



Resilience of Meat Supply Chains during and after COVID-19 Crisis

Gunta Grinberga-Zalite ^{1*}, Irina Pilvere ¹, Aina Muska ¹, Zenija Kruzmetra ¹

¹Latvia University of Life Sciences and Technologies, Jelgava, 18 Svetes Str, LV-3001, Latvia

Abstract

To protect their population during pandemic outbreak, countries apply several preventive restrictions and even shut down their economies to slow the spread of the coronavirus. Since food supply chains in developed countries are complicated and dependent on their external suppliers, these restrictions cause not only economic but also social tension. The limited access to raw materials, packaging material and labour force result in the increasing prices of food products, which forces the population to refuse from quality food products. In the European Union food supply chains, which are negatively affected by protectionist elements and COVID-19 restrictions, the room for manoeuvre of Latvia's small open economy is limited. The current paper analyses the impact of COVID-19 crisis on global food industry, providing a deeper insight into the case study of Latvia meat supply chains' experience in overcoming pandemic risks. The research outcomes lead to the conclusion that although COVID-19 impact during first breakout has not caused unexpected and serious consequences for the meat sector companies, the main internal and external risks are associated with further uncertainty and instability in the EU markets. Based on extensive analysis of meat sector specifics, the authors have summarized the recommendations for meat sector companies to better prepare for further potential pandemic situations.

Keywords:

Food Security;
Supply;
Demand;
Consumption;
Meat Sector.

Article History:

Received:	18	November	2020
Revised:	26	December	2020
Accepted:	03	January	2021
Published:	01	February	2021

1- Introduction

The COVID 19 pandemic was first identified among the population in China in December 2019, which later spread to the rest of the world. The World Health Organization (WHO) declared COVID-19 outbreak an emergency on 30 January 2020 and later in March 2020 a global pandemic [1]. The COVID-19 pandemic is placing unprecedented pressure on global agricultural and food supply chains. The countries' lockdowns, which followed in March 2020, have gradually revealed the existing bottlenecks in agriculture production sectors, food processing companies, local and international logistics chains. In addition, the pressure from health organizations to take measures to address increasing health risks, caused serious economic tension that affected farmers, workers, and consumers around the world [2]. Despite the scale of the pandemic, Covid-19 has not been reported to be transmitted through food [3]. However, the previous experience in combating global health epidemics (e.g. Ebola virus) and their impact on food prices in 2008, call to action and development of efficient policy recommendations. The challenge, however, is lack of experience and many unknowns associated with COVID-19 transmissions and different approaches in combating it. [4]. Although the OECD and FAO medium term projections for global and national agricultural markets suggest that agricultural sectors and food processing will be only temporarily affected by logistic chains interruptions, the overall trade in agricultural commodities, changing consumer behaviour and limited access to seasonal labour will result in slow market recovery [2]. This calls for an assessment of countries' readiness to provide food security for their citizens in situations of possible short-term crises in the future. "Food security exists when all people, at all times, have physical and economic access to

* **CONTACT:** Gunta.grinberga@llu.lv

DOI: <http://dx.doi.org/10.28991/esj-2021-01257>

© 2021 by the authors. Licensee ESJ, Italy. This is an open access article under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<https://creativecommons.org/licenses/by/4.0/>).

sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” [4, 5]. This most often cited definition distinguishes four interrelated dimensions of food security: 1) availability; 2) access; 3) stability; 4) utilization.

Food availability dimension includes components that ensure sufficient and appropriate quality amount of food that is supplied by local food producers, is imported or stored properly. The dimension of *food access* includes those aspects that provide individuals with sufficient resources to obtain the most suitable food from a dietary and nutritional point of view. This dimension includes the legal, political, economic and social conditions in which they live. Food access is also often linked to purchasing power capacity, the development of transport and market infrastructure, and the specific food distribution. *Food stability* dimension refers to those components that allow the population, households or individuals to have an access to adequate food on regular basis. People should not risk losing access to food in the event of a sudden shock (such as an economic or climate changes caused crisis). This dimension refers to the components associated with the use of food with adequate nutrition, clean water, sanitation and health care to achieve a nutritional well-being that meets all physiological needs. In most cases, the use is only discussed from a biological point of view. However, food also plays an important social role in ensuring the existence of a community. This reveals and emphasizes the importance of non-food resources in food security [5].

According to Gross et.al (2000) and Hazell (2009), theoretical discussions of global nutrition and food security have been actively taken place during the last 50 years, which has resulted in a number of definitions, models and paradigms. In 1980s, the green revolution raised the role of research technology transfer initiatives, which has significantly increased agricultural production worldwide thus improving food availability globally. Moreover, from today’s viewpoint it has been clarified that food security does not associate any more with catastrophic shortfalls in food production but rather with sharp declines in the purchasing power of specific social groups. Therefore, the definition of food security is broadened to include both physical and economic access to food supply [3-5].

The novelty of the current paper is justified by the fact that COVID-19 crisis is a globally unique phenomenon with a lot of uncertainty for national economy sectors, therefore it is highly important to analyse the experience of countries and their economic sectors thus gaining a better understanding how companies could further overcome difficulties associated with global pandemic crises.

The article is structured in four consecutive parts. Literature review presents insights into the complex nature of food security as well as explains the interdisciplinary issues that are closely connected with food availability provision during global pandemic crises. Methodology part explains the methodological framework for the current study, the research aim, tasks and methods. Results present the authors’ empirical research outcomes that reveal the situation in Latvia’s meat production and processing sector during and after COVID-19 pandemic crisis as well as risk analysis for meat sector companies in global pandemic crises. Conclusions present authors’ recommendations to mitigate the impact of global pandemic crises risks for Latvia’s meat sector companies, which, in the opinion of the authors, are also applicable to meat sector companies from other EU countries.

2- Literature Review

Food security issues can be viewed in scope of: (1) the individual and the household - *micro* level; (2) the business (industry level) representing the *meso* level; and (3) the national economy - *macro* level. Given the different contexts of the food security dimensions and the levels at which they interact, food security analysis needs to consider both the natural and social sciences, so an interdisciplinary approach is necessary.

The COVID-19 pandemic affects food systems directly through impacts on food supply and demand, and indirectly - but just as importantly - through decreases in purchasing power, the capacity to produce and distribute food, and the intensification of care tasks, all of which will have differentiated impacts and will more strongly affect the poor and vulnerable [4]. The interdisciplinary approach to food security incorporates food supply and demand functions in the context of productive and commercial structures of the countries, their levels and degree of income inequality as well as on external factors related to energy and credit markets.

2-1- National Food Security at Macro Level

In April 2020, FAO and CELAC (Community of Latin American and Caribbean States) announced their forecasts on the impact of COVID-19, which both anticipated a fall in supply and demand for agricultural products and disruptions in food supply logistics chains. According to the forecasts, COVID-19 will affect all elements of the food system – raw materials, processing, marketing and supply chain systems. Accordingly, these value chain disruptions will have serious consequences on the labour and capital market, as well as intermediate products (e.g. pesticides, animal medicine, seeds). On the demand side, it goes for granted that the demand and the trade in agricultural goods would decline due to a slowdown of GDP and increasing unemployment. Figure 1 reveals the main channels of the COVID-19 pandemic impact on food security and agriculture: food demand, food supply and international food trade. Figure 1 shows that food supply

and demand depend on many macroeconomic factors, e.g. currency exchange rate fluctuations, prices in the energy and credit markets, unemployment rate and the overall economic activity. Moreover, agriculture in high-income countries is a finance-intensive sector that depends on availability of finance market instruments [6, 7, 11].

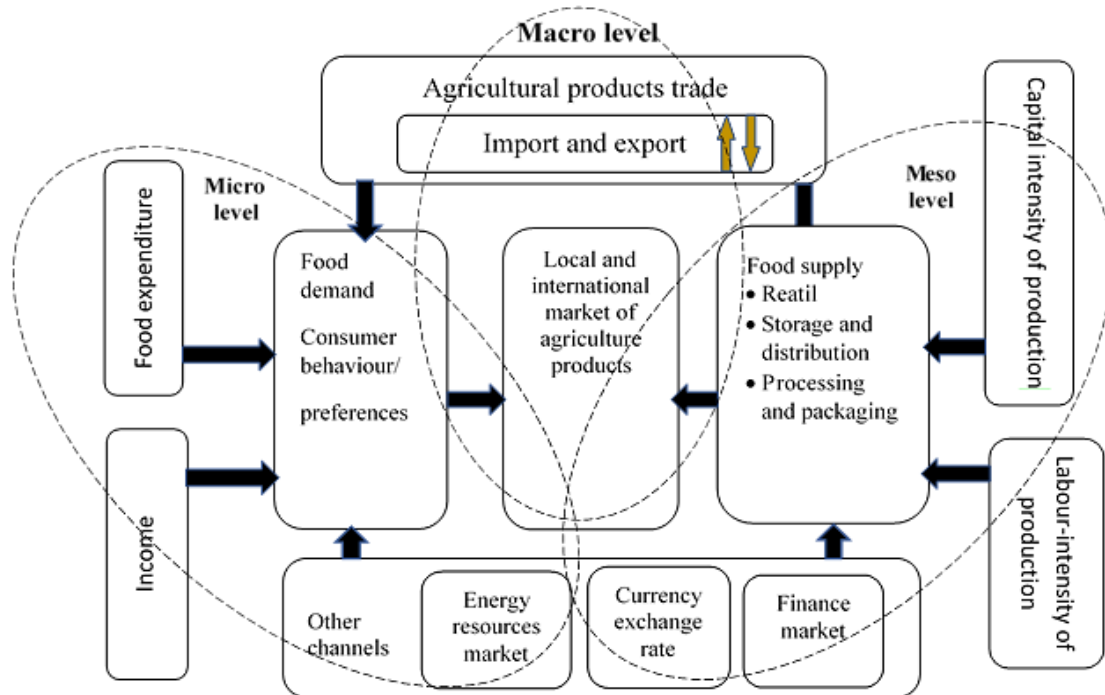


Figure 1. The main transmission channels of the COVID-19 pandemic impacts to food security and agriculture in the context of macro, meso and micro levels [6].

2-2-National Food Security at Meso Level

2-2-1- Food production

Food production in the EU countries is already regulated by strict hygiene rules and their compliance is subject to official controls. They must apply to all food production enterprises. Thus, hygiene controls prevent food contamination in food production enterprises caused by any pathogens and therefore also ensure prevention measures to avoid food contamination with the virus that causes Covid-19. Food production and processing companies are responsible for providing regular training for their employees to ensure that they obtain relevant practical knowledge how to comply with hygiene rules. Since it has been declared that food safety is the most crucial factor to keep supply chain operating, a responsibility lies on all chain participants, especially on food companies [3]. One of the measures that is recommended widely and already practiced in many countries is accelerating the development of e-commerce for small food enterprises. However, even the best approaches and strict following requirements cannot eliminate the problems caused by labour availability. Seasonal migrant workers that had been hired for farm work in reality could not arrive or their arrival was seriously delayed due to compulsory quarantine, which often resulted with fresh produce left on the field or spoiled [4].

2-2-2- Processing

Today the competitiveness of the food processing business in the European Union depends on the stable supply chain, access to quality ingredients as well as ecological and natural ingredients, availability of skilled and competitive labour, compliance with the industry standards and sustainability principles, developed transit infrastructure and international recognition and reputation.

Despite the scale of the pandemic, Covid-19 has not been reported to be transmitted through food [3]. However, the findings of the Acheson Group [8], which is a global food safety marketing consultations group, reveal that it is critical that during such global pandemic crises the food safety remains a top priority. For food processing enterprises it means maximum elimination of any gaps in food safety by preventive controls – both within the enterprise and at all levels of supply chain.

According to the Acheson Group recommendations, the main areas on which to focus are an assessment of the impacts of the seven following aspects.

1. Increased absenteeism

It is important to critically assess if an enterprise has an access to temporary workers and if it is possible to cross-train employees. Possibly, the enterprise will have to move its part-time or seasonal workers to full-time and have resources to actively seek workers.

2. Food safety training

Bringing in new or cross-trained workers means ensuring that they have a full understanding of the enterprise's food safety requirements and are focused on applying them. Creating a food safety culture of an enterprise may not be very easy during the pandemic, but it is more important than ever before to the public that the enterprise is caring and aware of its workers' safety.

3. Coronavirus and the food industry

Despite the overall panic, it is necessary to regularly stay informed with how COVID-19 is impacting the food industry.

4. Worker safety

COVID-19 has brought a number of new employee health and safety issues to the forefront. One advantage of the food industry is its long-held requirements for hygiene and handwashing – two of the key protections against coronavirus infections. A key disadvantage is the difficulty of enacting “social distancing” (in the USA - a six-foot, Europe – 2 metres) barrier between employees. In some facilities, it will be a significant challenge, in others it will not be possible.

The recommendations for the use of face masks are difficult to maintain for food industry workers who don't typically wear masks in performing their duties.

5. Cleaning and sanitation

Before COVID-19 pandemic, food sector employees had already been exposed to specific hygiene requirements, which must be clearly defined in all food sector enterprises and include both regular medical examinations of employees and the daily maintenance of food contact areas and surfaces. Food retailers are also subject to a set of hygiene requirements defined by national health departments, non-compliance with which is usually subject to severe penalties. Thus, the set of requirements already in place in food businesses significantly limits the risk of coronavirus. In addition, there is no evidence that food or food packaging is involved in the transmission of coronavirus. However, if an employee is diagnosed with COVID-19, it is highly recommended that the areas, where the employee worked or rested, be thoroughly disinfected by using COVID-19 registered “disinfectants”.

6. Supply chain

In the developed countries, food supply chains are often long and complicated. Therefore, it is advisable to critically assess if an enterprise has access to multiple reliable suppliers, particularly for most essential ingredients and packaging materials. The top management has to discuss availability of commodities with the enterprise suppliers and diversify them, particularly in the areas most exposed to lockdowns.

7. Leverage technology

With greater risks and likely fewer people, pandemic crises are the time to be thinking about how to better leverage technology to help companies to analyse all the data they are getting. This includes within enterprise operation and from its suppliers. While cash flow may be difficult at crisis situations, companies should not give up thinking about how to use data analytic tools more to save company's time, people, and reduce risks.

Supplies will be another potential sore point, especially when they originate overseas. Much of the raw ingredients for artificial sweeteners come from China, where the coronavirus originated – which presents a supply challenge. This is exacerbated by processor customers seeking to lock in supplies. In China, logistics constraints and labour crunches have caused losses of fresh vegetables, limited access to animal feed and diminished capacity of slaughterhouses [9]. IRI study also highlights the problems related with packaging and reveals the situation with Alkaline Water Company Inc. facing difficulties with adequate supply of PET bottles, which later turned out to be a potential industry-wide problem in the USA.

2-2-3- Logistics

In order to avoid food shortages, countries must apply meaningful policies to enhance the recovery and resilience of their food supply chains and keep them working [9]. Unlike in 2007-2008 global food crisis, food shortages this time are not a problem. When countries are fighting a coronavirus pandemic, they must also make every effort to ensure that their food supply chains function properly.

The food value chain can be divided into two broad food groups: (1) basic products (wheat, maize, soybeans and oilseeds) and (2) high-value products (fruit, vegetables and fish products). Accordingly, the main risks to the logistics of the food value chain should be assessed in relation to basic products and high-value products. The production of basic products is capital-intensive and their production is less affected by the problem of labour shortages due to restrictions on the movement of people due to the coronavirus. However, distribution logistics are affected, hampering food transport between cities, provinces, regions and countries. In turn, the production of high-value products requires a lot of labour. Thus, the production of these products is significantly affected if workers become ill or if local workers and migrant workers are unable to move because of lockdowns. Logistical barriers that interrupt food supply chains further affect the production of high-value products, as such products are perishable. The supply chain of high-value products includes food processing plants, where production is also labour-intensive. Currently, most sorting and packaging lines do not meet the requirements of social isolation. Nevertheless, the COVID-19 crisis is also an opportunity to identify food supply chain vulnerabilities and enhance their further resilience. The logistics services of the supply chain must be properly inspected and special permits must be issued for the transport of products. For exporters, transport and logistics staff (warehouse workers, loaders, drivers, port workers, customs officers etc.) should be considered as important staff and therefore appropriate health and safety measures should be implemented, including coronavirus testing, coronavirus protection equipment and social distancing practices. Thus, FAO emphasizes that supply chains for high-value products are more complex and that countries need to act quickly to make them a priority sector and ensure that migrant workers can access farms and factories [7, 9, 10].

2-3-Food Security at Micro Level

2-3-1- Consumers

The health crisis and the unprecedented difficulties caused by COVID-19 have had a significant impact on economies, businesses and consumers around the world, changing the way consumers live, work and shop [6]. Consumers continue to struggle with the spread of virus, travelling restrictions, unemployment and decreased earnings [11]. In July 2020, the authors' study on the challenges and experiences faced by the food supply chain during the first wave of the COVID-19 crisis (March to June 2020) in Latvia revealed that during the emergency situation, the demand for locally produced food products decreased in both Latvia and its export markets, this problem was also exacerbated by the dependence of certain studied sectors (e.g. beef sector) on exports, as well as food imports (e.g. pork sector). Due to the decrease in the sales market, the stocks of manufactured products increased for some companies in the sector, turnover decreased and, consequently, revenues decreased. These problems, alongside with the increase in costs for implementing anti-virus measures, re-planning logistics and covering additional costs, created cash flow difficulties. The COVID-19 crisis reaffirmed the dependence of the studied food sectors on the physical presence of labour in companies and exacerbated the problem of its availability, as well as made it difficult to plan for economic activity in the face of current market uncertainty.

The authors' research results comply with *McKinsey & Company* study and the *Euro-monitor International* survey that were conducted at the same time on consumer sentiment in different countries and suggest that during the crisis, people's shopping habits changed. During and after crisis, people became cautious about their spending, shopping less often but in larger volumes, preferring small grocery stores or buying food online. It was also typical for consumers to build up food stocks. In response to changing population habits, food e-commerce, including the online market, expanded and was increasing in unprecedented rate for a short period of time. In order to ensure the availability of food in the remote areas, internet platforms emerged where both online food shops and farms participated, which ensured the delivery of goods by parcel service to parcel terminals or home delivery. As a result of the COVID-19 crisis, catering companies had to replace their usual operations to new sales points such as kiosks for take-away or in cooperation with taxi smart phone applications (e.g. *Bolt*) - home delivery of food. In response to social tension, existing and new voluntary organizations were also involved in solving the problems caused by COVID-19, and new social initiatives emerged [12-15].

3- Methodology

The aim of the current research was to present an overview of food security issues during COVID-19 pandemic crisis at macro, meso and micro level. The specific research tasks are: 1) to describe the main transmission channels of the COVID-19 pandemic impacts to food security and agriculture; 2) to reveal the resilience of meat supply chain during COVID-19 pandemic crisis based on the analysis of Latvia's case study. The research object is food security issues during and after global pandemic crises, but the research subject – meat supply chain problems in Latvia during COVID-19 pandemic. The current research exploited the desk study, in-depth expert interviews with the representatives of Latvian meat production and processing companies, comparative analysis and logical construction research methods.

4- Results

The analysis of food security issues at macro, meso and micro levels, which gives evidence to the urgent need to develop locally tested solutions adapted to post-crisis conditions, that would improve the resilience of local producers, food supply chains and food ingredient supply chains while also strengthening countries' national food self-sufficiency and allowing enterprises to prepare to a possible sudden restructuring of food systems during and after the crisis. In authors' opinion, the crisis caused by the COVID-19 enables new risks for food supply chains (rapidly reshaping supply possibilities, sudden shifts in consumer demand and behaviour, need to address new food security threats etc.) and exacerbates pre-existing risks (over dependency on global supply chains, digital divide and unequal possibilities to benefit from e-commerce, inability to settle financial obligations etc.).

Latvia is a small and open EU member state (exports of goods and services made 60% of GDP in 2019 (EU28 – 46.5%)) with relatively high share of services, transportation, and financial services in total value added. According to the Global Competitiveness Report, Latvia is still in a transition from an efficiency-enhancing to innovation-driven economy. Traditionally, Latvians have always been a nation of skilled farmers, livestock keepers and high quality food producers. The food and beverage industry is the second largest national economy sector of Latvia, providing almost a quarter of the total manufacturing output [16]. Therefore, it is critically important to identify solutions and prepare recommendations for policies on the resilience of the food sector to crises caused by pandemic and other external shocks and promoting knowledge transfer to foster sustainable post-crisis economic development.

The overview of the meat sector's development trends in Latvia suggests that Latvia's beef sector is mostly export driven (Figure 2). Although the value of exports and imports has declined in 2020, the change has been insignificant. Beef producers use both zero-level logistics channels (farmer-consumer), multi-level logistics channels (retail, wholesale, distribution) to sell their products on the consumer markets. Producers co-operation exists mainly in the dairy sector. In the beef and veal sector, farmers have so far shown no initiative in setting up cooperatives. The main benefits of the cooperation are opportunities to access cheaper resources and sell products at higher prices. In Latvia, the trade in live animals is traditional, and auction houses, which sell animals for slaughter, play an important role in the export of beef. Currently, auction houses are an important element of supply chain for export-oriented beef producers.

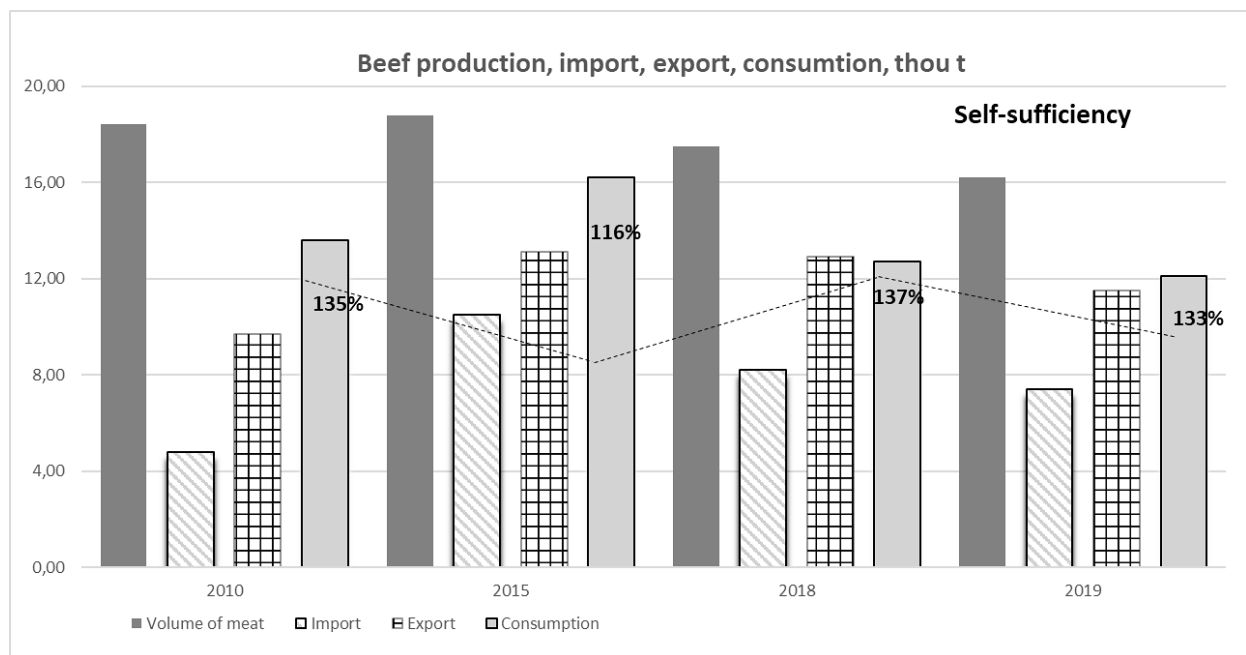


Figure 2. Beef sector in Latvia, 2010-2019 [17].

In turn, pork sector's self-sufficiency in Latvia remains low, and this sector significantly depends on imports (Figure 3). The cooperation between Latvian pig farmers is also insufficiently developed and, according to the pig farmers' association, should be enhanced to create joint logistics routes that would be safer, more cost efficient and would enhance the production of higher value-added pork products.

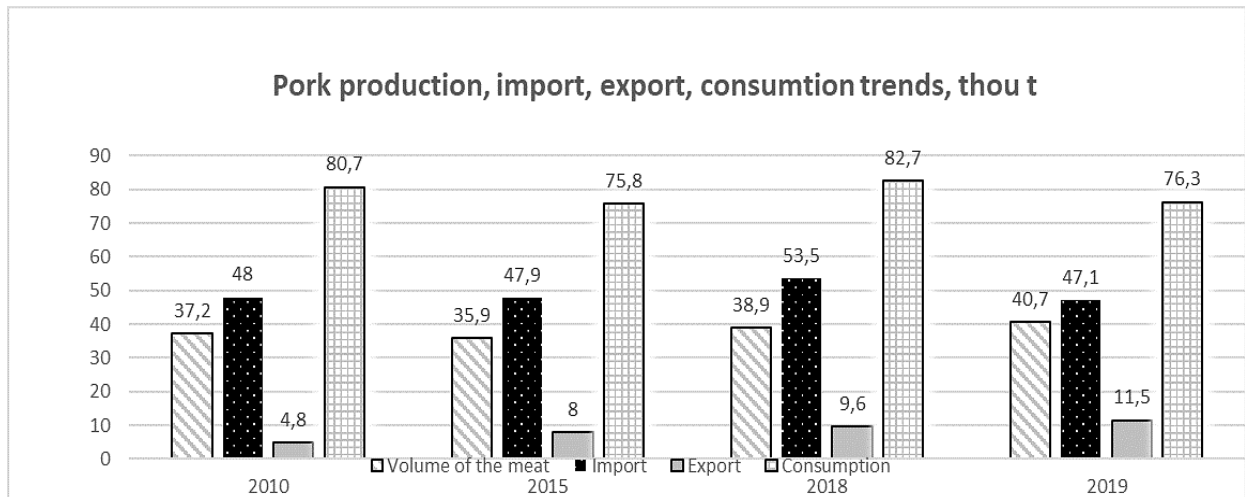


Figure 3. Pork sector in Latvia, 2010-2019 [17].

In the poultry sector, both consumption and import indicators show a growing trend (Figure 4), which according to experts' opinions could be explained by changes in young generation's values systems, which place environmental and climate changes prior to traditions (Latvian traditional cuisine is based on pork dishes).

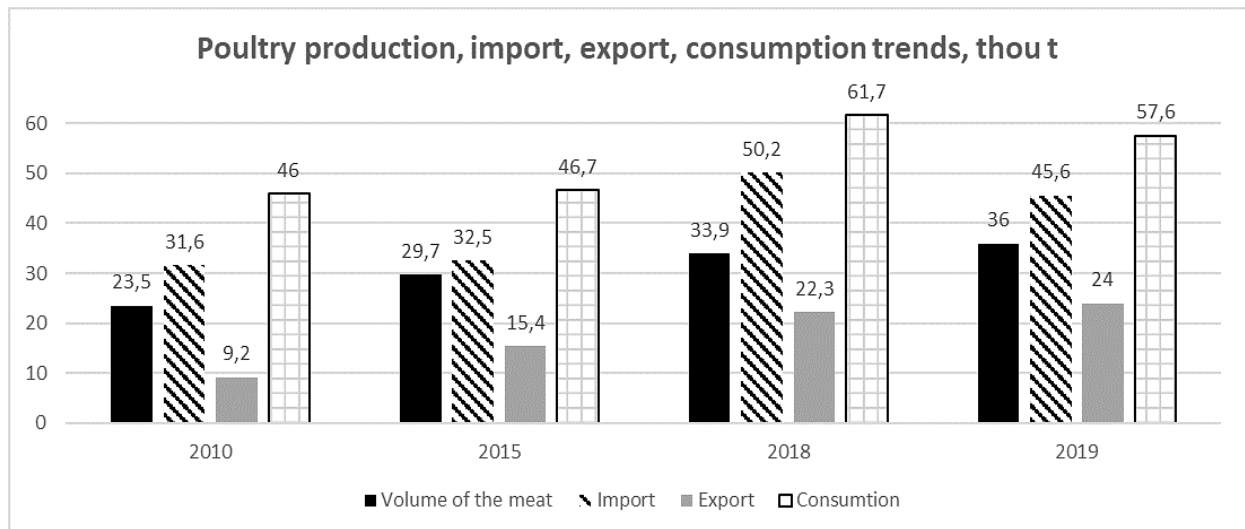


Figure 4. Poultry sector in Latvia, 2010-2019 [17].

In order to find out the most serious gaps in the resilience of meat supply chains in Latvia, the authors conducted an in-depth expert interviews with nine meat production and processing enterprise representatives as well as farmers' associations who represented all the three meat sectors – beef, pork and poultry. According to the authors' elaborated and specially to meat industry tailored research methodology, the experts were asked to assess 39 risks that occurred during and after COVID-19 pandemic and which could possibly cause further difficulties in pandemic crisis situations. The experts had to assess the probability of occurrence and impact of each risk. The risks were grouped into: (1) internal risks and (2) external risks. In the interviews, general issues were combined with group-specific issues for producers / processors / logistics etc. The combination of answers depended on the progress of the conversation and each company's situation was outlined in general terms. The purpose of the conversation was not to formally ask all the interview questions, but for the interviewer to understand the essence of each company's case.

As revealed in Figure 5, meat sector companies have distinguished more internal risks that are associated with specific working conditions requirements as serious obstacles for their further operation and consider that their occurrence and impact will be very devastating.

Summary of risks to be managed

<p>External risks – <u>very high and with very high probability</u></p> <ul style="list-style-type: none"> • Market uncertainty • Difficulties in finding new outlets to replace closed markets • Fluctuations in demand • Dependence on exports • Increase in hygiene requirements for food sector companies • Various physical restrictions at national borders 	<p>Internal risks – <u>very high with very high probability</u></p> <ul style="list-style-type: none"> • Difficulties in planning business activities ahead • Dependence on the physical presence of the workforce in the enterprise • Rise in raw material prices • Quarantine at the cooperation partners' companies • Difficulties in complying with national safety measures (especially if an employee falls ill) • Additional expenditure to adapt to an emergency situation • Decrease in revenue • Problems of receiving payment for products sold • Inability to settle credit liabilities
<p>External risks – <u>high with high probability</u></p> <ul style="list-style-type: none"> • Decrease in customer solvency • Driving time restrictions for truck drivers 	<p>Internal risks – <u>high with high probability</u></p> <ul style="list-style-type: none"> • Lack of similar experience • High dependence on the company's executive director • Redundancies due to closure or reduction in production volume • Shortage / unavailability of raw materials on the market • Freezing of company's assets • Ineffectiveness of existing marketing activities • Failure to cover monthly instalments • Increase in logistics costs

Figure 5. Summary of Latvia's meat sector risks during and after COVID-19 crisis.

Regarding external threats, although most of the companies claimed that already during the last decade meat sector in Latvia has been working in high integration and market concentration conditions, which today has resulted in strong competitiveness of local and international meat sector players, meat sector's long-term risks are more related not with COVID-19 pandemic but with market uncertainty. For example, those farms that specialize in meat production in long-term crises noted problems with fodder, which they would need to be prepared themselves as high quality fodder supply in Latvia could be insufficient, which is critically important for high-value herds [18]. Significant problem mentioned by interviewed experts of the meat sector in Latvia before, during and after crisis is lack of qualified and motivated labour force, which could be explained by low prestige and insufficient information about market sector, its career opportunities etc. Among other topicalities, all the respondents also emphasized the necessity to educate the public about the need to support short food supply chains and thus local farmers and companies that might be in a more difficult situation during and after pandemic crises. Moreover, the interviews revealed that in Latvia many farmers and food companies' founders have not inherited specific farming, meat production, processing and marketing knowledge from their parents, because as X generation representatives they mostly come from the former collective farming system, which was the dominant farming model in Latvia until 1990s. Thus, Y and Z generation farmers and entrepreneurs often lack practically applicable knowledge and thus have to learn farm management from scratch by their own empirical experience, which is often risky. Consequently, this unprecedented COVID-19 pandemic situation is unusual experience for meat sector entrepreneurs that alongside with daily multi-dimensional problems also requires making complex decisions at the companies' level to balance business viability issues with safety measures for employees, business partners and customers.

5- Conclusions

Based on the literature analysis, case studies and in-depth expert interviews, the authors have come to the following conclusions and recommendations.

- During the analysed period, all the indicators of meat production, consumption and foreign trade have increased. The volume of meat production in Latvia is stable; however, the level of self-sufficiency with meat products throughout the analysed period has been lower than the volume of meat consumption, which has a growing trend. Thus, especially in times of crisis, it is important to maintain the operation of local meat production and processing companies, thus increasing self-sufficiency in the Latvian market with local producers of pork and chicken products, as well as quality beef products.
- Meat producers and processors use various sales channels to launch their products on the consumer market. Although co-operation exists between different farmers and meat producers, in times of crisis co-operation between industry players should be promoted in terms of providing slaughterhouse functions, stimulating sales and creating higher value-added products. In addition, some agricultural raw materials are supplied through cooperatives, and in a crisis situation, cooperatives are better prepared to take risk by making timely purchases of raw materials and building up stocks for next year's season.
- The Covid-19 crisis is a new challenge for meat sector companies. The interviews with meat production and processing companies show that in the short term the companies in the sector were able to overcome the difficulties

caused by the crisis at the company level with various solutions tailored to the specifics of the company, but in the long run the existence of several companies would be jeopardized. This is particularly the case in the pig sector, which has already been significantly affected by the effects of the spread of African swine fever. During the COVID-19 crisis, the most significant risks for meat production and processing companies were associated with the problems of their cooperation partners (lockdown, quarantine of employees), as well as the inability to adapt to the new compulsory hygiene requirements. Due to the limited time in the meat production cycle for proper fattening of the animal / bird, the inability to sell the product on time creates significant burdens - both additional costs and reduces the quality of the meat. The risk for meat processing companies that operate in the HoReCa sector is also very significant, as deliveries of products were interrupted or significantly reduced during the COVID-19 crisis. Due to the closure of cooperation partners (schools, hotels, and restaurants), the demand in the HoReCa sector of the export market also decreased. Such potential revenue shortfalls and cost increases could jeopardize the long-term economic and legal independence of companies of the meat sector. Therefore, the promotion of short food chains and local products should be supported at the national level, as well as educating the public about the need to maintain local meat production and processing companies in crisis conditions, increase self-sufficiency in Latvian pork and chicken products.

6- Declarations

6-1-Author Contributions

All authors have contributed an equal amount of work to this article. The content of the study was elaborated and structured by G.G.Z; The overall research project design was developed and supervised I.P.; The research methodology was prepared by A.M.; Z.K. was responsible for research data collection and processing. All authors have read and agreed to the published version of the manuscript.

6-2-Data Availability Statement

The data presented in this study are available on reasonable request from the corresponding author.

6-3-Funding

The paper was supported by the National Research Programme “Towards the Post-pandemic Recovery: Economic, Political and Legal Framework for Preservation of Latvia's Growth Potential and Increasing Competitiveness” (reCOVery-LV), Project Agreement: VPP-COVID-2020/1-0010.

6-4-Conflicts of Interest

The author declares that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

7- References

- [1] Hapsara, H. R. “World Health Organization (WHO): Global Health Situation.” Wiley Encyclopedia of Clinical Trials (September 19, 2008). doi:10.1002/9780471462422.eoct992.
- [2] “OECD-FAO Agricultural Outlook 2020-2029 (Summary in Arabic).” OECD-FAO Agricultural Outlook 2020-2029 (October 6, 2020). doi:10.1787/25626d67-ar.
- [3] Marie-Agnes Jouanjean. “Digital Opportunities for Trade in the Agriculture and Food Sectors.” OECD Food, Agriculture and Fisheries Papers (February 15, 2019): 58. doi:10.1787/91c40e07-en.
- [4] Food security and climate change. A report by The High Level Panel of Experts on Food Security and Nutrition. HLPE Report No. 3. Published in 2012, pp. 98. Available online: <http://www.fao.org/3/a-av035e.pdf> (accessed on September 2020).
- [5] Trewin, Ray. “Crucial Food Security Analysis in Brief.” Crucial Agricultural Policy (March 18, 2016): 1–9. doi:10.1142/9789814689670_0001.
- [6] J. Schmidhuber, J. Pound & B. Qiao “COVID-19: Channels of Transmission to Food and Agriculture”, FAO (2020). doi:10.4060/ca8430en.
- [7] FAO and CELAC. “Food Security under the COVID-19 Pandemic” (2020). doi:10.4060/ca8873en.
- [8] “Maintaining Food Safety in the COVID-19 Era” by David Acheson of the Acheson Group, FoodProcessing.com, Apr 28, 2020. Available online: <https://www.foodprocessing.com/articles/2020/maintaining-food-safety-during-covid-era/> (accessed on 16 October 2020).
- [9] FAO. “COVID-19 and the Risk to Food Supply Chains: How to Respond” (2020). doi:10.4060/ca8388en.

- [10] FAO, "COVID-19 and the Impact on Food Security in the Near East and North Africa: How to Respond?" (2020). doi:10.4060/ca8778en.
- [11] How the Coronavirus is Affecting Food by Pan Demetrakakes, FoodProcessing.com, 31 March 2020, Available: <https://www.foodprocessing.com/articles/2020/how-the-coronavirus-is-affecting-food-processing/> Retrieved: 16.10.2020
- [12] Consumer sentiment and behavior continue to reflect the uncertainty of the COVID-19 crisis. McKinsey&Company. July 8, 2020 |Article. Available online: <https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/a-global-view-of-how-consumer-behavior-is-changing-amid-covid-19> (accessed on 16 October 2020).
- [13] Annie Gasparro, Jennifer Smith and Jaewon Kang, Grocers Stopped Stockpiling Food. Then Came Coronavirus. The Wall Street Journal. March 23, 2020. Available online: <https://www.wsj.com/articles/grocers-stopped-stockpiling-food-then-came-coronavirus-11584982605> (accessed on 16 October 2020).
- [14] COVID and the Economy. Then and Now: Consumer CPB Behaviour during Economic Downturns. IRI. Available online: <https://www.iriworldwide.com/IRI/media/Library/COVID-19-Thought-Leadership-3-25-2020.pdf> (accessed on 16 October 2020).
- [15] Wiebe, K., D. Dawe, and K. Stamoulis. "Food Prices and Economic Crises: Causes and Consequences for Food Security in Developing Countries." *The Food and Financial Crises in Sub-Saharan Africa: Origins, Impacts and Policy Implications* (2011): 48–60. doi:10.1079/9781845938284.0048.
- [16] Food industry in Latvia. Investment and Development Agency of Latvia. Available online: <https://www.liaa.gov.lv/en/trade/industries/food> (accessed on 16 October 2020).
- [17] Agriculture of Latvia 2020. Central Statistical Bureau of Latvia. Available online: <https://www.csb.gov.lv/en/statistics/statistics-by-theme/agriculture/crop/search-in-theme/424-agriculture-latvia-2020> (accessed on 16 October 2020).
- [18] Proskina, Liga, and Irina Pilvere. "Significance of Legumes as a Feed Source." 20th International Scientific Conference "Economic Science for Rural Development 2019". *New Dimensions in the Development of Society. Home Economics. Finance and Taxes. Bioeconomy.* (May 8, 2019). doi:10.22616/esrd.2019.146.