengths $n_1, n_2, \ldots, n_k, \ldots, n_m$ are constructed, where $n_{k+1} = n_k + \Delta$; Table 1 considers the value $n = 2$. For each successive value of $n_k$, a time series should be considered and divided into $r_k = [\frac{N}{n_k}]$ of successive segments $Z_k^t = \langle z_j^t \rangle, j = 1,2,\ldots,n_k$. The number of such segments will not include the remainder of the levels of the time series $Z$ that are not included in the last segment $Z_k^{r_k}$. For each segment $Z_k^t$, the average value is calculated (the results are shown in column "3"):

$$z_t = \frac{1}{n_k}\sum_{j=1}^{n_k} z_j^t, \quad (2),$$

where $t = \overline{1, r_k}$.

With a fixed index $k$ for each formed segment $Z_k^t$, the sum of the accumulated deviations is calculated (the intermediate stage is given in column "4", the final calculations are in column "5" of Table 1):

$$X_{k,q}^t = \sum_{j=1}^{q}\left(z_j^t - z^t\right), q = 1,2,\ldots,n_k., \quad (3).$$

Based on (3), the normalized range is calculated:

$$R_k^t = \max_{1\leq q\leq n_k} X_{k,q}^t - \min_{1\leq q\leq n_k} X_{k,q}^t, t = \overline{1, r_k}., \quad (4).$$

Column "6" shows the values of max, "7" - the values of min, "8" - the normalized range, calculated by the formula (4).

Further, for each segment $Z_k^t$with a fixed index $k$, the standard deviation is calculated (column "9"):

$$S_k^t = [\frac{1}{n_k}\sum_{j=1}^{n_k}(z_j^t - z_j)^2]^{0,5} \quad (5).$$

The final step is to calculate the $R/S$ value (shown in column "10"):

$$(R/S)_k = \frac{1}{r_k}\sum_{t=1}^{r_k}(R_k^t / S_k^t) \quad (6).$$

The stages of calculation for *n=3* and *n=4* were carried out similarly and, in general, all calculations for the time series of tariffs for utilities. Note again that social sectors are characterized by "short" time series. Therefore, before performing a pre-forecast analysis, it is necessary to decide on the feasibility of this stage.

Calculations were made on the time series of tariffs for cold water supply, established in the city of Krasnodar in 2008-2021.

According to the results obtained at the stage of intermediate calculations, we obtain the R/S values for each iteration of checking the investigated time series (Table 2).

**Table 2:** Values of the average value of R/S for intervals n of the time series "Coldwater supply"

| n | 2 | 3 | 4 |
|---|---|---|---|
| R/S | 0.79269811 | 1.299969549 | 1.360700942 |

Next, the Hurst exponent is calculated; for the considered time series "Coldwater supply," it is equal to 0.808, which indicates the presence of persistence in it. Thus, we can confidently assert that the size of the tariff for cold water supply has a steady upward trend. The input parameters of the second step of the previously described algorithm are the service cost, the maximum cash of the buyer, and the amount of the seller's excess income. Finally, the compromise tariff for a service (product) is calculated as follows:

$$P^* = \frac{1}{1-\sqrt{\frac{D'}{D}}} = c \times \frac{1}{1-\sqrt{\varphi}} \qquad (7),$$

Where c – is the service cost (product);

D' – the amount of excess income per unit of service (goods);

D – the maximum amount of the buyer's means of payment.

For "test" calculations, the seller's excess income will be set at the level of 2.2 rubles per 1 $m^3$, maximum consumer funds - 39 rubles; cost of the service - 29.5 rubles. Following formula (1), the compromise tariff for coldwater supply services is calculated: 38.68 rubles for 1 $m^3$. Note that the planned tariff for service in question in 2022 in the municipality of the city of Krasnodar will be 38.93 rubles per 1 $m^3$ for all population groups. Because in the example under consideration, the maximum amount of the buyer's funds is 39 rubles per 1 $m^3$. The compromise tariff can be adjusted (increased) to the planned value. Therefore, it will not lead to a violation of the social and market balance. However, in the case when it is impossible to adjust the size of the tariff, the calculation of social demand will be required:

$$\Delta D = D(P^*) - D' \qquad (8).$$

The third step in the implementation of the algorithm involves the selection of the optimal pair "buyer-seller" ("consumer-producer"). The general algorithm of the adapted TOPSIS method and the approach to assessing the competence of experts involved in the assessment. The possibility of flexible adjustment of the criterion apparatus both for assessing alternatives and for assessing the competence of experts allows taking into account all the needs of the buyer (consumer) when choosing the optimal seller (manufacturer) from those available on the market. All steps of the adapted TOPSIS method result in a ranked list of alternatives; the closer the obtained proximity coefficient is to 1, the more satisfying the conditions put forward is the alternative.

# 4 Conclusion

Using the algorithms and tools proposed by the authors for managing pricing and tariff setting in social sectors will significantly increase the transparency of these processes while ensuring that buyers' needs (consumers) are taken into account. The ability to "customize" the methodology, select steps, and control processes by changing the input data and criteria will allow you to get the most accurate and objective result of assessing current prices and tariffs, as well as calculating them for future periods. An essential feature of the tools developed by the authors is the ability to determine social demand; thus, the previously neglected volume of the partially solvent market can be considered when selecting levers for managing various social sectors. The considered example of calculations for the housing and communal sector can be easily extrapolated to other social spheres studied in the framework of the study.

# 5 Availability of Data and Material

Data can be made available by contacting the corresponding author.


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# 7 References


Bekar, E. T., Nyqvist, P., Skoogh, A. (2020). An intelligent approach for data pre-processing and analysis in predictive maintenance with an industrial case study. *Advances in Mechanical Engineering*, *12*(5). DOI: 10.1177/1687814020919207

Broniewicz, E., Ogrodnik, K. (2020). Multi-criteria analysis of transport infrastructure projects. *Transportation Research Part D: Transport and Environment*, *83*. DOI: 10.1016/j.trd.2020.102351

Chen, P. (2019). Effects of normalization on the entropy-based TOPSIS method. *Expert Systems with Applications*, *136*. DOI: 10.1016/j.eswa.2019.06.035

Dai, C., Lan, L., Lian, Z. (2014). Method for the determination of optimal work environment in office buildings considering energy consumption and human performance. *Energy and Buildings*, *76*. DOI: 10.1016/j.enbuild.2014.02.077

Dean, M. (2020). Multi-criteria analysis. In *Advances in Transport Policy and Planning* (Vol. 6). DOI: 10.1016/bs.atpp.2020.07.001

Fuentes, A. G., Busto Serrano, N. M., Lasheras, F. S., Valverde, G. F., Sánchez, A. S. (2020). Prediction of health-related leave days among workers in the energy sector by means of genetic algorithms. *Energies*, *13*(10). DOI: 10.3390/en13102475

Garcia-Cascales, M. S., Lamata, M. T. (2012). On rank reversal and TOPSIS method. *Mathematical and Computer Modelling*, *56*(5–6). DOI: 10.1016/j.mcm.2011.12.022

Hummel, K., Laun, U., Krauss, A. (2021). Management of environmental and social risks and topics in the banking sector - An empirical investigation. *British Accounting Review*, *53*(1). DOI: 10.1016/j.bar.2020.100921

Ismoilova, G. F., Qizi, N. D. A. (2019). Reformation of municipal economy: Application of ICT to the sphere of housing and communal services in Uzbekistan. *International Journal of Innovative Technology and Exploring Engineering*, *8*(5).

Khudoyberdiev, A., Ahmad, S., Ullah, I., Kim, D. H. (2020). An optimization scheme based on fuzzy logic control for efficient energy consumption in hydroponics environment. *Energies*, *13*(2). DOI: 10.3390/en13020289

Kinash, I., Shtogryn, H., Sakal, O., Zapukhliak, I. (2019). The ecologization of housing and communal services of ukraine in the context of sustainable development. *Journal of Eastern European and Central Asian Research*, *6*(1). DOI: 10.15549/jeecar.v6i1.251

Lode, M. L., Te Boveldt, G., Macharis, C., Coosemans, T. (2021). Application of multi-actor multi-criteria analysis for transition management in energy communities. *Sustainability (Switzerland)*, *13*(4). DOI: 10.3390/su13041783

Momot, T., Muraiev, Y., Savenko, K., Shapoval, G., Chekh, N. (2020). Information and communication support model of economic security of housing and communal services consumers: International experience and domestic practice. *Academy of Strategic Management Journal*, *19*(2).

Muslihudin, M., Ilayaraja, M., Sathesh Kumar, K., Shankar, K., Jamilah, J., Novitasari, D., … Maseleno, A. (2019). Decision support system in kindergarten selection using TOPSIS method. *International Journal of Recent Technology and Engineering*, *8*(1).

Mutuc, E. B., Lee, J. S., Tsai, F. S. (2019). Doing good with creative accounting? Linking corporate social responsibility to earnings management in market economy, country and business sector contexts. *Sustainability (Switzerland)*, *11*(17). DOI: 10.3390/su11174568

Nwaubani, J. C., Ohia, A. N., Ezechukwu, C. U., Opara, P., Uzokwe, C. A., Ezeji, U. M. (2020). Finding the Appropriate Model to Evaluate the Price Indices of Domestic Agricultural Production in EU24. *European Journal of Business and Management Research*, *5*(6). DOI: 10.24018/ejbmr.2020.5.6.556

Pei, Z., Liu, J., Hao, F., Zhou, B. (2019). FLM-TOPSIS: The fuzzy linguistic multiset TOPSIS method and its application in linguistic decision making. *Information Fusion*, *45*. DOI: 10.1016/j.inffus.2018.01.013

Rouyendegh, B. D., Yildizbasi, A., Üstünyer, P. (2020). Intuitionistic Fuzzy TOPSIS method for green supplier selection problem. *Soft Computing*, *24*(3). DOI: 10.1007/s00500-019-04054-8

Sarker, I. H., Alqahtani, H., Alsolami, F., Khan, A. I., Abushark, Y. B., Siddiqui, M. K. (2020). Context pre-modeling: an empirical analysis for classification based user-centric context-aware predictive modeling. *Journal of Big Data*, *7*(1). DOI: 10.1186/s40537-020-00328-3

Tao, J., Deokar, A. V., Deshmukh, A. (2018). Analysing forward-looking statements in initial public offering prospectuses: a text analytics approach. *Journal of Business Analytics*, *1*(1). DOI: 10.1080/2573234X.2018.1507604

Ugurlu, U., Tas, O., Gunduz, U. (2018). Performance of Electricity Price Forecasting Models: Evidence from Turkey. *Emerging Markets Finance and Trade*, *54*(8). DOI: 10.1080/1540496X.2017.1419955

Vasilieva, E., Danilova, E., Poltavskaya, M., Strizoe, A. (2018). Development of the third sector: Social activity management. *Journal of Social Sciences Research*, *2018*(Special Issue 3). DOI: 10.32861/jssr.spi3.364.368

Vergara, L. M., Gruis, V., van der Flier, K. (2019). The role of third sector organisations in the management of social condominiums in Chile: the case of Proyecto Propio*. *International Journal of Housing Policy*, *19*(3). DOI: 10.1080/19491247.2019.1613871

Xu, G., Wang, S., Yang, T., Jiang, W. (2018). A neutrosophic approach based on TOPSIS method to image segmentation. *International Journal of Computers, Communications and Control*, *13*(6). DOI: 10.15837/ijccc.2018.6.3268

Yang, W. (2020). Ingenious Solution for the Rank Reversal Problem of TOPSIS Method. *Mathematical Problems in Engineering, 2020*. DOI: 10.1155/2020/9676518

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