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Qualitative Research on Solving Difficulties in Maintaining Continuity of Food Supply Chain on the Meat Market during the COVID-19 Pandemic

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Abstract: Although the pandemic phenomenon is not the first of its kind in human history, the common feature of COVID-19 is its rapid impact on the global economy. The challenge for the national economy on the world stage is to maintain a continuous food supply. The scientific purpose of the study is to report, analyze and evaluate backgrounds, causes of instabilities and their effects of the COVID-19 pandemic on supply and demand side of the meat market in the United States of America, China and Russia. The practical purpose of the study is to present implemented measures and recommendations on how to return to meat market equilibrium. In the theoretical part of the study, the revised public source of information coming from well-known organizations such as: EC, FAO, OECD, and WB, are used. In the practical part of the manuscript, qualitative research on the People's Republic of China, Russian Federation, and the United States of America, along with semi-structured in-depth interviews with experts and Ishikawa diagram are presented. The primary data come from authors' own research and collection of multiple sources. The article indicates the use of qualitative systematic review, supported by a creation of a prototype of the issues of maintaining continuity of the food supply chain during the COVID-19 pandemic in the secondary sources, intensified by a keyword search. The results of the research are diverse and oriented toward the needs of the analyzed meat markets. In the case of the People's Republic of China, the solution is to develop a system of subsidies and preferential rates for the use of rail transport in exports. In the case of Russia, the solution is to provide support to the meat and poultry farmers for cold storage of slaughtered animals. In the case of the USA, the solution is to develop technical and technological facilities in order to speed up the supply chain between local livestock with meat and poultry farmers. Moreover, the outcomes indicate that sustainability of the food supply chain needs well-thought-out support on agri-food supply production.

Keywords: COVID-19 pandemic; meat and poultry supply chain; resilience; qualitative research

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1. Introduction

Food Supply Chains during the COVID-19 Pandemic

After air and water, food, as one of the most complicated sets of chemical elements, is the third most important thing for living [1].

According to article 2 of the Regulation of the European Parliament and of the Council of 28 January 2002 [2] "food means any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be, ingested by humans. Food includes beverages, chewing gum and any substance, including water, knowingly added to food during its manufacture, preparation or handling. Food does not

include, but is not limited to, feed, medicinal products, cosmetics, tobacco and tobacco products, narcotics" [2]. The purpose of consuming food is to provide the human body with essential nutrients (building blocks, energy and regulation). Foods, when taken orally, are digested in the digestive tract and the nutrients are absorbed into the body [1].

An increase in food production due to growth of world population is associated with an increased quantity of high quality raw materials. A legitimate concern for the food industry is the negative impact of increased production on climate, water shortages and intensive agricultural land use [3,4].

The COVID-19 pandemic affected food security, defined as an access to safe and sufficient food, and caused damage to the global economy [5]. The COVID-19 pandemic has short- and long-term effects on economic growth, food production and mankind worldwide [6–8].

Food security includes four domains, i.e., availability, access, stability, and use and recycling [9]. The COVID-19 pandemic affected all dimensions of food security [10,11]. An outbreak of COVID-19 pandemic has caused food systems to become incapable of delivering the required amount of food items on the market worldwide. Production, processing and trade were disrupted by decreased availability of many food items. Due to the economic meltdown, people lost their jobs [12] or had to cope with limited resources, experiencing serious problems in access to nutritious food [13–16]. Numerous households have been challenged to compile their menu from the constrained amount of food or incomplete ingredients while trying to comply with higher sanitary standards [5,17,18]. Serious changes in the supply and demand of food accompanied by price movements have led to instability of food systems and resulted in food insecurity. The supply disruptions were the most serious and acute for basic but labor-intensive goods such as: meat, dairy, vegetables [19,20] and imported goods [21]. For example, Balagtas and Coope (2021) tracked livestock and the meat market in the United States during the COVID-19 pandemic [22]. Ramsey, Goodwin, Hahn, Holt (2021) showed the influence of COVID-19 on the transmission of wholesale and retail prices on the US meat market [23]. Tonsor, Lusk, Tonsor (2021) monitored meat demand during the COVID-19 pandemic [24].

For the purpose of the article, it is needed to recollect a model of food supply chain. Food supply chain describes the main components of the system by identifying its stocks and flows. The food supply chain is a complex system, as it includes different actors, like farmers, producers, processers, wholesalers, and retailers. The complexity of the supply chain results from the high fragmentation of actors and the high diversity of produced food. Consumers take a keen interest in the origin of food and follow the path that food takes before it reaches their table [25].

The food supply chain is influenced by the feedback of information to its production, processing and distribution components such as buyer preferences, willingness to pay, weather and climatic variations and market conditions. This is how those components tweak when they remain competitive in the market system. Moreover, the food supply chain is vulnerable to intervention at any of its leverage points such as prices, production practices and food imports competing with inland-produced foods and the livelihoods of inland-farmers and food processors [26–29].

According to Bendeković et al. [30], a food chain is formed by the following stages: agricultural production, postharvest, handling, processing, distribution, retail/service and, intake. Regarding food quality and safety, two systems are being implemented [31]. The first one relays on regulations and laws, inspected by state authorities, and ultimately lead to mandatory regulations [32]. The second one relays on voluntary standards, inspected by national and international associations, and ultimately leads to voluntary regulations. Although COVID-19 is not transmitted to livestock and agricultural products, the pandemic indirectly affects food production.

Governments in most countries around the world have implemented numerous safety measures, which include increased health and safety for workers in the agri-food sector (wearing masks or visors, and gloves), disinfection of the workplace and work environment,

and increased attention to personal hygiene outside of work (frequent hand washing and disinfection, maintaining social distance). As Rizou et al. stated [33], safeguard measures in the last stages of the food supply chain have increased in strength and importance. Hueston and McLeod [34] showed that food and agricultural products are diverse. Restriction among cities, provinces, regions and countries affected distribution of staple products: wheat, corn, maize, soybeans, oilseeds [35] as well as high-value products, such as fruits, vegetables, and fisheries [36]. Martin [37] indicated that the need to consume high-value products, which include fruits, vegetable, and fisheries, will force an increase in the technological sophistication of production and the skills of workers.

Meat represents an important source of nutrients in a human diet. An amount of 18.5% of daily energy is taken up into the body from meat, meat products, and seafood in the western diet [38]. Meat and fish as a food category sequestrates (starting from the production, transport, handling and processing) the most energy and contribute to over 20% of the total energy absorbed in the annual diet in developed countries [11,39]. Meat products are characterized by one of the lower efficiencies considering input and output energy in a human diet [39–41], including when only protein sources are considered [41]. Nevertheless, the low energetic efficiency of meat production and high environmental footprint can be significantly improved by rendering meat by-products and waste treatment [42–45]. Nonetheless, the high cost of production including environmental burden, energy and high nutrition value, makes this food category of a special concern in a food supply chain [44]. Securing the continuity of meat supply and avoiding meat losses and waste in the supply chain requires governmental policy interest at any time, particularly in the case of COVID-19 pandemic.

To emphasize the fact of high universality and utilitarianism of the presented research, which is based on the assumption of the necessity to maintain continuity of food supplies to citizens, redefinition of the concept of peripheral development of economy, based on cost advantages of raw materials and production. The essence of the presented results is the optimization of the country's raw material potential to ensure food security and respect the principles of sustainable development. This is possible through the use of digital technologies implemented by state institutions, e.g., ministries of agriculture.

The study aims to report, analyze and assess different influences of the COVID-19 pandemic on the supply and demand side on the meat market in the USA, China and Russia. The article offers an attempt to comprehensively show the different backgrounds, causes of instabilities and their effects in the meat market resulting from COVID-19, along with various measures that were introduced to return to market equilibrium. The scope of the study covers the policy actions undertaken to balance analyzed meat markets. The research is supplemented by general conclusions and recommendations for public policy and different market actors. The article formulates the hypothesis (H1): The differentiation of food system policies in the time of the COVID-19 pandemic affects the reduction of demand- and supply-shocks on the meat market. Accepting or rejecting the hypothesis in conclusion required the formulation of three research tasks:

1. Creation of a set of key supply-side disruptors;
2. Creation of a set of key demand-side disruptors;
3. Evaluation of the effectiveness of the undertaken actions to reduce food-supply chain distortions on the analyzed meat markets.

The paper consists of five parts, i.e., an introduction to the food supply chain, its resilience, and the consequences of implementing COVID-19 pandemic restrictions, materials and methods, results and discussion, conclusion, and bibliography.

2. Materials and Methods

2.1. Primary and Secondary Research Materials

For the research, primary and secondary research sources were used (Table 1). Primary research sources included semi-structured in-depth individual interviews, which play a supplementary role. Secondary research sources included a set of materials necessary for the preparation of case-studies. In order to present case-studies, the analysis of the situation and effect of COVID-19 pandemic on total food demand and total food supply on the meat market in China, USA and Russia was conducted using databases, market reports, newsletters, and information services from the Center for Disease Control and Prevention (CDC), European Commission (EC), Food and Agriculture Organization (FAO), International Food Information Council (IFIC), International Food Policy Research Institute (IFPRI), International Labor Organization (ILO), International Trade Center (ITC), the Organization for Economic Co-operation and Development (OECD), and World Health Organization (WHO). The secondary research sources were used to collect all written sources [46] on the disruptions in order to conduct case-studies. Based on the literature review (Figure 1), six main areas in maintaining the continuity of food supply chain in the COVID-19 pandemic were identified (Table 2). To compare the findings from qualitative studies into quantitative ones, a qualitative systematic review was undergone as described in Grant & Booth [47] and Snyder [48]. The qualitative systematic review is a method of comparing findings from qualitative studies in order to collect and assess them in a quantitative manner. The compilation of literature is the starting point for conducting case studies and expert interviews to identify and prioritize the importance of each problem. Table 1 presents the research characteristics.

Table 1. Characteristics of the study.

Study Subject	Study Objects, Territory and Time	Evaluation Methods and Tools	Implementation of Methods
Evaluation of food supply chain resilience	Database on case-studies of good practices in food supply chains on local, national and transnational level on the meat market	Database Collection, Case-studies, Semi-structured in-depth interviews (IDIs), Ishikawa diagram	Carry out the analyses of food supply chain resilience

Table 2. Presentation of the supply-side and demand-side issues in maintaining continuity of food supply chain during COVID-29 pandemic in the literature.

	Differentiation of Supply- and Demand-Side Issues in Food Chains in the Literature	Number of Sources
1.	Raw materials difficulties, such as: delivery delays, temporary animal feed shortages, feed ingredients shortages	19
2.	Difficulties in farm sector, such as: raw materials shortages, limitation of sales markets, animal surplus	26
3.	Market disruptions, such as: assortment shortages, price increase, selected food products rationing	31
4.	Obstacles in processing and packaging lines, such as: cost increase, shrinkage of sales markets, temporary closings.	32
5.	Obstacles in transport and logistics, such as: cost increase, delivery delays, closing borders	27
6.	Changes in consumer behavior, such as: eating and shopping habits, meals organizations.	39

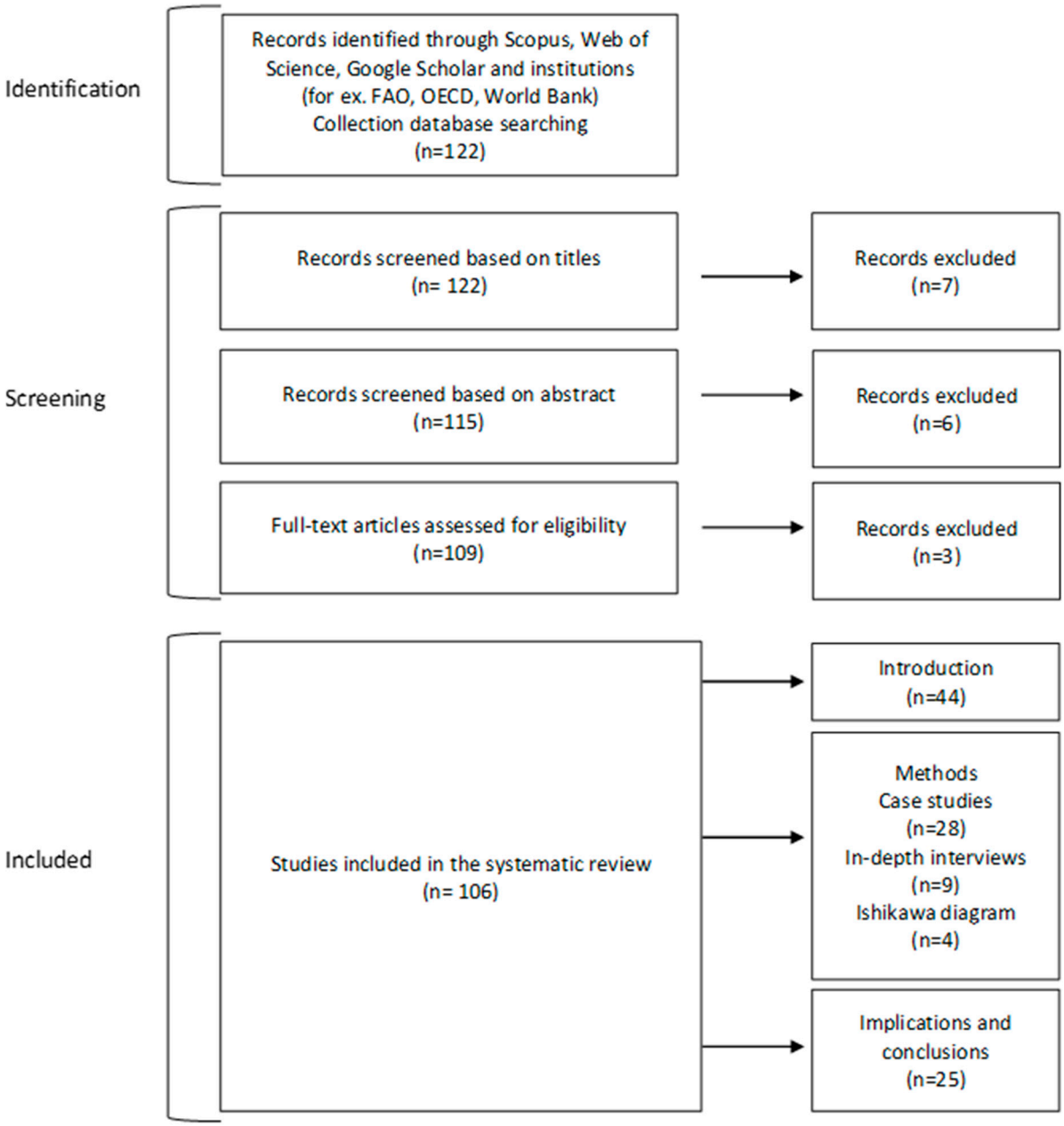

Figure 1. Selection of secondary sources according to PRISMA guidelines.

Figure 1 presents the selection of secondary sources according to PRISMA guidelines.

Table 2 presents the supply and demand side issues in food chains during COVID-19 pandemic worldwide tackled in the literature.

2.2. Methods

The first research measure is a case study in order to gain the knowledge on good practices in maintaining continuity of food supply chains on different continents. The case study is a common method of describing phenomena, which have a cognitive educational or promotional value. Case studies are good examples on how theory can be applied in practice [49–51]. The preparation of case-studies was supported by experts' interviews (N = 6) conducted between 3 January–30 June 2021 in the form of semi-structures in-depth interviews led in remote mode (Table 3). Tables 4–6 present the results of research using the case study method on the meat market in China, the USA and Russia. Individual in-depth interviews belong to the classic methods of social research, one of the basic qualitative methods.

Table 3. Presentation of the semi-structured individual-in depth review.

Individual In-Depth Interviews		
Instructions: The researcher conducts a scenario-based interview with the respondent, exploring important issues.		
1.	Duration of interview: 45 min	Duration of the research: 3 months
2.	Composition: 1 participant versus 1 researcher	Sample: 6 experts
3.	Design stage: during context analysis and project modelling as part of evaluation and basis for redesign	
4.	Infrastructure: minimum 1 recorder, a notebook, a pencil, 1 separate room	
5.	Research tools: researcher's scenario,	
	Objective of the study: to obtain an independent opinion on the current state of affairs	

Minichiello et al. [52] stated that in-depth interview is a qualitative technique and tool for collecting data to better understand the studied phenomenon. In-depth interview is a focused talk between the researcher and the interviewee in a specific area. The popularity of this method grew with the increasing recognition of qualitative methods as valuable research tools that allows to understand and explain the studied phenomenon in a socio-cultural context [53]. The advantages of the individual interview include [54,55]: (a) a free, unhindered conversation, (b) the possibility of choosing questions depending on the course of the interview, (c) learning about the respondent's experience, (d) discovering patterns of behavior, (e) noting opinions. Conversely, the disadvantage of an individual interview is its declarative character, and the fact that not every statement of the respondent can be covered in reality. The authors of the article decided to use the semi-structured interview in the remote mode because it gives the possibility to modify the order of the questions, as well as formulate additional ones [56]. The semi-structured in-depth interviews (IDI) are more time- and effort-consuming in comparison to standard interviews. The IDI is the research tool that can contain variety of different types of questions: open questions, closed questions, simple questions, questions with options for answers.

The conducted IDIs were focused on the experts' identification of the main factors affecting the food supply chain interruptions in meat market as a result of the COVID-19 pandemic with the indication of market and institutional methods to minimize the negative effects of the pandemic. The meat market was the subject of analysis, as it is an important part of the agri-food sector, requiring huge amounts of human labor [42]. The substantive reason for using this method was the need to obtain qualitative data from a group of experts on a topic that was little recognized, and little structured in order to indicate the importance (significance) of particular problems. IDIs were to provide the insights how the representatives of the distribution channel perceived and handled difficulties related to market distortions during the pandemic and how in their view the other market actors reacted to the changes in supply and demand.

The second research method is a classical interview analysis involving detailed transcription and coding. Coding was performed according to a categorization key in order to classify expert's statements. The findings discovered through the interviews were visualized, mapped and translated into artefacts. Conducting in-depth interviews requires a lot of researcher's efforts. First, he/she has to fill in a metric with the time, date, place, as well as a name and position of the interviewed person. Second, the researcher has to arrange a comfortable environment for the time of the interview. Third, the respondent must be thoroughly informed about the objectives and rules of the interview, i.e., why it is being recorded, to whom it will be made available. Fourth, the interview should be recorded with at least one voice recorder. Fifth, the researcher is obliged to know the content of the interview by heart. Sixth, the questionnaire script is its support, not the main research tool.

The processes described above allowed to create the process flow (Tables 4–6), identify the problem (Figure 2) and indicate possible solutions (see Conclusions). The purpose of the classical interviews conducted with 6 representatives of the meat market, i.e., the owner of a poultry farm (1 person), manager of a red meat slaughterhouse (1 person), 2 sales managers in international food corporations (meat department), and 2 wholesalers of meat and meat products, was to obtain information on problematic areas of maintaining the continuity of supply chains during COVID-19 pandemic. Due to the expert knowledge, it was possible to conduct case studies (see Tables 4–6) and formulate the Ishikawa diagram (Figure 2) [49–51].

The third research measure is the Kaoru Ishikawa diagram (known also as a cause and effect diagram, a fishbone diagram, or sometimes as a fault tree diagram, because when the diagram is turned 90° clockwise, it resembles a tree) (Figure 2). The Ishikawa diagram is used to illustrate cause and effect relationships, thus helping to separate the causes from the effects of a situation and to see the complexity of a problem. Ishikawa developed the cause-effect diagram, in which the analysis starts with the identification of an effect (e.g., a shortage, failure or other undesirable condition) and proceeds to identify all possible causes that caused it [57]. Among the causes, it listed 5 main components, referred to as the so-called 5 M + E: manpower, methods, machinery, materials, management + environment. Each of these is broken down into individual causes, which should be considered individually as problems to be solved. The Ishikawa diagram presents, in a structured way, the most important problems that emerged on the analyzed meat markets during the COVID-19 pandemic. The thickness of the font indicates the scale of the difficulty of the analyzed problem (Figure 2).

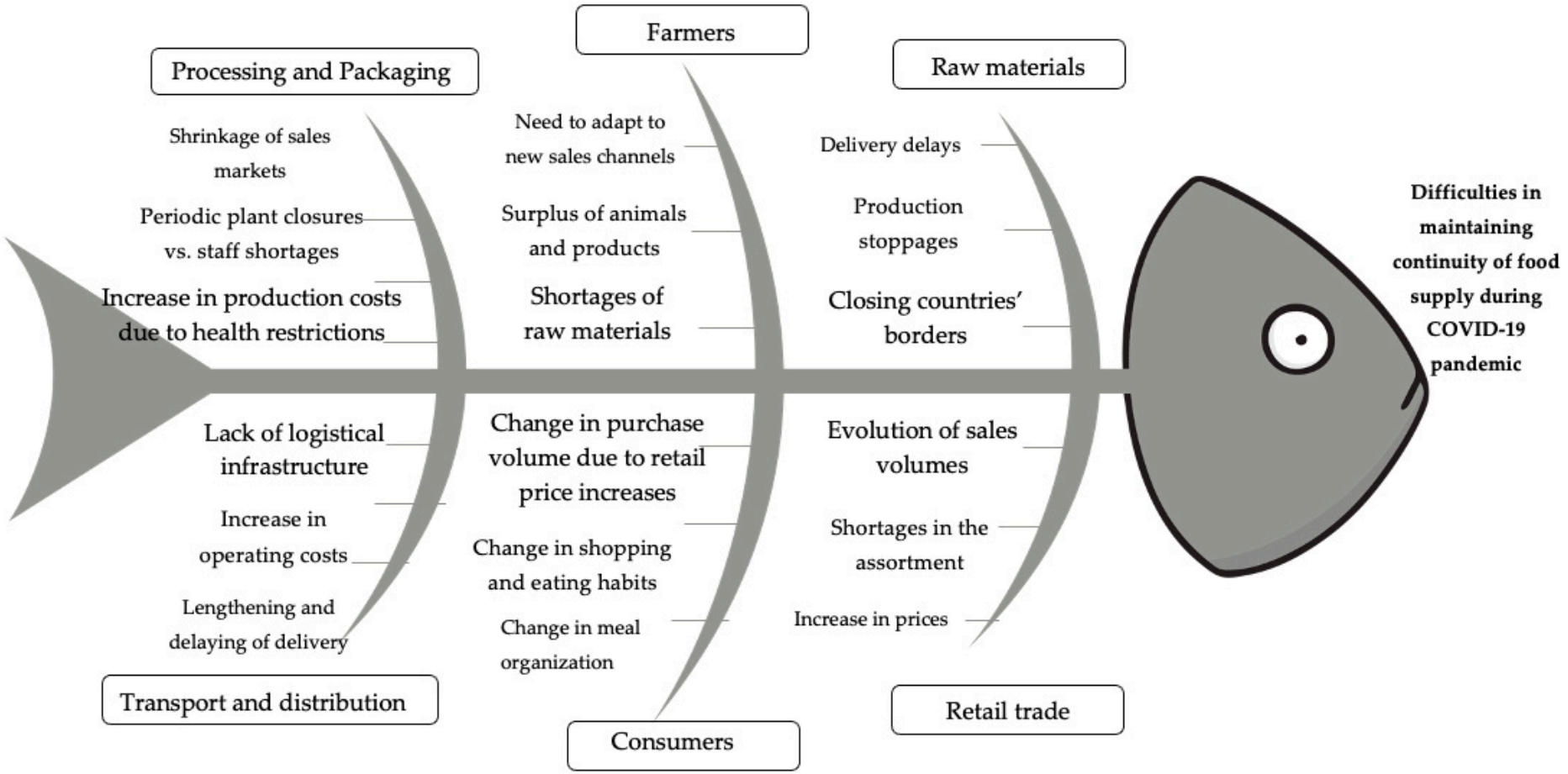

Figure 2. Ishikawa's fishbone diagram on main problems in maintaining resilience of food supply chain on the meat market during COVID-19 pandemic.

3. Results and Discussion

3.1. The Validity of Structure of Good Practices on the Poultry Meat Market in People's Republic of China

Agriculture and the food sector play an important role in the Chinese economy. In 2019, China belonged to a major agri-food exporter in number of 45.13 million tons [58]. The Chinese food supply chain successfully feeds millions of its inhabitants every day. The COVID-19 pandemic unfolded vulnerability of the food supply chain in logistics and distribution.

Summing up the information provided in Table 4, it can be said that bridging the poultry supply disruption in the People's Republic of China has been achieved through a number of top-down measures, mainly through assistance from ministries and local governments, as well as a high level of discipline and solidarity from the public through grassroots initiatives.

Table 4. The case of People's Republic of China on the poultry market.

Demand-Side Shocks	Supply-Side Shocks
Shortages of selected food items.	Reduction of small poultry supply (chicken and duck) to the market by 50% due to constraints of supply of animal feed and blockade of transportation of live poultry, as well as shortages of employees who are on extended leave, migrant workers who stay at home on national quarantine.
Reactions and actions	
Positive actions undertaken:	
1. Proximity order fulfillment (e.g., installing shelves in communities, service points in neighborhoods, deliveries made via robots). 2. Creating "the shared workforce model", whereby workers in non-functioning food service and retail, did the work for e-commerce and delivery companies. 3. In Hangzhou "the integrated pick-up points" were introduced, whereby while refueling at a gas station of the Sinopec chain, clients can make purchases of fresh vegetables and meat from the Freshippo chain, previously ordered via the mobile application. Paid goods were loaded in the trunk of the car. 4. Creating "the social group buying model", whereby a community placed group chat orders to stores. The orders were delivered the very next day to the community.	
Institutional aid	
1. The government required slaughterhouses to accelerate production to increase the number of efficiency of livestock and poultry product supply. 2. The government banned the closure of slaughterhouses and ordered food to be shipped from production centers in Shouguang to the areas hit by pandemic and supply shortages. 3. The government initiated a "green channel" for fresh agricultural products. 4. The government has exempted food suppliers from road restrictions to enable the transport of food. 5. The checkpoint personnel assist in disinfecting vehicles. Upon reaching the destination, the driver's temperature is measured, and vehicles are disinfected. 6. The China Agricultural Products Market Association has partnered with a number of e-commerce media and business platforms and launched an online platform for public service to help match producers of agricultural products with customers during the pandemic. 7. In addition to existing online platform, mobile chat groups, official WeChat accounts, and 24 h hotlines were used to simplify the process of gathering, flow and exchange of information. 8. The Ministry of Finance and the Poverty Alleviation Office of the State Council initiated an online platform to support produce sales in 832 counties with high poverty rates. 9. Local provincial and municipal governments have also formed online service platforms for support local transactions. In Beijing, such a platform contained information of product supply, and farmers' demand for production tools. 10. The government has encouraged e-commerce platforms owners to involve in sales of agricultural product. E-commerce enterprises simplified the registration procedure, provided resources for live streaming, short videos and individual trainings. 11. In January 2020, the State Administration of Taxation publicized that all income from transporting sources and agricultural products are exempted from VAT. Financial support is contributed to develop cold storage and on-site storage facilities for farmers and agricultural cooperatives to simplify logistics services and enhance food supply chain resilience.	

Source: [59–67].

3.2. The Validity of Structure of Good Practices on the Red Market in the United States of America

Concluding the information provided in Table 5, it can be said that in the United States of America, the greatest difficulty arose from the temporary closure of meat processing enterprises, leading to an oversupply of pigs and cattle, as well as an incomplete product range for consumers. The processing enterprises introduced many innovative solutions to

survive the COVID-19 pandemic. State institutions also stepped in to help, introducing a number of measures to improve the continuity of meat supplies to the market.

Table 5. The case of United States of America on the red meat market.

Demand-Side Shocks	Supply-Side Shocks
Meat shortages in stores across the country. Increased demand for fast-food chain offerings and lack of selected menu items at fast-food restaurants. The necessity to close bars and restaurants and the cancellation of sports competitions resulted in surplus of chicken wings on the market. Much higher retail prices due to a wholesale price increase.	Oversupply of hogs and pigs resulted from inability to slaughter. Closure of meat processing enterprises, which provide 15% of inland production. Closure and downsizing of meat packing enterprises. Temporary stoppages at meatpacking enterprises resulted in an oversupply of animals on farms. The need to adapt to sanitary restrictions slowed down processing lines. Food-service providers have experienced sudden order cancellations from their regular customers. A large number of food service suppliers were left with excess stock, which, due to the size of the packaging, could not be redirected to individual customers. The stoppages in packing enterprises caused a decrease in demand for livestock, which contributed to lower prices for cattle and hog.
Reactions and Actions	
Positive actions undertaken:	
1. Donating animals to farm animal sanctuaries, food banks, and organizations that cook meals for paramedics. 2. Limits on meat purchases: (a) Costco temporarily imposed a limit of up to 3 meat purchases (poultry, beef, pork) per person at a time in order to ensure meat purchase among citizens. (b) Kroger* implemented limits on the purchase of ground beef and fresh pork. (c) Wegmans Food Markets, Inc. set limits on family packs of boneless chicken breast and 80% ground beef. 3. Reorganization of fast-food menus, e.g., chicken sandwiches at forefront. 4. Launching new fast-food items, e.g., breakfast menu. 5. Many companies are expanding e-commerce, targeting their offer directly to consumers who, during the pandemic, have turned to online shopping. 6. Firms are expanding production to preserve their maintenance on store shelves, using incentives to keep employees working, and expediting raw materials or attracting new contractors in order to meet the needs of the market (as examples, Walmart has employed 50,000 additional workers, and Instacart—300,000). 7. Restaurants where there was no foot traffic or was significantly reduced coped by offering raw products directly to consumers, either from existing stock or from providers they still had access to. 8. In order to reduce the oversupply of livestock on farms, resulting from production downtime, slaughtering activity was increased on Saturdays.	
Negative actions undertaken:	
1. Burning pigs alive. 2. Due to temporary closures of meat processing enterprises, slaughter animals were euthanized. 3. Dilemma of humane treatment of animals for slaughter.	
Institutional aid	
1. Introduction of "Pass the Pork donation program" where farmers donate pigs to a food bank. The pigs are slaughtered, processed, portioned, packaged and donated to local food pantries to meet consumer demand for food bank use. 2. The American Farm Bureau along with Feeding America (food banks) created a network of 200 food banks and 6000 food pantries across the country to provide food to citizens most in need. 3. In April 2020, US President Donald Trump signed an executive decree according to which meat and poultry processors meet the criteria of the necessary infrastructure and steps have been taken to ensure continuity of production and supply. 4. Food Safety Inspection Service (FSIS) temporarily approved to enlarge speed on pork, beef and poultry producing lines at processing enterprises. 5. The Food and Drug Administration allowed temporary exemptions from selected food safety standards to redirect food for gastronomy to retail.	

* Kroger is the largest grocery chain in America https://www.statista.com/topics/4404/kroger-company/ (accessed on: 1 June 2021), A privately held US supermarket chain, Source: [22,31,67–74].

3.3. The Validity of Structure of Good Practices on the Poultry Meat Market in the Russian Federation

To summarize the information provided in Table 6, it can be said that the pandemic disruption has affected both B2B and B2C markets. Numerous restrictions were placed on poultry exports, especially to China. In order to restore stability of poultry supply to the market, the Russian government has provided significant support to producers and consumers.

Table 6. The case of Russia on the poultry meat market.

Demand-Side Shocks	Supply-Side Shocks
1. Meat shortages in stores across the country.In household increased demand for meat and meat products due to the state's obligation to stay at home (B2C). Decrease in demand for food (incl. meat) services due to closure of restaurants, hotels, cultural and educational institutions (B2B).	Difficulties in maintaining cash flows by farms. Difficulty maintaining export liquidity due to exchange rate risk and loss of international trade profitability. Food banks limit their acceptance of produce due to limitations on cold storage space and number of volunteers. The cost of transporting food to food banks is a financial burden for producers Rapid changes in the volume of sales of food products (meat) due to remote work of public sector employees. The need to adjust the size of unit food packages (meat and meat products, and milk and milk products) due to changes in the number of operators and size of recipients of ordered products, i.e., changes in sales volume of meat products in the semi-wholesale trade, for the HoReCa sector, and the focus on customers in the retail trade.
Reactions and actions	
1. Lack of feed and its components forces destruction of hatching eggs. 2. Reduction in poultry exports to China, which account for 60% of Russian poultry sales. 3. Ships with goods are redirected to other ports of discharge. 4. Numerous disruptions in sea clearance at ports and the closure of several seaports have led to a shortage of refrigerated containers for poultry (lack of free electrical connection positions). This is causing losses to suppliers and transporters. A number of the largest suppliers have stopped exports to China. 5. Small, local companies cannot afford to pay for shipments of goods.	
Institutional aid	
1. Food vouchers (to help increase poultry consumption in the country). Russian meat and poultry producers have asked the government to allocate 800 billion rubles ($11 billion) for a food voucher program. 2. The Russian government has spent 800 billion Russian rubles ($11 billion) introduced a food voucher scheme to stimulate domestic demand for the purchase of meat and meat products. The food voucher system is intended to help maintain jobs and improve the operations of food suppliers. 3. In most cases, Russian agricultural producers have qualified for government assistance in the form of: debt restructuring, deferment of loan installments, access to loans with reduced or zero interest rates, loans for payment of workers' salaries. 4. Russian agricultural producers can benefit from a moratorium on business inspections until the end of 2020, moratorium on the collection of debts and penalties, a moratorium on bankruptcies, a reduction in social security contributions for wages above the minimum level (from 30% to 15%), a six-month deferral of social security payments for micro-enterprises; deferral of rent payments for items rented from the state and municipalities.	

Source: [75–82].

3.4. Implications of the Difficulties in Marinating the Resilience on the Analyzed Meat Markets

The pandemic has influenced changes in food purchasing and eating habits [83]. As a result of restrictions on movement, traffic in shops declined. Consumers shopped less frequently, but they stocked up on longer-lasting food, which contributed to temporary food shortages on shop shelves [36]. Shortages in the assortment of large shops, as well as queues and a higher risk of contamination, increased interest in buying food in small, local shops or from local producers, less exposed to disruptions in imports or in individual

links in the supply chain [84]. An increased interest in nutrient-rich foods that support the human immune system through diet has been observed [85]. Moreover, the rise in prices of certain food products, mainly fresh fruit and vegetables, meat and fish, caused an increase in demand for ready-to-eat snacks, frozen meals and processed food, which affected the diet of less affluent consumers [86].

Pandemic restrictions and safety concerns have increased the popularity of online grocery shopping [87]. Door-to-door shopping and community shopping within small local communities have irreversibly changed shopping habits. In a pandemic environment, there is an increased interest in self-prepared meals [88]. Consumers began to spend more time cooking and baking together, which also increased their interest in purchasing specific food products (e.g., pasta, eggs, vegetables, milk, meat) and the volume of purchases. In turn, hoarding of food products affects the level of food wastage [89]. Excessive shopping is one of the key factors causing food waste in households [90,91].

It has to be said that the meat industry is vulnerable to the viruses spared by humans due to the labor intensity and working conditions conducive to the spread and survival of viruses like COVID-19. High humidity and lower temperatures during processing at slaughterhouses, meatpacking and processing enterprises make these places favorable to virus survival and proliferation. Thus, the industry organizations are calling to revise the hygiene standards and establish new biosecurity procedures at these places [92].

Shortages of workers on each stage of supply chains cause bottlenecks in primary animal production, processing and meat distribution. The meat industry in developed countries experienced staffing problems before COVID-19 [92,93]. The pandemic aggravated the recruitment difficulties in the group of skilled workers and deepened the need for overseas workers. The flow of the workforce is conditioned upon migration law that is relatively stable and hard to respond to changing needs of the labor market.

The livestock producers operate on thin margins, which make them vulnerable to changes in input on the supply-side and output on the demand-side. The demand from mass scale caterers was constrained. HoReCa creates about 50% of meat demand in developed countries, particularly for more expensive and high-profit margin products [22]. Due to financial burden and market destruction, several livestock producers experienced losses and awaited pandemic assistance programs. In turn, market processors increased their profit margins during the pandemic [94].

The COVID pandemic has altered the way consumers perceive meat and consume it. The disease caused people to be more involved in food and to analyze what they eat in health, ethical and environmental dimension. Higher consumer interest in food, along with climate change, attributed also to animal food production mobilized consumers to cut on meat consumption or give it up [92]. If the trend persists, the industry will experience massive layoffs and closures, unless it changes the operations from price-oriented products to high quality, expensive assortment. As the methods of meat production and processing will be of the same importance as a product itself, both producers and farmers will have to consider this in their purchases. Food safety and environmental objectives on meat production will accelerate the industry transformation. Changes of consumer objectives and introduction of flexitarian diet can influence the future meat market, forcing meat producers and processors to integrate plant-sourced ingredients with meat or completely substitute meat with plant-sourced ingredients [95].

International processes of meat have slightly decreased in 2020 (from year to year) [94]. The upward trend in meat prices from previous years was hindered due to trade restrictions and a consumption decline [96].

The Ishikawa fishbone diagram shown in Figure 2 consists of the head and backbone of a fish. In creating the fishbone model, the 5 M's + E principle was used [97]:

- Man—qualifications, job satisfaction, habits or seniority;
- Machine—modernity, efficiency, precision, durability, safety and working conditions;
- Material—input raw materials, substitutes, semi-finished products;

- Method—procedures, instructions, responsibilities, standards, know-how and technology;
- Management—organizational structure, work organization;
- Environment—elements of the work environment.

Names of the individual components of the Ishikawa diagram, i.e., 5 M's + E principle were adjusted to the specifics of the analyzed markets, similarly to studies by other authors [98–100]. The fishbone head presents the problem to be solved, which is the difficulty of maintaining a sustainable food supply chain during COVID-19 pandemic and the backbone fish describes the main causes. The fish backbone illustrates the causes influencing the analyzed problem, which in chronological order, are: raw materials, farmers, processing and packaging, transport and distribution, consumers, and retail trade. Each cause is co-developed by three prime causes. In our Ishikawa fishbone diagram, the ordering of the prime causes is two-fold. The root cause closer to the backbone is more important, as indicated by the larger font size. Each category of causes is expanded to include further specific causes. The expansion of the diagram is completed because the phenomenon is fully identified.

4. Conclusions

The COVID-19 pandemic holds a large number of different implications for food supply chains across the world. The first one is the urge to focus on sustaining and developing resistance of food supply. Pandemic daily life has shown that the just-in-time supply chain model worked well in pre-pandemic economies.

For national economies for which the issue of sustainable food supply chain model has been an important part of the competitive advantage strategy requires solutions that will reduce the negative effects of demand-side and supply–side shocks. People are more willing to take care of their health, e.g., by implementing healthier diet [101]. Food safety has revalidated more attention, especially in the sense of respecting the hygiene rules between entities in the food chain, e.g., producers, processers, wholesalers, retailers, and consumers.

Food security has become increasingly important. Agriculture and the food supply chain, as well as supporting services, such as transport, distribution, and maintenance are key businesses [36].

The undertaken research based on a qualitative systematic review allowed to collect scattered research materials, classify them into six thematic groups, as well as verify the results along in-depth interviews. Due to consistent research procedure, the qualitative data were used to develop quantitative perspective on the influence of COVID-19 pandemic on the analyzed meat markets.

Companies in the production chain should create an operating model based on relative self-sufficiency. In the manuscript, the hypothesis has been positively verified. The outcomes, supported by a qualitative systematic review, have made it possible to draw general conclusions on resilience of food supply chains on the analyzed meat markets exemplified on qualitative research:

1. There is a need to implement the priorities of the post-COVID-19 pandemic food system policies, as to be more resilient to demand- and supply-shocks on the meat markets. In particular:
    (a) Strengthening shortened food supply chains by managing farm labor workforce from inland abroad in accordance with legality, equity and solidarity;
    (b) Promoting inland, regional and local agriculture and food producers;
    (c) Protecting and safeguard small food retailers;
    (d) Developing food hubs and marketing platforms;
    (e) Supporting logistic production and consumption on-site;
    (f) Promoting healthy diets, preparing food at homes, organizing regular day-by-day common meals;
    (g) Fighting against food waste.

2. Among policy tools to manage local agri-food system on the analyzed meat markets are mentioned:
   (a) Territorial integration of actors acting in production process and maintenance of food supply chains starting from national to a countryside level;
   (b) A profound need to coordinate the state's agri-food policies with the socio-economic environment and other sectoral state policies on the state's level;
   (c) Prioritization through economic and social incentives purchases of locally produced food;
   (d) Supporting knowledge and know-how of preparing local sustainable menus during lunch breaks in public (e.g., nurseries, kindergartens, schools, universities, institutes, etc.) and private sector (in canteens and cafeterias);
   (e) Promoting the use of uncultivated land for food production to meet the needs of local communities;
   (f) Actions to halve food waste by developing a common measurement methodology, improving labelling of expiration dates by 2030 [102–105];
   (g) Amending the Fertilizer Ordinance to make it easier to identify organic and waste-based fertilizers in the single market and to promote the importance of biological nutrients.

The results of the research, supported by a qualitative systematic review, has made it possible to draw specific conclusions on the meat market in the People's Republic of China:

- Prepare donation centers where farmers can donate surplus live animals (by receiving compensation), which will be processed and distributed by state institutions to the areas most affected by the crisis;
- Develop a system of subsidies and financial, technological and know-how support for meat and poultry farmers to enable them to develop partially processed production;
- Introduce preferential rates for the use of rail transport for meat and poultry export during crisis situations.

The results of the research have made it possible to draw specific conclusions on the meat market in the United States:

- Develop technical and technological facilities, using the experience of e-commerce companies, to facilitate and speed up the linking of local livestock and poultry farmers with their customers, both in B2B and B2C markets;
- Promote, in retail shops, the offer of widely available products (fruit, vegetables) to shift demand away from products (like meat) with limited availability;
- Conduct intensive campaigns targeting consumers to promote greater use of fruits and vegetables in the daily diet.

The results of the research have made it possible to put forward specific conclusions on the meat market in the Russian Federation:

- Farmers' support to enable them to store slaughtered animals for longer (e.g., a cold storage rental scheme);
- A shift toward the export of semi-processed poultry products that do not require refrigerated containers for transport;
- Inclusion of e-commerce companies to engage in meat sales and make available to farmers their facilities and resources to connect meat producers with consumers.

To summarize, the sustainability of the food supply chain on the analyzed meat markets requires a systematic, continuous institutional support on agri-food supply production.

Recommendations at the legislative level for state authorities concern supply-side support on the analyzed meat market, such as:

- Purchasing surpluses of raw materials and food in order to transfer them to the regions most affected by their shortage and, consequently, famine;
- Supporting producers in cold storage of surplus of raw materials and food;
- Supporting producers in the sale of raw materials and foodstuffs through e-commerce;

- Supporting producers in mobile payment systems;
- Reducing or eliminating VAT rates on key raw materials and food products, as well as their transport.

Recommendations at the legislative level for state authorities concern demand-side support on the analyzed meat market, such as:

- Creation of a system of food vouchers for citizens in need;
- Initiating joint points of purchase and collection of food products;
- Initiating common points of procurement for food-related services;
- Promotion of preparation of healthy meals in households and local communities;
- Promotion of recipes requiring the use of surplus products, such as: eggs, milk, chicken, pork, seasonal fruit and vegetables.

The authors are conscious of the general limitations of the undertaken research, which includes the difficulties of conducting qualitative research fraught with subjectivity, as well as the difficulties of quantifying the results, in particular, the case studies. To minimize the limitations of qualitative research, the authors consciously used a wide range of large, diverse, but above all, reliable set of materials in the case-studies. In the case of interviews with experts, the method of in-depth interviews was used, supplemented and supported by a semi-structured conversation sheet. In the case of Ishikawa diagram, introduction of weights of individual reasons and sub-reasons were found and categorized in order to show key indicators of the analyzed problem. The larger the problem was, the closer it was to the fish spine in the diagram, and the larger the font size it had.

To summarize, the authors will, in the future, deepen and broaden the analyses, endeavoring, as far as possible, to use qualitative and quantitative methods for this purpose.

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