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Review article

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FOOD SECURITY, FOOD WASTE AND FOOD SHARING: THE CONCEPTUAL ANALYSIS

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KEY WORDS:
food security, access to food for people in need, food waste, food sharing, platform economy

ABSTRACT

Authors emphasize that food in the modern world is becoming less accessible due to the present global economic, geopolitical and climatic situation. At the same time a large share of food produced in the world goes to waste. It means that there is a need to implement tools that could provide people with access to food and reduce amount of food waste. Food sharing, a novel tool of collaborative food consumption, can be used to solve this problem. The paper introduces the concept of distributive food sharing and describes its different types. A description of the present state of distributive food sharing in Russia. We state that the environment for development of distributive food sharing in Russia is not favorable. The main conclusion of the article is the need to create conditions for the development of the concept of food sharing to provide those in need with food and minimize waste.

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Обзорная статья

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ПРОДОВОЛЬСТВЕННАЯ БЕЗОПАСНОСТЬ, ПРОДОВОЛЬСТВЕННЫЕ ПОТЕРИ И ФУДШЕРИНГ: КОНЦЕПТУАЛЬНЫЙ АНАЛИЗ

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КЛЮЧЕВЫЕ СЛОВА: АННОТАЦИЯ

продовольственная безопасность, доступность продовольствия для нуждающихся, нерациональное использование продовольствия, фудшеринг, платформенная экономика, бедность

Авторы подчеркивают, что в современном мире продукты питания становятся все менее доступными в связи со сложившейся глобальной экономической, геополитической и климатической ситуацией. В то же время значительная часть производимого в мире продовольствия используется нерационально и попадает в отходы. Это означает, что существует необходимость внедрения инструментов, которые могли бы обеспечить людям доступ к продуктам питания и сократить количество пищевых отходов. Для решения этой проблемы может быть использована раздача продовольствия как новый инструмент коллаборативного потребления еды. В статье представлено понятие распределительного способа раздачи продуктов питания и описаны его различные виды. Описано современное состояние распределительного способа раздачи продуктов питания в России. Мы констатируем, что условия для развития распределительного способа раздачи продовольствия в России неблагоприятны. Основной вывод статьи — необходимо создать условий для развития концепции раздачи продовольствия для обеспечения нуждающихся слоев населения продуктами питания и для минимизации количества выбрасываемого продовольствия.

1. Introduction

Sharing economy has emerged as a social reaction to two key challenges of the modern capitalism. On the one hand, capitalist economy encourages excessive consumption that leads to waste of commodities and to unnecessary financial expenses. On the other hand, many people often have only a limited access to the food and services they need as they are not able to pay the full price. Sharing economy partial

ly alleviates these problems by promoting the responsible consumption and collaborative use of resources [1,2].

Though sharing economy initially appeared as a social tool, now it is a popular business model (Uber and Airbnb are probably the most prominent examples). Sharing-driven commercial and non-commercial projects exist in various industries including food industry (where this phenomenon is known as food sharing). In the food industry the above-mentioned challenges of the capitalist economy are especially visible [3]. A substantial part of the global population does not have a stable access to food. This problem of poor food security has many reasons: gradual demise of welfare state in developed countries [4], high food prices (caused by climatic changes and geopolitical situation) [5], low level of income in developing and underdeveloped countries (in African and Asian countries the share of population that has no guaranteed access to food can be over 50% [6,7]) etc. At the same time, a significant part of food produced in the world is not consumed and goes to waste. This is why food sharing, despite its limited potential, can be an impor-

tant element of the set of tools that are used to ensure food security and to eliminate food waste.

Over last two years new factors emerged that disrupted global food supply chains, led to higher food prices and to lack of food in the retail chains and further worsened the food security of people with low and no income. These factors are the COVID19 pandemic and the Russian special military operation in Ukraine [5]. Due to the coronavirus pandemic, not only existing global system of food supplies was disrupted (which resulted in escalation of food prices, food shortage and food rationing), but also many working people lost their income and faced a lack of finances to buy food [8,9]. This problem has had a particularly strong impact on citizens of the countries whose government has not developed a proper package of social aids to those who have lost their jobs due to the pandemic. The effect of the special military operation in Ukraine is even deeper:

- the sanctions imposed on Russia [10] and the battles in Ukraine [11] restricted access of food produced in these countries (grain, sunflower oil etc.) to the global market. It substantially reduced the availability of food (as Russia and Ukraine used to be important players on the food market, as their share accounted for 29% of world's wheat exports [10]) led to increase of global food prices. It had an especially severe impact on Middle East and North Africa due to this region's strong dependence on food imports [12]. However, it also has long-lasting effects for the food security of countries beyond this area [13];

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- Russian fertilizers are banned in the international market that leads to a further increase of food production costs [14];
- Russian oil and gas are forbidden in Europe. It is one of the reasons of growing costs in the whole food production chain, as oil and gas are necessary at all stages of this chain (production of fertilizers, agriculture, transportation etc) [14].

On the other hand, a significant share of the food produced in the world is not consumed but is sent to waste [15]. This is due to ineffective planning of production and marketing (when food products produced and purchased by retail chains are not sold before their date of expiration [16,17,18,19]), poor organization of transportation and improper storage, as well as overconsumption of the population (which purchases excessive food that will go to waste). This creates economic problems (lower efficiency of manufacturers and retail chains, higher disposal costs) and undesirable environmental effects (since waste creates an additional load on the environment) as well as social threats (because this food waste reduces availability of food for the people with low and no income).

The problem of providing the guaranteed access to food for all people has a long history. Traditionally, it was solved either by the state (using various non-market instruments, such as food stamps in the USA [20,21]), or by charitable organizations (which, however, due to their limited resources could not reach all those in need) [22,23,24]. However, currently, thanks to the active application of digital technologies (transition to a platform economy) [25,26,27], self-organization of economic agents [28] and changing consumers' priorities (abandoning excessive consumption in favor of responsible use of food), as well as the emergence of new ways to organize access to food [29], it is possible to create new tools to solve this problem.

It is necessary to propose a comprehensive solution that would allow the population to have access to food and at the same time reduce the amount of food waste. It should be noted that this task differs from traditional approaches to ensuring food security (which are aimed exclusively at providing the population with guaranteed access to food and do not set any other goals, for example, improving the efficiency of food use and thus minimizing negative environmental impact) [30,31,23]. Currently, one of the main directions of the modern society evolution is the concept of sharing and collaborative consumption [2,32]. For this reason, we propose to consider the prospects of using the sharing to address the issue of food availability for vulnerable groups of population.

It should be noted that although sharing is gradually gaining popularity in Russia, there are relatively few studies on it [33,34] and this studies mostly deal with general economic and social effects of sharing economy while the use of as a tool of access to food for epy people who live in food insecurity remains completely unexplored (there are only analytical reports on it [35] Our article fills an important gap, contributing to a better understanding of the market of sharing in Russia.

The article includes theoretical and analytical components. In the theoretical part, we offer a comprehensive description of the phenomenon of distributive food sharing that can be used as a partial solution for the existing imbalance between excessive food waste and insufficient food security of people with low and no income (as far as we know, there is no such description in the existing literature). In the analytical part, we will show the state of food sharing in Russia and formulate recommendations for its development.

2. Objects and methods

Considering the goals set, we used the following research methods:

1. To identify factors that worsen the availability of food for people in need (agflation and the consequences of the pandemic), we analysed statistical data (the source of which was the information collected and published by the Russian Statistical Agency (Rosstat)).

2. The comprehensive description of the phenomenon of food sharing was carried out based on a narrative review of the literature on food sharing as a tool for solving the economic, environmental and social problems. For this review, the articles in the journals indexed in Scopus and Web of Science databases were used.

3. The analysis of the level of food sharing development in Russia is based on analytical reviews [35], information published on the websites of Russian food sharing organizations and in their social media groups. In addition, we performed a search for the keyword "foodsharing" in the social network *Vkontakte* (popular in Russia), which allowed us to identify informal consumer communities which participate in food sharing in Moscow and St. Petersburg.

3. Results and discussion

3.1. Food sharing: basic models

Food sharing is a complex social phenomenon that encompasses various practices in the field of collaborative production, purchasing, cooking and consumption food. Similar practices have always existed in various

societies but generally food sharing took place among the members of the same community [36]. The digital revolution helped to extend these practices and to include strangers [32]. Thanks to the digital technologies (first of all — the digital platforms) people who do not know each other can now cooperate in order to enhance their access to food, reduce cost of food consumption and avoid food waste. Participation in these practices provides food sharing activists not only with the material benefits (listed above), but also with social value as their pro-social behavior is approved by other participants [37]. The classification of these practices is given below in the Table 1.

Table 1. Types of food sharing

Table 1. Типы фудшеринга

Type of food sharing	Description	Example
Food co-production	People combine their efforts to grow agricultural products together, and share the harvest among themselves	Various models of collaborative urban agriculture [38]
Collective purchase of food	People pool their financial resources to buy food directly from the producers (or suppliers)	Solidarity purchase groups [39]
Collective cooking	Centralization of participants' efforts and resources for cooking meals	Collective kitchens [40]
Collaborative food consumption	Process of redistribution of the food surplus between suppliers and recipients	Sharing of food among two people

Some researchers extend the concept of food sharing to include common (collaborative) use of resources that can be used to produce or to get food (urban plots, information about points for gleaning, collective workshops on growing food, on cooking etc). However, we do not agree with this approach as it over-generalizes the concept of food sharing.

As Table 1 shows, there are four basic types of food sharing. The first three of them represent collective production of food (generally organized without any formal registration) [41,42]. These productive models of food sharing help people to enhance their access to food by enabling them to get food that is not available in the food retail chains and restaurants and/or to save money and/or time thanks to economies of scale. They also contribute to community building as participants share the common values and establish social ties through the food sharing. However, these productive models generally do not deal with food surplus and are not oriented towards reduction of food waste.

To the contrary, the goal of collaborative food sharing is to avoid inefficient use of food by redistributing food surplus [43,44]. This model of food sharing (that can be described as distributive food sharing to differentiate it from productive food sharing models described above) has four dimensions [45,46]:

- Economic dimension as it helps to reduce financial losses related to food waste and creates value for recipients of food. Food suppliers either can charge a price for the food they re-distribute (generally this price is substantially lower than the normal market price of the product) or avoid cost related to waste disposal. Food recipients save money by getting food at a lower price or for free. Thanks to food sharing recipient can get a larger amount of food than usual or receive food of higher quality;
- Social environment impact as it fosters social responsibility of food suppliers and provide recipients (many of whom belong to groups with low or no income) with food they need [47];
- Ecological dimension as redistribution of food reduces food waste. It helps to decrease the negative impact of the global food security system on the environment [48,49,50,51];
- Community dimensions as participation in food sharing helps to build social ties.

Importance of distributive food sharing is recognized not only by the activists, but also by the other stakeholders, including governments. For example, in France, since 2016 law has been introduced that prohibits stores with more than 400 square meters of area dispose of the food products. Shops are obliged to transfer products to charitable organizations, otherwise they must pay a fine of up to 75 thousand euros (the list of penalties for violation includes arrest for up to two years) [52].

Of course, the development of distributive food sharing will not be able to solve all problems of food security and food waste. Nevertheless, it is one of the possible tools to improve the current situation.

As collaborative food consumption (or distributive food sharing) is the only type of food sharing that contributes to a compromise between fighting food waste and providing people with access to food, productive

types of food sharing will be excluded from the research. We will analyse only distributive food sharing practices.

3.2. Analysis of distributing food sharing

Key features of distributive food sharing:

- ❑ Food products are provided free of charge (non-commercial food sharing), or at a price significantly lower than their initial or normal market value (commercial food sharing).
- ❑ The goods transferred to the needy must be of satisfactory quality or the supplier must explicitly inform recipients about potential problems. For example, the suppliers may re-distribute food products that are beyond their “best before” date but are not spoiled yet. In this case suppliers should clearly state this problem so that potential recipients could decide if they are ready to take risk related to this food. But in no case can re-distributed food be dangerous, really spoiled etc. However, it is only possible for C2C food exchanges. If food is provided by businesses (producers, retail chains etc) it must meet all legal requirements and may not be expired. Therefore, unprocessed meat and fish and dairy products are rarely used in the food sharing.
- ❑ As a rule, food re-distribution is supported by the intermediaries that facilitate interactions between the suppliers and the recipients.

Intermediaries use various models of facilitation. Depending on these models the following types of food sharing can be identified:

1) B2B2C. This food re-distribution mechanism is used when the company that wishes to transfer goods is a store (or the amount of donated food is large enough). In this case, the distribution is normally organized through charitable foundations — food banks etc [53,54] which collect food from suppliers and re-distribute it among its users (so B2B2C in this context means “food supplier — food bank — final user”) through soup kitchens, free shops etc. Food bank as a rule has facilities and personnel (generally volunteers) necessary to collect, store and distribute the food. The food bank may own soup kitchens and free shops or cooperate with independent organizations (in this case the chain of intermediaries becomes longer: “food supplier — food bank — soup kitchen (free shop) — end user”).

As food banks are non-commercial institutions, they often do not have enough resources to develop food redistribution infrastructure. It limits their potential to support people in need and to promote food sharing as a social practice [22].

2) B2C. In this case intermediaries do not participate directly in physical redistribution of food. They provide the suppliers and the recipients with digital infrastructure (platforms) where suppliers can publish information about their food surplus and the recipients can respond to these offers. Platform also set up the rules of food sharing that suppliers and recipients are obliged to respect. Commercial food sharing (sale of expiring food products at a discount) is generally organized in this format. Unlike B2B2C model,

where large amounts of food are transferred from suppliers to intermediaries (wholesale deals), B2C format mostly corresponds to retail deals (when the individual customers purchase small amounts of food at a discount).

The potential of commercial factoring as a tool to ensure access to food for people in need is limited, since food is mainly provided by restaurants, cafes etc. Taking into account the high margin that restaurants include into their prices [55], even the discount provided often does not make the food re-distributed through commercial food sharing affordable for the people in need.

3) C2C. This mechanism is used when one person wants to give surplus food to the other consumers [56]. As a rule, the groups in social networks are used for this purpose. These groups are used only as a platform of communication and are normally non-commercial. Owners of these do not provide any support for suppliers and recipients (unlike operators of digital platforms used for B2C food sharing) [57,58]. There are also specialized applications for smartphones [59].

People who have food surplus publish information in this social media group and specify terms of transfer. People who are potentially interested in receiving this food reply to this ad (directly in the group or via their private messages). Normally the model “the first come first served” is used. After that suppliers and recipients agree upon the place and the time of the food distribution.

Organization of C2C food sharing:

- ❑ products are transferred free of charge (or for a small compensation);
- ❑ recipients should not take more food than they can consume;
- ❑ products re-distributed through food sharing cannot be resold;
- ❑ limited counts of food transfers to one recipient during a fixed period of time may apply;
- ❑ no discrimination of the recipients (age, race, gender, income etc).

Similar practices have long existed in various regions of the world [60], but the use of digital technologies has significantly simplified their use [61,62].

4) C2B2C. Within the framework of this model, an infrastructure that simplifies the exchange of food products between users can be created. An example of such an infrastructure is the public refrigerators, which have gained great popularity in Germany. In these refrigerators installed in public places, anyone can leave and pick up food [63,64]. Transfer of food within this model is organized without any negotiation between the suppliers and the recipients (so there is no need in digital platforms for communication). Suppliers simply leave their food in these refrigerators while the recipients check the available food and take what they like.

The owner of these refrigerators does not participate in food exchanges either. It simply provides public infrastructure for food re-distribution free of charge.

The more detailed classification of distributive food sharing is presented below in the Table 2.

Table 2. Classification of food sharing

Table 2. Классификация фудшеринга

Classification criteria	Type of foodsharing	Comments	Example
Participants	B2B2C	Legal entities (food suppliers, foundations, etc.) participate in the program of food sharing, which is organized by a specialized organization that collects, stores and distributes food, as well as controls the processes of food distribution	Distribution of food through food banks
	B2C	Providing distribution participants with an online service (platform) that simplifies interaction. Typical for retail food distribution	Food sharing apps (DoggyBag)
	C2C	The food is directly exchanged between the consumers	Food sharing groups in the social media
	C2B2C	Creating an infrastructure for the exchange of the food in a physical environment	Public refrigerators
Interaction space	Physical	Food sharing is run via the purposely created material infrastructure (warehouses, shops, pick-up points, canteens, etc.) and/or with the involvement of personnel and means of delivery	Food banks Public refrigerators
	Digital	Interaction between the participants of the sharing is organized using digital tools, no special material infrastructure is created	Food sharing digital platforms
	(Phygital)	Both digital and material tools are used for food sharing	Russian project “Foodsharing”
Economic nature	Commercial	Food suppliers participate in food sharing for commercial purposes	Commercial food sharing
	Non-commercial	The participants of the food sharing are interested in (social, environmental, etc.) goals	Non-commercial food sharing groups in social media
Type of products	Not ready to eat	Suppliers provide food that should be cooked	Food provided by retail chains
	Cooked	Suppliers provide ready-to-eat meals	Food provided by restaurants
	Combined	Both food for cooking and ready-to-eat food can be re-distributed	Typical for C2C food sharing
The amount of food provided	Wholesale	Redistribution of large amounts of food	Typical for food supplies from the stores and from the manufacturers
	Retail	Redistribution of small amounts of food	Typical for food supplies from the restaurants and for C2C food sharing

3.3. The current state of food sharing in Russia and recommendations for its development

The first food sharing project in Russia is the movement of the same name [65]. It has been operating since 2015 in Moscow and St. Petersburg. The principle of operation of the Russian Food sharing movement is close to the concept of B2B2C. The peculiar feature of this project is the absence of its own distribution center. Re-distribution is carried out by volunteers who pick up food from the suppliers and deliver it to the recipients (if the weight of the provided food exceeds 12 kg). At least 50% of the food collected by the volunteer should be distributed among people in need free of charge, and volunteers can keep the rest for their personal consumption.

Absence of physical infrastructure reduces operation costs and accelerates food distribution. It helps to increase the quality of food. The coordination of the interactions of the participants of the foodsharing is carried out through the Vkontakte social media network and Google forms.

To assess the level of development of C2C food sharing in Russia, a search was run for the keyword “food sharing” in the Vkontakte social network (the most popular social network in Russia) in order to spot out the specialized social media groups supporting distributive food sharing (Table 3). A total of 521 groups were found, the analysis of the most active of them is presented below in the Table 3.

**Table 3. Food sharing communities in Russia
(The online study was run on 15.10.2021 by the authors)**

Table 3. Фудшеринговые сообщества в России (онлайн-исследование было проведено авторами 15.10.2021)

Group name	Number of subscribers	Average number of posts per day for the period 29.09–13.10
Fudshering Sankt-Peterburg (Food sharing Saint Petersburg)	23621	11
Fudshering v SPb! [Produkty pitaniya darom] (Foodsharing in St. Petersburg! [Food for free])	7501	1,33
Fudshering Otdam darom edu (Moskva i Sankt-Peterburg) (Foodsharing I will give away food for free (Moscow and St. Petersburg))	78632	21,6
Helpfud. Fudshering. Sankt-Peterburg (Helpfood. Foodsharing. Saint-Petersburg)	7361	1,07

The Table 3 shows that the food sharing trend is gaining popularity in St. Petersburg and Moscow. The results of our search are not complete as many food sharing transactions in social media are organized in small local groups (for example, groups created for a single district or even for a single residential complex: these groups are not specialized in food sharing, and support all types of interactions and deals among their members). In the analysed groups, a wide range of food products are redistributed (ranging from infant formula to ready-to-eat home cooked food). Thus, in Russia, the concept of food sharing is beginning to attract followers in large cities. In regions food sharing is less developed but not absolutely absent. One of the local food sharing projects is the group “Foodshering | Nefteyugansk” (“Фудшеринг | Нефтеюганск”) [66], created in Nefteyugansk (a small city in the north of Russia but with a high level of life thanks to the local oil industry). This group is especially interesting because it was founded by the schoolchildren.

Unfortunately, the conditions for development of distributive food sharing in Russia are not favorable. For example, if a food store decides to transfer food to a food bank, the food bank has to pay 40% of the goods value, as there is tax 20% — income tax, and 20% — value added tax). Therefore, food retail stores have no economic incentives to participate

in distributive food sharing in Russia. It is important to introduce legislation that would support food sharing practices.

The government is reluctant to exempt food sharing from taxes for the following reasons:

- possibility of using the write-off of products for tax evasion.
- complexity of tax administration of the write-off procedure.

However, these concerns are unjustified. Russia has developed a digital system of control over the payment of taxes, which can effectively counteract tax evasion and simplify the process of administration.

It is interesting to note that the largest retail chains in Russia support amendments to legislation that would simplify the procedure for writing off the food products and create favorable conditions for their use for distributive food sharing [67]. The interest of retail chains in creating a favorable legislative environment for food sharing may contribute to the adoption of necessary changes (since retail chains in Russia are influential market players).

4. Conclusion

The traditional ways of providing food to the low-income people based on government intervention and on the activities of individual charitable organizations do not correspond to the current social and technological environment. It is necessary not only to increase food production, but to ensure more efficient and considered consumption of available food and reducing of waste through self-organization of participants of the food production and consumption chain.

Food sharing as a tool for food redistribution will improve the quality of food use and reduce the negative effect of food waste on the environment. It will not be able to replace traditional food security tools (such as food stamps), but it will be an effective supplement for them.

In order to fully realize the potential of food sharing in Russia, it is necessary to develop an appropriate regulatory framework, in particular, to accord tax-exemption for the food transferred to people in need. In this case, it will be possible to involve in food sharing not only the private suppliers, but also the commercial organizations. It will increase the volume of available food, expand its assortment and achieve stability in the amount of the provided food. Without this, food sharing will remain a narrow niche tool covering only a limited number of participants.

Another measure is the promotion of food sharing as a social tool (among the retail chains, the consumers and people in need). The knowledge that food cannot and should not go to waste, but should be transferred to people in need, will contribute to consumers' adoption of distributive food sharing concept. The formation of an attractive image of sharing as a way to solve social and environmental problems will allow its more efficient using to provide food to the people in need and to reduce food waste.

It should be emphasized that food sharing will not be able to solve the problem of food shortages in the poor countries. Due to the large number of starved populations, the food sharing resource for these states is insufficient (since the volume of excess food both among the consumers and the retail chains — due to their insufficient development — is quite small). On the contrary, in the developed countries, where the people in need make up a relatively small proportion of the population, and at the same time the retail trade infrastructure is well-developed (where the retail trade produces a large amount of waste), and the consumers, as a rule, have a significant amount of excess food, food sharing can serve as an effective tool for providing food to the people in need.

It is important to note that food sharing is a reaction of the society to unreasoned (excessive) production and irresponsible consumption of food. With the increase of the retail chains efficiency (minimizing losses due to more accurate planning of orders) and the transition to responsible consumption, the amount of food that will be used for food sharing will inevitably decrease. This serves as an additional confirmation that food sharing cannot be the only or even the main tool for providing food for the people in need.

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