



Ranking the Russian Regions by the Technological Development of Retail Trade

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Abstract: *The purpose of the study is to rank the Russian regions by the technological development of retail trade. The components of the technological development of retail trade are justified in the article; a method for calculating particular and general indicators of the technological development of retail trade in the region is proposed; the Russian regions are ranked based on the proposed indicators, the regions are grouped by the level of technological development of retail trade; and the regions representing "best practice", as well as the regions that require the improvement of trading technologies are revealed. The ranking outcomes indicated that trading technologies in the regions of Russia were developed unevenly and insufficiently in most regions. The online trading development is the most relevant area of the technological development of retail trade in the Russian regions. Out of the leaders in the ranking, the Tomsk and Novosibirsk regions demonstrate the best practices of the technological development of retail trade, which can be used in other regions of Russia. The regions of Russia that require the improvement of trading technologies primarily include the Republic of Dagestan, the Chechen Republic, the Republic of Sakha (Yakutia), the Republic of Buryatia, the Karachay-Cherkess Republic, the Republic of Kalmykia, the Republic of North Ossetia-Alania, the Sakhalin region, and the Kabardino-Balkar Republic. Besides, Sevastopol and the Republic of Ingushetia are the problem regions.*

Index Terms: retail trade, technological development, region, trading format, trading network, online trading.

I. INTRODUCTION

The Russian economy is described by a high socioeconomic differentiation of regions [1-3]. Its manifestations include the uneven development of retail trade, which differs in the Russian regions by the level of consumer prices, amount of the shopping facilities and retail space, quality of transport and logistics infrastructure, state of

chain and online retailing, small businesses, etc. [4-5].

Technologies have significant impact on the development of state and regional retail trade. Modern retailers use geo-tracking, mobile apps, smart shelves, digital price tags, self-checkout, etc. [6, 7]. The development of retailment contributes to the spread of gaming technology in trading [8]. New technologies allow retailers to increase efficiency, create sustainable competitive advantages [7-10] as well as better fulfill their social functions, including the provision of consumer goods and services.

The purpose of the study is to rank the Russian regions by the technological development of retail trade.

The components of the technological development of retail trade are justified in the article; a method for calculating particular and general indicators of the technological development of retail trade in the region is proposed; the Russian regions are ranked based on the proposed indicators, the regions are grouped by the level of technological development of retail trade; and the regions representing "best practice", as well as the regions that require the improvement of trading technologies are revealed.

II. THEORETICAL JUSTIFICATION

The Federal State Statistics Service of Russia (Rosstat, www.gks.ru) describes the technological development of retail trade with three indicators: the share of retail network trade turnover in the retail trade turnover, the provision of the population with modern trading formats, and the share of online sales in the retail trade turnover.

The first indicator used by Rosstat (www.gks.ru) to describe the technological development of trade is the share of retail network trade turnover in the retail trade turnover. The indicator allows to assess the degree of consolidation of the industry, as well as the scale of investment in innovative technologies and methods of work, since only large companies are able to implement them. The technological development of trade networks is encouraged by the need to create new competitive advantages, due to high competition from both Russian and foreign trade networks that normally use more modern technologies [11-13].

Rosstat includes hypermarkets and supermarkets in the modern trading formats. The area of the modern trading formats refers to the retail area of self-service stores over 600 sq.m., which offer customers a wide range of goods and additional services and have counters with fresh products.

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New technologies and modern management methods are used to a greater extent in the stores of the modern format. Goryaninskaya [14] explains the relationship between innovation and the development of trading formats in the following way: trading enterprises first recognize innovations, get used to those introduced to the consumer market, and then adapt the existing trading formats to them. Kozlova [15] associates the development of trading technologies with changes in consumer behavior. Business models of commercial enterprises of modern formats allow them to better adapt to the expectations of consumers through new technologies.

Rachuk et al. [16] mention the great importance of innovative trading formats in the regional economic development, implying the development of online trading. Abalakina and Voroshilova [17] also associate the dependence between the technology and new trading formats with the development of online trading. According to the Russian state standards, online trading is "a form of electronic commerce where the buyer is familiarized with the product and terms of sale, as well as informs the seller about the intention to buy goods through the Internet information and communication network" [18]. The share of online sales in the total volume of retail trade turnover allows evaluating the development of the distance-based technologies in commerce, the degree of penetration of the Internet access, the development of electronic payments, the increase in geographical availability of goods for the population, convenience for consumers, as well as the efficiency of trading enterprises.

Thus, when estimating the level of technological development of retail trade in the Russian regions to rank them, it is advisable to be based on three statistical indicators: the share of retail network trade turnover in the retail trade turnover, the provision of the population with the modern retail formats, and the share of online sales in the retail trade turnover.

III. PROPOSED METHODOLOGY

General description. The Russian regions are ranked based on the indicator of technological development of retail trade, which is calculated in two stages. At the first stage, particular indicators are found. The calculation of the private indicators of the technological development of retail trade involves their rationing, i.e., bringing to a common scale of measurement:

1) chain retailing development indicator (I_1):

$$I_{1i} = \frac{x_{1i} - \min x_1}{\max x_1 - \min x_1}$$

where I_{1i} is the indicator of the chain retailing development in the i -th region;

x_{1i} is the share of chain retailing in the retail turnover of the i -th region, %;

$\min x_1$ is the minimum share of retail turnover in the retail trade turnover for the regions, %; and

$\max x_1$ is the maximum share of retail turnover in the retail trade turnover for the regions, %.

2) indicator of the population provision with the retail space of the modern format (I_2):

$$I_{2i} = \frac{x_{2i} - \min x_2}{\max x_2 - \min x_2}$$

where I_{2i} is the indicator of the provision of the population of the i -th region with the modern retail area;

x_{2i} is the provision of the population of the i -th region with the modern area retail space, m² per 1,000 people;

$\min x_2$ is the minimum provision of the population with the modern retail space for the regions, m² per 1,000 people; and

$\max x_2$ is the maximum provision of the population with the modern retail space for the regions, m² per 1,000 people;

3) indicator of the online trade development (I_3):

$$I_{3i} = \frac{x_{3i} - \min x_3}{\max x_3 - \min x_3}$$

where I_{3i} is the indicator of the online trade development in the i -th region;

x_{3i} is the share of online sales in the retail trade turnover of the i -th region, %;

$\min x_3$ is the minimum share of online sales in the retail trade turnover for the regions, %; and

$\max x_3$ is the maximum share of online sales in the retail trade turnover for the regions, %

The general indicator of the technological development of retail trade in the regions is found at the second stage on the basis of the above particular indicators:

$$I_i = \sqrt[3]{I_1 * I_2 * I_3}$$

where I_i is the indicator of the retail trade technological development in the i -th region;

I_{1i} is the indicator of the chain retailing development in the i -th region;

I_{2i} is the indicator of the provision of the population of the i -th region with the modern retail area; and

I_{3i} is the indicator of the online trade development in the i -th region.

Algorithm. The following scale is used to interpret the results obtained within ranking of the Russian regions by the retail trade technological development (Figure 1):

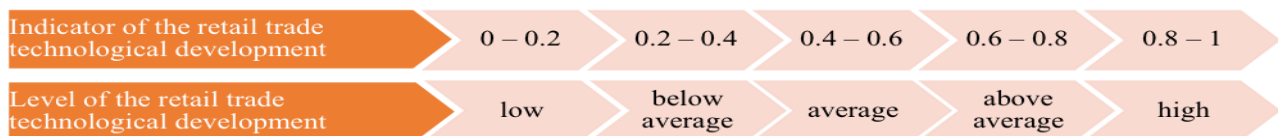


Fig.1: Procedure of interpretation of the retail trade technological development indicator

The data from the Federal State Statistics Service of Russia (Rosstat, www.gks.ru) for 2017 were used in the calculations. The Nenets Autonomous District is considered as part of the Arkhangelsk region, the Khanty-Mansiysk and Yamalo-Nenets Autonomous Districts are considered as part of the Tyumen region. Saint Petersburg and Sevastopol, the Republic of Ingushetia, the Magadan region, and the Chukotka Autonomous District are missing in the ranking due to the lack of some source data. As a result, the ranking was compiled for 77 regions of Russia.

IV. RESULT ANALYSIS

The calculation results indicate that there are no regions in Russia with a high level of the retail trade technological

development. On the top of the ranking there is the Moscow region with the retail trade technological development indicator of 0.74, which corresponds to above average. The relatively large value of the indicator for the region is primarily associated with the high provision of its population with retail area of the modern format. Aside of the Moscow region, the group of regions with the level of technological development of retail trade above average includes the Tomsk and Novosibirsk regions located in the Siberian Federal District, as well as the capital of Russia, Moscow. The Novosibirsk region is the leader among the regions of Russia in the online trade development (Table 1).

Table 1: The Russian regions with the above the average level of technological development of retail trade

#	Regions	I_1	I_2	I_3	I
1	Moscow region	0.69	0.99	0.60	0.74
2	Tomsk region	0.70	0.74	0.71	0.72
3	Novosibirsk region	0.69	0.46	1.00	0.68
4	Moscow	0.50	0.98	0.65	0.68

I_1 is the indicator of the chain retailing development, I_2 is the indicator of the provision of the population with the modern retail area, I_3 is the indicator of the online trade development, and I is the indicator of the retail trade technological development.

Source: calculated by the authors using the Rosstat data (www.gks.ru)

The group of the average level of the retail trade technological development includes six regions, which respectively occupy 5 to 10 lines in the ranking (Table 2). The leader of this group (Nizhny Novgorod region) significantly lags behind the previous region (Moscow), by 0.15. For all regions with an average level of the retail trade technological

development, the largest indicator among particular indicators is the provision of population with the retail area of the modern format, and the smallest indicator is the online trade development. The regions are located in the Volga, Urals, North-West and Siberian Federal Districts.

Table 2: The Russian regions with an average level of the retail trade technological development

#	Regions	I_1	I_2	I_3	I
5	Nizhny Novgorod region	0.54	0.95	0.29	0.53
6	Chelyabinsk region	0.64	0.86	0.25	0.51
7	Republic of Tatarstan	0.45	0.86	0.27	0.47
8	Vologda region	0.60	0.68	0.19	0.42
9	Omsk region	0.57	0.62	0.19	0.41
10	Arkhangelsk region	0.40	0.84	0.19	0.40

I_1 is the indicator of the chain retailing development, I_2 is the indicator of the provision of the population with the modern retail area, I_3 is the indicator of the online trade development, and I is the indicator of the retail trade technological development.

Source: calculated by the authors using the Rosstat data (www.gks.ru)

The group of the Russian regions with the below average level of the retail trade technological development is the most numerous and includes 39 regions that occupy lines 11 to 49 in the ranking (Table 3). The Leningrad region is on the 11th position with the index 0.39. The technological development of retail trade in the Leningrad region is mainly secured by the retail chain development, while the level of online trading development in the region remains low.

For most regions with the below average level of the retail trade technological development, the indicator of the online trading development has the lowest value among particular indicators. Particular attention should be paid to the Kostroma

region, which has the greatest provision of population with the retail area of the modern formats among the Russian regions and an online trade development indicator of 0.04, and the Kemerovo region, where at the same indicator for the online trade development, the chain retailing and modern retail area formats indicators are 0.73 and 0.89, respectively.

The Stavropol region (North Caucasian Federal District), the Altai region (Siberian Federal District), the Chuvash Republic (Volga Federal District), and the Republic of Adygea (Southern Federal District) are in the end of the group of regions with the

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below average level of the retail trade technological development, occupying lines from 46 to 49 in the ranking, respectively. The indicator of the online trade development is the smallest particular indicator in these regions as well.

Table 3: The Russian regions with the below average level of the retail trade technological development

#	Regions	I_1	I_2	I_3	I
11	Leningrad region	0.85	0.47	0.15	0.39
12	Samara region	0.55	0.42	0.23	0.38
13	Sverdlovsk region	0.52	0.25	0.38	0.36
14	Republic of Karelia	0.74	0.31	0.21	0.36
15	Krasnoyarsk region	0.46	0.32	0.31	0.36
16	Pskov region	0.66	0.54	0.13	0.36
17	Vladimir region	0.67	0.39	0.17	0.35
18	Murmansk region	0.74	0.40	0.15	0.35
19	Saratov region	0.60	0.34	0.17	0.32
20	Rostov region	0.43	0.43	0.17	0.31
21	Altai Republic	0.52	0.70	0.08	0.31
22	Khabarovsk region	0.36	0.21	0.40	0.31
23	Tyumen region	0.48	0.69	0.08	0.30
24	Tver region	0.62	0.36	0.13	0.30
25	Kemerovo region	0.73	0.89	0.04	0.30
26	Voronezh region	0.41	0.34	0.19	0.30
27	Oryol Region	0.55	0.53	0.08	0.29
28	Volgograd region	0.57	0.28	0.15	0.29
29	Bryansk region	0.46	0.78	0.06	0.28
30	Ryazan region	0.61	0.34	0.10	0.28
31	Perm region	0.44	0.79	0.06	0.28
32	Novgorod region	0.65	0.26	0.13	0.28
33	Tula region	0.50	0.49	0.08	0.27
34	Kaliningrad region	0.63	0.78	0.04	0.27
35	Kirov region	0.57	0.33	0.10	0.27
36	Kostroma region	0.48	1.00	0.04	0.27
37	Krasnodar region	0.43	0.37	0.13	0.27
38	Ulyanovsk region	0.56	0.52	0.06	0.26
39	Ivanovo region	0.49	0.36	0.10	0.26
40	Kaluga region	0.63	0.41	0.06	0.25
41	Lipetsk region	0.46	0.76	0.04	0.24
42	Udmurt Republic	0.45	0.39	0.08	0.24
43	Penza region	0.46	0.73	0.04	0.24
44	Republic of Mordovia	0.53	0.58	0.04	0.23
45	Irkutsk region	0.45	0.26	0.10	0.23
46	Stavropol region	0.26	0.28	0.15	0.22
47	Altai region	0.59	0.42	0.04	0.22
48	Chuvash Republic	0.57	0.28	0.06	0.22
49	Republic of Adygea	0.60	0.34	0.04	0.20

I_1 is the indicator of the chain retailing development, I_2 is the indicator of the provision of the population with the modern retail area, I_3 is the indicator of the online trade development, and I is the indicator of the retail trade technological development.

Source: calculated by the authors using the Rosstat data (www.gks.ru)

The low level of the retail trade technological development is typical for 28 regions of Russia, occupying lines 50 to 77 in the ranking (Table 4). Inter alia, lines 50 to 54 are occupied by the regions of the Central Federal District (Smolensk, Kursk, Yaroslavl, Tambov and Belgorod regions). There is no statistically significant online trading in the last six regions, which occupy lines 72 to 77 in the ranking, due to which the indicator of the trade technological development is zero. Besides, there is no chain retailing in the Republic of Dagestan, and the provision of the population with the

modern retail area is extremely low (the corresponding indicator is 0.003).

Table 4: The Russian regions with a low level of the retail trade technological development

#	Regions	I_1	I_2	I_3	I
50	Smolensk region	0.46	0.25	0.06	0.19
51	Kursk region	0.49	0.34	0.04	0.19
52	Yaroslavl region	0.65	0.15	0.06	0.18
53	Tambov region	0.40	0.13	0.10	0.18
54	Belgorod region	0.40	0.21	0.06	0.17
55	Mari El Republic	0.66	0.17	0.04	0.17
56	Republic of Crimea	0.34	0.19	0.06	0.16
57	Kurgan region	0.58	0.16	0.04	0.16
58	Republic of Khakassia	0.28	0.32	0.04	0.16
59	Jewish Autonomous District	0.35	0.42	0.02	0.14
60	Primorsk region	0.14	0.15	0.13	0.14
61	Kamchatka region	0.44	0.26	0.02	0.13
62	Astrakhan region	0.38	0.15	0.04	0.13
63	Orenburg region	0.51	0.20	0.02	0.13
64	Tyva Republic	0.14	0.09	0.17	0.13
65	Komi Republic	0.52	0.16	0.02	0.12
66	Republic of Bashkortostan	0.34	0.25	0.02	0.12
67	Transbaikal region	0.19	0.34	0.02	0.11
68	Amur region	0.31	0.19	0.02	0.11
69	Kabardino-Balkar Republic	0.10	0.08	0.02	0.06
70	Sakhalin region	0.09	0.08	0.02	0.05
71	Republic of North Ossetia Alania	0.12	0.003	0.02	0.02
72	Republic of Kalmykia	0.43	0.11	0.000	0.000
73	Karachay-Cherkess Republic	0.29	0.41	0.000	0.000
74	Republic of Buryatia	0.18	0.60	0.000	0.000
75	Republic of Sakha (Yakutia)	0.16	0.04	0.000	0.000
76	Chechen Republic	0.04	0.13	0.000	0.000
77	Republic of Dagestan	0.000	0.003	0.000	0.000

I_1 is the indicator of the chain retailing development, I_2 is the indicator of the provision of the population with the modern retail area, I_3 is the indicator of the online trade development, and I is the indicator of the retail trade technological development.

Source: calculated by the authors using the Rosstat data (www.gks.ru)

Figure 2 demonstrates the general distribution of the Russian regions by the retail trade technological development. In the absence of regions with a high level of the retail trade technological development, regions with the above average level (including Moscow and the Moscow

region) make up only 5.2 %. Retail sales of 87 % of all regions are described by a level of technological development below average (50.6 %) or low (34.6 %). For example, the corresponding figure equals 0 in six regions due to the absence of any component of technological development.

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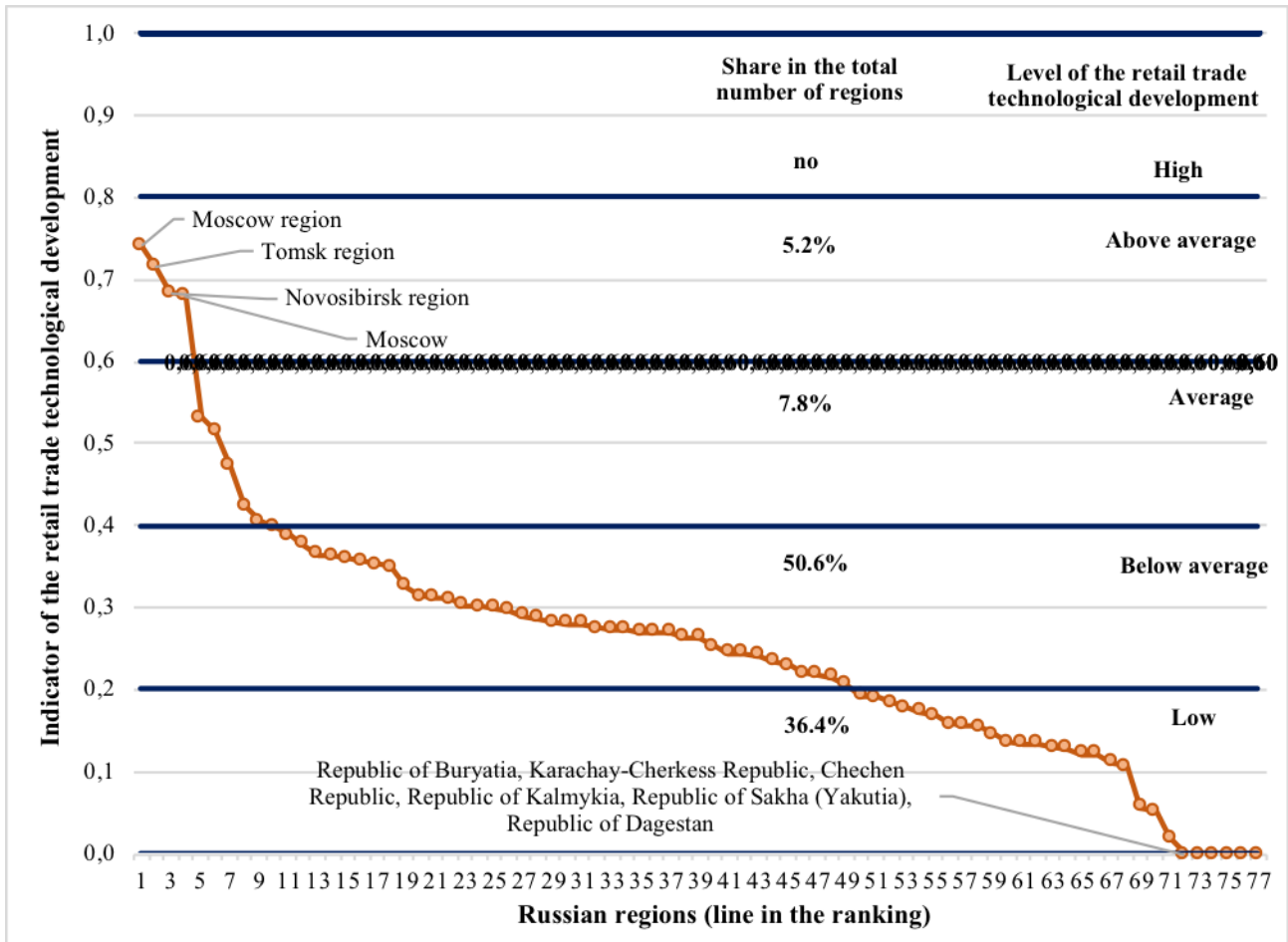


Fig. 2: Retail trade technological development of the Russian regions

As mentioned earlier, the regions for which certain data are unavailable were withdrawn from the ranking, such as Saint Petersburg and Sevastopol, the Republic of Ingushetia, the Magadan region, and the Chukotka Autonomous District. Saint Petersburg is a leader among the Russian regions by the retail chain development and shares 6 – 7 positions in the online trade development with the Sverdlovsk region. Other missing regions are described by low accessible indicators of the retail trade technological development and do not pretend to be high in the ranking.

The analysis of particular indicators of the retail trade technological development in the Russian regions has led to the following results. Retail chains are most developed in the regions of the North-West Federal District, namely in Saint Petersburg (the corresponding figure is 1), the Leningrad region (0.85), followed by the Republic of Karelia (0.74), and the Murmansk region (0.74). At the same time, chain retailing is almost absent in the Chechen Republic (0.04), the Republic of Ingushetia (0.03), and the Republic of Dagestan (no statistically significant data), which are located in the North Caucasus Federal District.

The regions of the Central Federal District, such as the Kostroma region (1), the Moscow region (0.99) and Moscow (0.98) are leading in terms of the provision of population with the retail area of modern formats. The regions of the North Caucasus Federal District – the Republic of Dagestan (0.003), the Republic of North Ossetia Alania (0.003), and the Republic of Ingushetia are also lagging behind on this indicator (there are no statistically significant data).

The online trading is developed best in the Novosibirsk region (1) and the Tomsk region (0.71) located in the Siberian Federal District, as well as in Moscow (0.65) and the Moscow region (0.60). At the same time, the indicator of the online trade development is less than 0.2 in 66 regions under study, which indicates a low level. Inter alia, there is no online trading in seven regions at all, according to the Rosstat data. They include three regions of the North Caucasus Federal District (the Karachay-Cherkess Republic, the Chechen Republic, and the Republic of Dagestan), two regions of the Southern Federal District (Sevastopol and the Republic of Kalmykia), and two regions of the Far Eastern Federal District (the Republic of Sakha (Yakutia) and the Republic of Buryatia).

V. DISCUSSION

High positions in the ranking of Moscow and the Moscow region, i.e., the capital region, are associated with a higher level of their general socioeconomic development. The Moscow region is ahead of Moscow in the development of the chain retailing and modern trading formats. This is due to the location of large shopping centers designed for the population of Moscow in the Moscow region. High population density, higher incomes, good infrastructure, etc. distinguish Moscow and the Moscow region and do not allow using their practices correctly in most other Russian regions.

In this regard, the Tomsk and Novosibirsk regions should be considered as the regions with the best practices of the retail trade technological development. The Tomsk region has indicators of the above average level for all components of the retail trade technological development. The Novosibirsk region is among the leaders in the ranking mainly due to the online trade development.

Due to the peculiarities of the local government, the ranking does not include the former capital of Russia – Saint Petersburg, one of the most socially and economically developed regions. Saint Petersburg and other regions of the North-West Federal District have the best indicators of the chain retailing development. Moreover, the chain retailing in these regions continues to spread, i.e., the share of chain retailing in the retail trade turnover is increasing [19]. Sevastopol, a federal city located on the territory of the Republic of Crimea, is another significant region that is not represented in the rating due to the lack of data. The political situation in 2014, which caused a discussion about the status of Crimea and Sevastopol, resulted in the significant economic consequences for the region [20]. The trade industry development was one of the conditions for the economic recovery. The research results indicate that the main problems of the Crimea trade, which arose after its introduction into the Russian Federation, have been solved or continue to be solved by means of the state regulation measures [21]. Crimea ranks 56th in the ranking and has a low level of the retail trade technological development. Particular attention should be paid to the development of online trading and commercial enterprises of modern formats.

The Republic of Sakha (Yakutia) and the Republic of Dagestan are among the regions that occupy the last lines of ranking, i.e., lag behind in the retail trade technological development. These regions are recognized as the most in need of state support for the trade development, as trade in them is poorly developed and declines. There are positive trends in trade in other regions with an indicator of the retail trade technological development less than 0. [4].

Comparison of the individual components of the trade technological development reveals that its main problem is related to online trading. E-commerce in general and online trading, in particular, should be supported by the state, as they are vital for its development [22]. The use of information technology plays an important role in trade and national economic growth to achieve public welfare [23]. The main barriers to the e-commerce development in Russia include concerning market, infrastructure, and institutional issues [24-26]. Solution of these problems will contribute to the retail trade technological development in Russia and its regions.

VI. CONCLUSION

The ranking of the Russian regions by the retail trade technological development allows presenting the following results and conclusions.

1. Trading technologies in the Russian regions are developed unevenly and insufficiently in most regions. There are no regions with a high level of the retail trade technological development. The regions whose retail trade

has above average or average level of technological development make up only 13 % in the aggregate, while those with a below average or low level make up 87 %. This situation confirms the need to eliminate regional imbalances, as well as accelerate the general retail trade technological development in Russia.

2. The development of online trading is the most relevant area of the retail trade technological development in the Russian regions. Online trading is the least developed technological component in most regions represented in the ranking. There is no online trade at all in seven regions (the Karachay-Cherkess Republic, the Chechen Republic, the Republic of Buryatia, the Republic of Kalmykia, the Republic of Sakha (Yakutia), the Republic of Dagestan, and Sevastopol).

3. Out of the leaders in the ranking, the Tomsk and Novosibirsk regions demonstrate the best practices in the retail trade technological development, including online trading. The practices of these regions will be useful and can be used in other Russian regions. The focus should be made on the regions of the North-West Federal District in the development of chain retailing (Saint Petersburg, Leningrad and Murmansk regions, and the Republic of Karelia). The Kostroma region is an example of the best practices of providing the population with retail area of modern formats.

4. The Russian regions that require the improvement of trading technologies primarily include the Republic of Dagestan, the Chechen Republic, the Republic of Sakha (Yakutia), the Republic of Buryatia, the Karachay-Cherkess Republic, the Republic of Kalmykia, the Republic of North Ossetia Alania, the Sakhalin region, and the Kabardino-Balkar Republic. Besides, Sevastopol and the Republic of Ingushetia are the troubled regions, which are not included in the ranking due to the lack of certain data.

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