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Supply Chain Disruption in Fresh Produce Swine Industry: Impact and Mitigation of Disruption

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SUPPLY CHAIN DISRUPTION IN FRESH PRODUCE SWINE INDUSTRY: IMPACT AND MITIGATION OF DISRUPTION

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List of Abbreviations

AKI	(Agrárközgazdasági Intézet) Institute of Agricultural Economics
AI	Artificial Intelligence
ASF (ASP)	African Swine Fever (Afrikai sertéspestis)
BSE	Bovine Spongiform Encephalopathy
CAGR	Compound annual growth rate
CV	contingent valuation
FAO	Food and Agriculture Organization of the United Nations
HCA	Hierarchical cluster analysis
HPAI	Avian influenza
IoT	Internet of Things
KMO	Kaiser-Meyer-Olkin index
KSH	(Központi Statisztikai Hivatal) Hungarian Central Statistical Office
MARA	Chinese Ministry of Agriculture and Rural Affairs
MOA	Ministry of Agriculture
Mt	Metric tons
Nébih	National Food Chain Safety Office
NBS	National Bureau of Statistics
NOAA	National Centers for Environmental Information (NCEI)
O2O	Online-to-offline
OECD	The Organization for Economic Cooperation and Development
OIE	World Organization of Animal Health
OOHB	one-and-one-half-bound
PPP	Public-Private Partnership
RFID	Radio Frequency Identification
r.w.e.	Retail weight equivalent
R&D	Research and Development
SARS	Severe Acute Respiratory Syndrome
TPB	Theory of Planned Behaviour
USDA	The U. S. Department of Agriculture
WTP	Willingness to Pay

INTRODUCTION

Meat, especially pork, is a vital source of protein in global diets, with consumption patterns deeply influenced by cultural, economic, and demographic factors (Verbeke et al., 2010). However, the stability of meat supply chains is increasingly threatened by external disruptions, including disease outbreaks, trade conflicts, and geopolitical instability (Li et al., 2021). Among these, the African swine fever epidemic has had devastating consequences for pork production, triggering market volatility, supply shortages, and shifts in consumer behaviour. Given pork's economic and dietary significance—especially in China, the world's largest producer and consumer (FAO, 2023), and Hungary, a historically pork-reliant country (Marczin, 2023)—understanding the impacts of African swine fever on supply chains is critical for ensuring food security, economic resilience, and sustainable agribusiness practices.

The pig business serves as an example of more general issues with fresh food supply chains, where disease risks, demand swings, and perishability call for effective mitigation techniques. The need for this research is further highlighted by recent disruptions, such as the foot-and-mouth disease outbreak in Hungary in 2025 (Nébih, 2025). Even if supply chain efficiency has increased due to managerial innovations and technical improvements (Ivanov et al., 2019), systemic vulnerabilities still exist, especially in the face of cross-border crises like African swine fever.

In the present study, we research and investigate the topic of fresh food supply chain disruptions and their possible mitigation, especially by highlighting the pork business, with an emphasis on the African swine fever outbreak's influence in China and Hungary. The importance of studying this topic is that public health, economic stability, and food security are all greatly influenced by the global food supply chain, especially the fresh produce of the swine sector. Both producers and consumers may ultimately be impacted by interruptions, resulting in large financial losses, food shortages, price changes, and consumption pattern changes.

Few studies offer a comparative study of African swine fever's implications across multiple markets or empirically evaluate mitigation methods for swine supply chains, despite the fact that existing literature extensively investigates consumer adaptability (Verbeke et al., 2010) and supply chain hazards (e.g., Li et al., 2021). This research fills this gap by examining how African swine fever has affected and would affect the supply chains for pork in Hungary, with an emphasis on trade adjustments, price volatility, production losses and consumer eating pattern changes towards pork—in addition, examining how changes in supply shortages due to disruption affect consumer preferences and buying patterns. The research proposes a framework for supply chain resilience by incorporating case studies, qualitative and quantitative modelling.

By improving the literature on supply chain risk management, especially for perishable items, and by combining multidisciplinary viewpoints from logistics, economics, and agribusiness, this study advances theory. It provides useful information for industry stakeholders (e.g., diversification strategies), policymakers (e.g., disease containment methods), and international food security initiatives. The emphasis on China and Hungary, two disparate but linked markets, allows for the development of generalizable lessons for other areas dealing with comparable crises. This study's theoretical rigour is increased by the incorporation of management science and innovation, which also guarantees that the results are useful and applicable to actual situations.

1. RESEARCH BACKGROUND AND OBJECTIVES

The recent trend of placing nutrition, food, and consequently food safety issues at the forefront justifies the relevance and significance of the selected research topic. Ensuring a steady, dependable, and safe food supply for the world's expanding population is one of the most pressing challenges of the twenty-first century (Yu et al., 2021). To meet the increasing need for food, industrialisation, innovation, and intensification of agriculture and animal husbandry present both opportunities and challenges for food safety and marketers (Verbeke et al., 2010). Considering the short lifespan of fresh produce, including raw meat, fresh fruits and vegetables, seafood, and fresh flowers, deterioration issues pose a significant risk to the efficiency of supply and demand in the fresh produce market (Li et al., 2021). Natural disasters and other unforeseen events are among the primary reasons why supply chains face production and distribution disruptions (Li et al., 2021). The reduction of greenhouse gas emissions, a focus on animal welfare practices to enhance environmental compliance, and the issue of social responsibility are some new challenges facing the food manufacturing industry (Yu et al., 2021). Food demand and consumption are also influenced by the factors affecting food production and shifts in consumer preferences; consequently, food supply chains and pork supply chains have had to rapidly and haphazardly adapt to demand-side shocks, such as panic buying and changes in consumption habits and preferences when disruptions occur (Yuen et al., 2020).

African swine fever (hereinafter, ASF) has been a significant contributing reason to shortages in the swine business, particularly in China, which is one of the world's leading markets for pork products (Salling, 2025). Such epidemics are considered disturbances that could affect supply chains, including changes in demand. ASF is a fatal disease impacting both domestic and wild boars and has impacted the pig industry in several countries throughout the world (Olasz et al., 2019). The event caused supply and demand in the markets for pork and other meats to be out of balance. Hungary's pork market is also a witness to the ASF outbreak, which highly affected domestic pork businesses (Olasz et al., 2019).

1.1. The Scope of Objectives

In general, if disruptions occur in the supply chain, they directly and indirectly affect the players, especially the end-users, of the chain (Salling, 2025). Study objectives (O1, O2, O3, O4, O5, O6, O7, O8, O9) were created in line with the main hypotheses and research questions of the study.

The first two pertain to the literature evaluation and secondary research, while the third, fourth, fifth, sixth, seventh, eighth, and ninth pertain to our empirical study. These subsequently served as the foundation for the new scientific findings (see *New Scientific Results*) and the research hypotheses (see *Materials and Methods*). During the preparation of the dissertation, the following research objectives were formulated and summarised in **Table 1**.

Table 1: Summary of the objectives of the study

	Objectives related to secondary research
O1	Introducing and examining the main causes of supply chain disruptions in the fresh produce swine sectors, by highlighting the pork market at the domestic and Chinese levels.
O2	Exploring the connections between ASF outbreaks and consumer behaviour changes, as well as assessing the industry's suitability and the efficacy of current mitigating techniques on a managerial level.
	Objectives related to primary research
O3	Exploring the preferences and attitudes related to pork consumption at the domestic level in connection with the influencing factors.
O4	Examining how consumer tastes and behaviours are being affected by ASF-related swine sector disruptions.
O5	Building a welfare idea regarding the changing behaviours due to ASF.
O6	Building a model on the influencing factors impacting pork choice during an ASF outbreak.
O7	Building a model of the economic effects of the ASF outbreak in the Hungarian pork market.
O8	Introducing measures to mitigate a possible ASF outbreak on the managerial level in the domestic market with qualitative techniques.
O9	Exploring innovation and innovation management from a complex viewpoint of the primary research regarding the topic.

Source: Own research, 2025

One of the criteria for picking the present topic was to look at facts that affect our daily lives, lifestyle, health, and quality of life. Pork is one of the most often consumed meats and is traditionally consumed in Hungary (Marczin, 2023). Even if poultry meat has recently surpassed pig in terms of yearly consumption per capita (Hungarian Central Statistical Office, hereinafter, KSH, 2024), albeit not by much value, it is still one of the most popular kinds in our diet. Disruptions like the ASF outbreak could deeply affect business strategies and the supply-demand side.

The bibliometric analysis and the goal of the research determine which secondary and primary research methods are used. The comprehensive account of circumstances, incidents, and observed behaviour is the foundation of the secondary research methodology. Primary research was also conducted, which included both qualitative and quantitative data. In addition to developing novel scientific findings, the goal in writing the present dissertation was to fill the above-mentioned research gap and add to the scant literature from which different industries, particularly pork businesses, and other scientific areas, such as management science, veterinary science, marketing science, risk-management science, among others could benefit.

In the doctoral dissertation, taking into account the objectives and the above reference, the following research questions emerge (Q1, Q2, Q3, Q4, Q5, Q6), which are summarised in **Table 2**.

Table 2: Summary of research questions

RESEARCH QUESTIONS	DESCRIPTION
Q1	Which factors can be impacted by a supply chain disruption?
Q2	How does the ASF outbreak impact the supply-demand balance in China and Hungary?
Q3	How to mitigate and coordinate fresh produce supply chain disruption in the case of an ASF outbreak?
Q4	What are the trends in meat consumption in Hungary, considering pork?
Q5	How do consumers change their consumption patterns due to disruption shocks, especially due to ASF?
Q6	What kind of innovations can be derived from the topic?

Source: Author's illustration

The flow chart of **Figure 1** presents how the research has progressed throughout the study period.

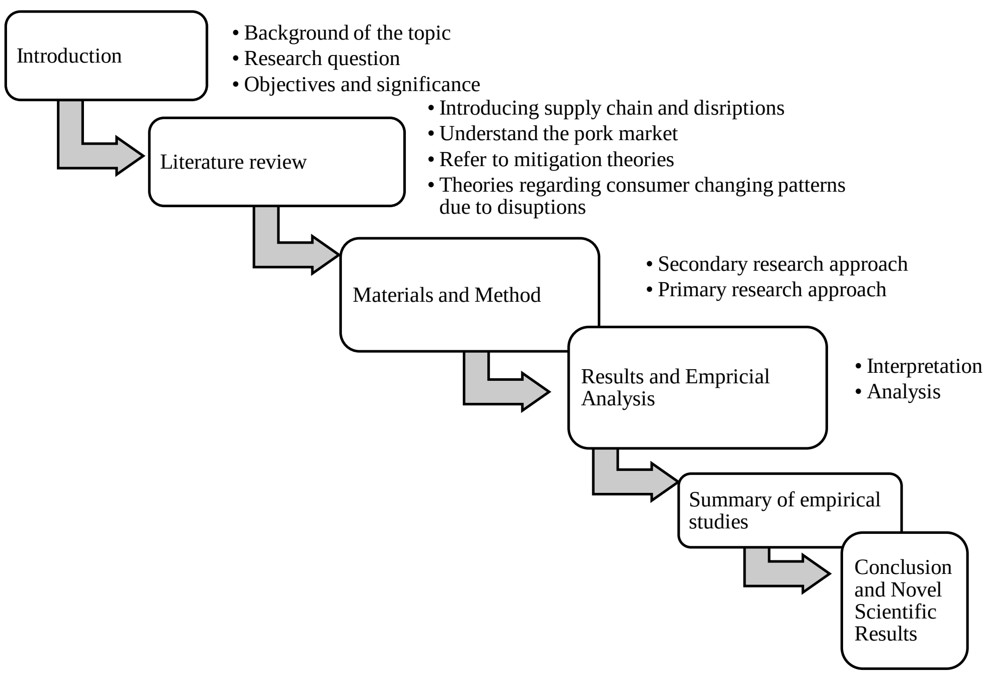

Figure 1: Structural map reflecting the logical arrangement of the study
Source: Own research, 2025

1.1.1. Tasks Related to Secondary Research

Pertinent questions were developed that the study can help answer when determining the objectives summarized previously. Duties have been allocated necessary to accomplish the study objectives so that we can respond to the inquiries. The analytical definition of disruptions, pork consumption, and the ASF outbreak are the most crucial sections of the literature review, focusing on the China and Hungary markets.

Tasks and activities assigned to secondary research and objectives:

1. Collect, evaluate, and analyse relevant literature sources on the subject at the domestic and foreign levels.
2. Using econometric techniques and data collection from many sources to create new interpretations and information from the statistical data that has been collected (e.g. correlations, ratios, indices, trend analysis, price elasticity indicators, average clusters)

1.1.2. Tasks Related to Primary Research

The primary research's major goal, on one hand, is to conduct a corporate interview by examining the management and structure of the business corporation. Furthermore, concentrates on its analysis of monitoring and preventive measures for a possible ASF outbreak on domestic pig farms. In parallel, a snowball seed survey technique is used to conclude aspects of pork consumption in Hungary and to analyse eaters' consumption pattern changes due to a hypothetical situation of ASF outbreak among domesticated pigs, using data from the sample population (i.e., questionnaires included in the evaluation). The study would particularly measure and address how ASF affects the eating and purchasing choices of end-users.

Tasks and activities assigned to primary research and objectives:

1. Contact a corporate business and set an interview on the subject of structural setup and managerial methods of its supply chain, prevention, monitoring system, etc.
2. Build a standardised survey by using an online technique in the case of the end-user.
3. Conduct primary research with at least 300-320 samples with the framework of a questionnaire survey about the habits and attitudes of consumers regarding pork, as well as surveying on ASF awareness and the impact of changing dietary habits in case of an ASF outbreak in the domestic pig market.
4. Comprehensive assessment and mathematical-statistical analysis are to be used to process and interpret the questionnaire survey data.

The literature review, secondary research, and primary research would shape the topic and help us construct a conclusion at the very end of the thesis, determining the existing position of pork in the market in the event of a disruption. Recommendations, innovativeness of the topic, and novel findings are also provided for additional future research.

1.2. Structure of the Thesis

The remainder of the paper is organised as follows. The thesis consists of 6 main chapters: *Introduction, Literature Review, Materials and Methods, Results and Findings, Conclusions, Novel Scientific Results*. The *Introduction* part gives the reader an exact explanation of the choice of topic, as well as the key research questions and hypotheses. The aim and objectives of the study, and the brief description of the content of the different chapters, are also introduced in this chapter.

Literature Review offers a straightforward diagrammatic and systematic analysis of the literature, the theoretical implications of supply chain disruptions, pork market, ASF outbreak and associated disruptions, and the deterioration of fresh food of swine business in consumption level both in China and Hungary. It includes the effects on pricing, preventive measures, and consumption patterns as well. The resources and techniques used for primary research on the domestic swine market, as well as an overview of the research's development and methodology, will be covered in the next *Materials and Methods* chapter. Chapter four, *Results and Findings,* provides a mathematical-statistical analysis based on the conducted primary research. It will provide a complex view on the mix of qualitative and quantitative primary research at an end-user and managerial level. It is an empirical analysis based on collected data from questionnaire surveys and in-depth interview analysis. The *Conclusions* chapter is the ending section of the thesis by providing an overall conclusion of the topic, as well as highlighting the key results according to the empirical analysis based on the previous chapters. Last but not least, *Novel Scientific Results* highlights some new and novel suggestions for policymakers and future researchers.

2. LITERATURE REVIEW

Mapping and characterising supply chain disruptions, the current pork market in China and Hungary, as well as determining how the ASF virus outbreak has affected pork consumption patterns and prices, are some of the main objectives of the study. The research addresses and concludes through the example of the ASF's effects on price distribution, risk management and consumer habit changes. It is crucial to present and evaluate the most recent research, techniques, and conclusions related to this subject in detail.

In this section, a general overview is given of what supply chain disruption is, providing a better understanding of the definition of pork consumption and production in China and Hungary, and highlighting some important definitions that have been contributed by various researchers worldwide. The purpose of this research is to give the reader a thorough, yet sophisticated, overview of the present subject. To comprehend the subject matter more thoroughly, graphs and tables are created, and the study presents exact scenarios. The present study's primary goal is to investigate and highlight the effects of disruptions, especially throughout the ASF, on the pork industries and changing consumers' habits towards pork, by highlighting China and Hungary. The literature review's structure shifts from a topic-wide emphasis. The sub-headings will address the significance of the supply chain disruptions and the pork market from an economic, social, and ecological perspective. There will be a more thorough understanding of pork consumption in China and Hungary, including data on consumers, consumption patterns, and industry conditions from the perspective of ASF. Lastly, disruption mitigation literature and consumption habit changes due to disruptions will be expanded.

2.1. Overview of Supply Chain Disruptions

The supply network is pervasive, abundant, and invisible to everyone. Operations throughout the supply chain affect everything we touch, hear, smell, and taste (Londe & Masters, 1994). Londe and Masters (1994) define the supply chain as a collection of autonomous businesses; several supply chain elements are involved in these activities, including raw materials, manufacturers, producers of intermediate goods, producers of finished goods, wholesalers, distributors, retailers, and consumers. Chopra and Meindl (2007) define the supply chain as all parties directly or indirectly involved in satisfying the needs and expectations of customers. The goal of the entire supply chain, according to

Chopra and Meindl's (2007) research, is to maximise the total generated value; this value is comprised of meeting customer wants and requirements.

According to Bailey (2001), the main difference between the agricultural supply chain and the supply chain for other industries is that agricultural supply chains are both demand and supply-driven. Consumers are typically at the end of the supply chain, and they have highly particular wants that are not and cannot be promptly met by agricultural output (Bailey, 2001). Agricultural supply chains can be thought of as systems that are customer-centric and production-adapted (Dong et al., 2015). Producing, distributing, and selling fresh goods, like live seafood, fruits, vegetables, and cut flowers, is standard procedure for businesses. (Dong et al., 2015) The post-harvest life spans of fresh products, including fresh fruits, fresh vegetables, fresh flowers, and live seafood, are usually unpredictable (Li et al., 2021).

2.1.1. Types and Consequences of Disruptions

Based on the report of Cruz (2013), in a global environment, businesses face a variety of challenges such as competition, disruptions, and operating with an emphasis on efficiency. Supply chains may face shortfalls from suppliers, uncertain demand, problems at the operational level, as well as product contamination, security, and catastrophic risks, more and above natural disasters (Lee, 2022; Manuj, 2007). Supply chain disruptions can impact not only the supply chain's immediate and direct performance, but also its regulations, policies, designs, and strategic level configurations (Hilmola and Lorentz, 2012). According to the study by Katsaliaki and Mustafee (2019), and the website of the National Oceanic and Atmospheric Administration (hereinafter, NOAA, 2024), there have been 212 disasters in the United States since 1980, with an estimated USD 1.2 trillion in damage. A disruption similar to the 2011 earthquake and tsunami in Japan, the floods in Thailand, severely impacted the supply chains of numerous goods and businesses (Chongvilaivan, 2011). According to research by Pant et al. (2011), a port closure that disrupts the supply chain for two weeks might cause revenue losses of up to USD 190 million. In 2005, Hurricane Katrina caused havoc along the US Gulf Coast (Katz, 2005). Furthermore, in 2003, epidemics such as severe acute respiratory syndrome (hereinafter, SARS) struck Southeast Asia, according to Swaminathan (2003). A blockade on Egypt's canal for almost 7 days disrupted global trade, costing approximately USD 10 billion in loss per day. The coronavirus outbreak in a significant hub for industry and transportation in central China has caused facilities to shut down, substantially limiting worldwide production and transportation routes (Araz et al. 2020). COVID-19 caused lockdowns in numerous nations due to the contagion's severity and geographic spread, which resulted in a precipitous decline in supply and demand (Sherman, 2020). Perishable item spoilage can cost fresh products businesses in Western nations up to 15% of their profits. China loses USD 8.9 billion annually in fruits and vegetables, or over 30% of the country's total annual production (Bolton & Liu, 2006). To increase the resilience and sustainability of fresh food enterprises in the supply chain, Li et al. (2022) report that they evaluated the coordination of operational management of a dual-channel fresh food supply chain in the case of disruption, utilising decentralised and centralised decision-making models. Hou and Liu (2017) looked into the coordination problem of a typical Chinese fresh produce supply chain, which is defined by a wholesale market connecting the supply chain and a random market pricing resulting from uncontrollable supply and demand. Yu et al.'s (2020) study distinguished between horizontal and vertical consolidation and concluded that vertical consolidation might be more advantageous for increasing retailers' profits. Yang et al. (2019) looked into the best ways to maintain freshness and set prices for a fresh produce supply chain that involved both suppliers and retailers operating in the retail mode, as well as dual-channel and online-to-offline (O2O) modes. Tang et al. (2021) discovered that in the downstream market, the customer's price sensitivity has the biggest impact on the link between supply and demand.

In summary, any unforeseen circumstance or element that impedes or disrupts the regular flow of products, services, or information within a supply chain is referred to as a disruption in the supply chain. These disruptions can influence several stages of the supply chain and multiple stakeholders, with a wide range of causes and consequences. Disruptions to the supply chain can have serious negative repercussions on customers, businesses, and the economy as a whole.

2.2. The Fresh Produce Swine Supply Chain and the Pork Industry

2.2.1. Structure of the Swine Supply Chain

To provide value to consumers, the pork supply chain is a complicated process involving numerous businesses and related aspects that must be coordinated (Pérez, 2005). The supply chain industry is engaged in the organisation and distribution operations of pork meat production (feed producers, processors, retailers, end-users). Christopher (2011) states that in the first instance, various cooperatives that handle animal stunning, slaughter, meat processing, and market distribution collaborate with swine producers. The second scenario involves the pork industry's production and contract, which can be integrated or autonomous (Christopher, 2011). Referring to the research of Nakrachata-Amon et al., (2024), the four main activities of the modern pig supply chain are breeding, farrowing, nursery, and fattening. Effective risk management includes devising backup plans for any hazards, like disease outbreaks or supply chain interruptions (Rodríguez, 2014). Over the past ten years, there have been numerous attempts at vertical integration or coordination within the pig supply chain (Pérez, 2005). **Figure 2** presents the supply chain flow of pork production. The feeding agency, which produces and processes raw materials and distributes them to the farms, is where the stage begins (Rosenvold et al., 2003).

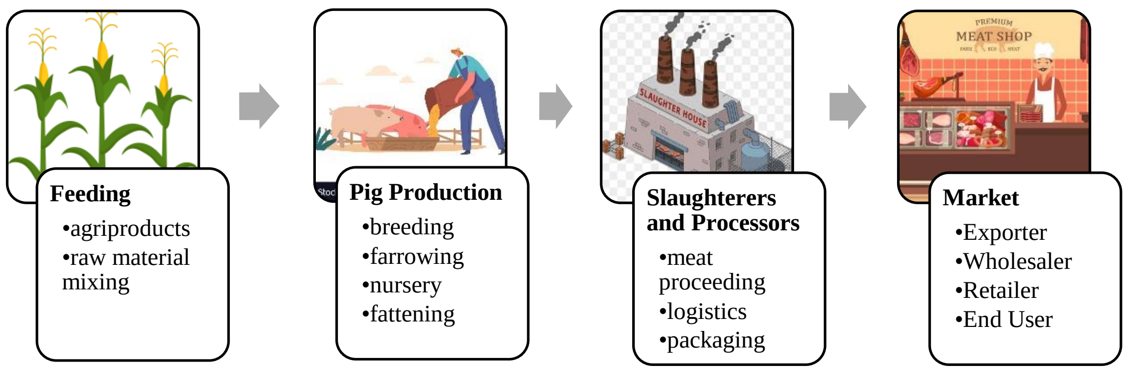

Figure 2: Pork supply chain
Source: Author's illustration based on Nakrachata-Amon et al. (2024); Pérez et al. (2005)

The next stage in the chain is the production of pigs, which can be divided into different groups: breeding, farrowing, nursery, and fattening (Nakrachata-Amon et al. 2024). As far as slaughtering and pig meat processing, referring to the research of D'Souza and Matthews (2024), numerous procedures are involved in the pig slaughter process, and each one has an impact on the quality of the pork. The laws that govern food safety and animal welfare have also influenced pork processing, and significant improvements have also been made to the slaughter process to maximise pork quality in response to customer demands and supply chain segments' expectations for product quality (Barton-Gade, 1997).

In terms of market, globalization has led to a creative flux in the production and manufacturing of meat products, thus meat and food firms must examine changing customer purchase and consumption patterns, as well as perceived and actual trends in consumer expectations if they hope to maintain or strengthen their leading position in the market (Pérez, et al, 2005). Today's consumers want a greater range of meals, restaurant concepts, and retail formats (Pérez, et al., 2005). Additional expectations are placed on food manufacturers, distributors, retailers, and food service operators as they work to efficiently offer a wide range of goods and services in the right quantity and on schedule, therefore to better serve customers, a growing number of food stores are collaborating more closely with manufacturers and distributors (Stewart & Martinez, 2002). The focus on consumers and markets has been determined to be essential for the meat businesses to flourish successfully (Verbeke, 2000).

2.2.2. Challenges in the Swine Supply Chain

The production risk associated with each link in the pork supply chain is directly linked to the safety of people's food because of the nature of the swine business (Gunnarsson et al., 2020). According to related research, human factors, including supply chain participants' infractions, account for almost 90% of pork quality and safety problems (Wu et al. 2017). Thus, improving participant management is essential to bolstering safety and risk mitigation in the pork supply chain (Abrudan et al. 2022). Some academics contend that pig farmers should bear primary accountability for the safety and quality of the meat (Leikas et al. 2009; Henderson et al. 2010). According to Osadchiy et al. (2016), the stability of the entire supply chain network structure is directly correlated with the risk present in the upstream supply chain.

According to Huffman (2002), past events demonstrated that bacterial infections or other viral outbreaks in the chain can resist corporate, governmental, and public efforts to eradicate them. Therefore, the meat processing industry has long faced significant challenges related to bacterial reduction during the conversion of muscle to meat (Huffman, 2002). The agro-food industry is compelled to develop management concepts and management systems that extend the traditional focus on economic efficiency to, first, incorporate quality assurance and quality improvement and, second, reduce the use of natural resources and the negative impacts of production and trading activities on the environment (Schiefer, 2002). Food quality and safety are significantly influenced by the actions of every participant throughout the entire supply chain, encompassing production, processing, and sales (Zhu et al., 2022).

Research conducted by Wu et al. (2017) ranked the responsibilities for ensuring pork quality and safety among various stakeholders, including feed manufacturers, pig farmers, pork processors, slaughterhouses, supermarkets, farmers' markets, pig transporters, and consumers, in descending order. Harray et al. (2018) emphasised the importance of government regulation in fostering an environmentally sustainable food supply. While consumers typically engage minimally in the supply chain, their satisfaction, willingness to pay, consumption habits, and preferences are significantly influenced by production strategies and practices (Zhu et al., 2022). Studies indicate that consumers tend to trust food products bearing certification labels and are inclined to pay a premium for pork as their awareness of environmental protection issues increases (Wang et al., 2018; Santaramo & Lamonaca, 2021). Furthermore, Assefa et al. (2017) noted that market shocks can be transmitted to the upstream supply chain, thereby affecting and modifying behaviours. Furthermore, it is essential to strengthen the supply chain's capacity to withstand risk shocks through vertical collaboration among key participants and horizontal cooperation among members within the primary structure (Perez et al., 2010; Leat & Revoredo-Giha, 2013). Vertical integration mechanisms can improve the quality of the buyer-farmer relationship and have a favourable impact on farmers' performance (Abdul-Rahaman, 2020). An extensive study of multi-farm vertically integrated pig firms was carried out by Nadal-Roig et al. (2020), with a focus on the examination of pig production decisions made in response to future selling price uncertainty. Additionally, referring to the research of Dong et al. (2020) and Ouma et al. (2017), several nations use vertical integration to boost the value of the pig industry chain, and it also successfully reduces disease in the pig industry.

2.2.3. The Pork Market

Consumers around the globe are gradually adopting healthy lifestyles and, consequently, changing their eating habits (Yu et al., 2021). The need for efficiency, sustainability, and a way to meet the world's growing food demand is a driving factor in this transformation (Yu et al., 2021). Since meat is an essential source of sustenance for a large number of people worldwide, from 1961 both the absolute and per capita consumption of meat worldwide have quadrupled; 350 million tons of meat are produced annually (Ritchie et al., 2023). Therefore, the global meat supply is reaching 374 metric tons (Mt) by 2030, according to the FAO Agricultural Outlook of 2021. The United States, Brazil, and China are expected to share the majority of the rise in meat output (FAO, 2021). Referring to the research of Ritchie et al. (2023), Asia is the world's greatest meat producer, accounting for a significant share of the world's total meat production. According to Parlaska and Qaim (2022), pork and poultry are the most popular meat varieties worldwide. The global consumption of chicken has skyrocketed due to its affordability, perceived health benefits, and lack of sensitivity to religious constraints (Mottet et al., 2017). The FAO states that pork, which accounts for 36% of global meat consumption, is the most consumed meat worldwide (Global Preferences: The Most Consumed Meat in the World, 2023). Pork accounts for roughly 40% of total meat consumption, with other meats, including beef, accounting for about 24%, and poultry and other meat accounting for 31% and 5% of the total (Statista, 2023). The countries with the highest per capita consumption of pork in 2016 were the United States (22.8 kg/capita), Vietnam (28.9 kg/capita), China (30.8 kg/capita), and the European

Union (32.3 kg/capita) (Soare and Chiurciu, 2017). As one of the most popular meat products consumed globally, pork is expected to grow at a compound annual growth rate (hereinafter, CAGR) of 4.5% throughout the forecast period, accounting for over half of the global market share in 2019 (Sumesh and Roshan, 2020). Sumesh and Roshan's (2020) research estimates that the global market for pork meat was worth USD 236,112.7 million in 2019 and is expected to increase to USD 257,874.5 million by 2027, with a 3.9% CAGR from 2021 to 2027. The publisher projects that the global pork market will reach USD 418.37 billion by 2028 (Sumesh & Roshan, 2020).

2.2.3.1. The Pork Market of the People's Republic of China

One could even argue that pork is a mainstay of Chinese cooking. Pigs have their advantages to be at the top of the food chain, because they were among the first domesticated animals in China (Li, 2019). Pigs may represent vigour and family, because wealthy families in ancient China typically kept several pigs in their homes, and pigs are seen as a sign of affluence in Chinese culture (Li, 2019).

China and a few other Southeast Asian nations are the main sources of the rise in pork consumption (Parlaska & Qaim, 2022). Over one-third of the world's meat products come from China's pig production system (Zhu & Chen, 2018). According to the U. S. Department of Agriculture (hereinafter, USDA) (2021) datasets, China's pork output in 2018 was 54.03 Mt or 47.80% of the world's total. With 51 million tons of pork produced annually, China is the world's largest pork producer and had the greatest pig population in 2022 (USDA, 2021). Referring to the research entitled "Global pig meat market developments in 2023" (2024), China became the world's largest producer of pig meat in 2023, producing 58.8 million tons (more than 2.5 million tons), or 4.5% more than the previous year; this accounts for 47% of the world's total pig meat output. Pork intake in China is not constrained by tradition or religious beliefs (Vida & Szűcs, 2016a). Furthermore, China is expected to produce 58.05 million tons of pork by 2028 (The Organization for Economic Cooperation and Development (hereinafter, OECD), 2019). The agricultural industry greatly benefits from the pork production sector, therefore, Chinese people make up just over 18% of the world's population, but they consume almost half of all pork produced worldwide (Zhang et al., 2021). **Table 3** presents how pork market share is distributed worldwide.

Table 3: Pork production on global aspects

Country	Global market share	Total production (2023-2024) tons, million
China	50%	57.94
European Union	18%	20.83
America	11%	12.39
Brazil	4%	4.45
Russia	3%	4

Source: Author's illustration based on USDA (2024)

It can be concluded from the data that China is the leader in producing pork. Research by FAS-USDA (2016) states that pork is the most popular type of meat among Chinese people as their main source of protein; in Beijing, Nanjing, and Chengdu, the per capita intake of pork is 3 kg and 4.27 kg, respectively. Of the growth in pig meat consumption from the reference period to 2030, 70% will come from China (Han, 2019). According to Han (2019), China's pork consumption in that same year made up 49.60% of global pork consumption. According to the research of Salling (2025), the variance in meat consumption from 2015 to 2021 also presents that pig is the most consumed meat type among Chinese people with 31.7 kg per capita consumption, while poultry consumption rose to 11.2 kg per person in 2015, sheep and beef consumptions are to less than 5 kg per person.

2.2.3.2. The Pork Market of Hungary

A mainstay of Hungarian cooking, pork has great cultural significance. Pork is frequently used in traditional recipes such as *töltött káposzta* (stuffed cabbage) and *gulyás* (goulash), among others. Hungary's lifestyle revolves around pork, and the country's deep-seated custom of rearing and consuming pigs is part of its heritage (Challenges and Opportunities of the Pig Sector in Hungary, 2021). During the 1970s and 1980s, the pig industry dominated domestic agriculture; during this time, few other European nations could demonstrate a similarly dynamic development as Hungary did (Nábrádi et al., 2008).

The pork industry in Hungary is subject to market competition, and shifts in the global market significantly affect it (Marczin, 2023). There were 12 pigs per farm in the Hungarian market in 1993, compared to an average of 77 pigs per farm in the EU; thus the domestic pig herd performed worse than the average in Europe (Vida, 2012). The Hungarian pork sector saw new opportunities to overcome competitive disadvantage following the old regime, by joining the EU in 2004 (Marczin, 2024). Based on some research analysis by Harangi-Rákos (2013), Bartha (2014), and Nagy (2011), it can be stated that contrary to the aforementioned expectations, the agricultural catch-up has fallen behind. Many pig farmers quit growing pigs because they could not cope with the harsher environmental protection requirements that came with our EU entrance (Jön a sonkaszezon, 2011A). Due to issues in the pig industry, the government decided in 2012 (Government Decree 1323/2012, VIII.30.) to take strategic steps to enhance the industry's status, regarding the approval of a government resolution intended to boost domestic pig herd numbers and pig farmers' ability to compete. As of right now, it can be said that this initiative is insufficient to grow the industry (Szántó et al., 2020; Marczin et al., 2023). Máhr (2020) asserts that the pork strategy, which was unveiled in 2012, fell short of expectations. Additionally, increasing the supply chain's efficiency, lowering risk factors, and lessening its effects can also be effective vertical solutions; numerous examples of these strategies can be found throughout Europe (Perez et al. 2010, Leat et al. 2013, Rodríguez et al. 2014).

The Northern Great Plain is home to 701,000 pigs, or 26% of the herd, according to KSH (2023b) data. The pig herd is distributed as follows: 22% in the Southern Great Plain, 13% in the Middle Danube, 9% in the Western Transdanubia, 4% in Northern Hungary, and the remaining 1% in Central Hungary. 2% (KSH, 2023c). The KSH (2024) statistics show that the pig population in Hungary peaked in 1983 at 9.84 million individuals and that in the 30 years that have elapsed since then, the number has fallen to less than a third. During the peak time, the adage "Hungary is the country of 10 million pigs" gained popularity, given that the country had 9,844,000 pigs in 1983; since then, the number of herds has drastically declined; as of right now, Hungary is home to almost 3 million pigs (KSH, 2023; Marczin, et al., 2023). **Figure 3** shows that from 1960 to 2023, the average decline in pork stock accounts for 1%.

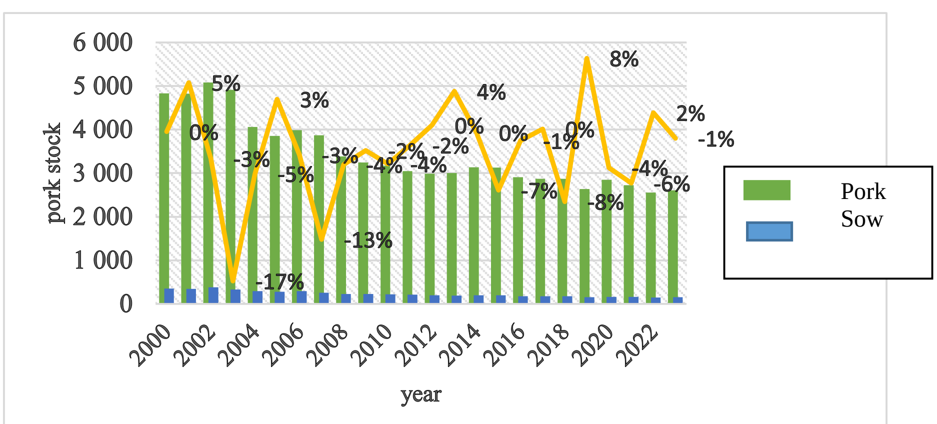

Figure 3: Percentage decline and increase in pork stock x 1000 heads from 2000 to 2023
Source: Author's illustration based on KSH data (2024)

A notable 25% decline from 1989 to 1990 can be observed, as well as a 13% decline from the year 2006 to 2007. The number of small farms is declining, and backyard pig rearing is also declining, which is a sign of the dire situation facing farmers. The loss in farming has been attributed to both the sharp decline in domestic demand and the consumption of pig meat. Pork made up 43% of the total in 2014, with poultry meat continuing to hold the highest percentage at 45% (**Figure 3**; KSH, 2024).

2.3. African Swine Fever Outbreak and Its Impact on the Swine Industry

ASF, a fever that killed nearly all domestic pigs, was first discovered in East Africa, in Kenya, in the early 1900s (Weihr, 2022). In the next decades, it expanded to several sub-Saharan African countries but remained on the African Continent until 1957 (Weihr, 2022). ASF first spread trans-continentally to Portugal between 1957 and 1960, after spreading to other European, Caribbean, and Brazilian nations (Galindo and Alonso, 2017). Other European nations, including France (1964, 1967, 1970), Italy (1967, 1980), Malta (1978), Belgium (1985), and the Netherlands (1986), reported several cases following the Iberian outbreaks. A new phase of transmission began in 2007 when Georgia reported its first case of the ASF, and it subsequently spread to other regions of Europe and Russia (Dixon et al., 2019). The first cases were reported in 2017 by Romania and the Czech Republic, and in 2018 by Hungary, Belgium, and Bulgaria (Alkhamis et al., 2018; Ferenc et al., 2019). It was August 2018 when ASF was identified in Asia; it expanded fast in China and affected over a dozen other Asian countries (Weihr, 2022). On **Figure 4**, we can observe how ASF expanded throughout the years in the European region and Asia.

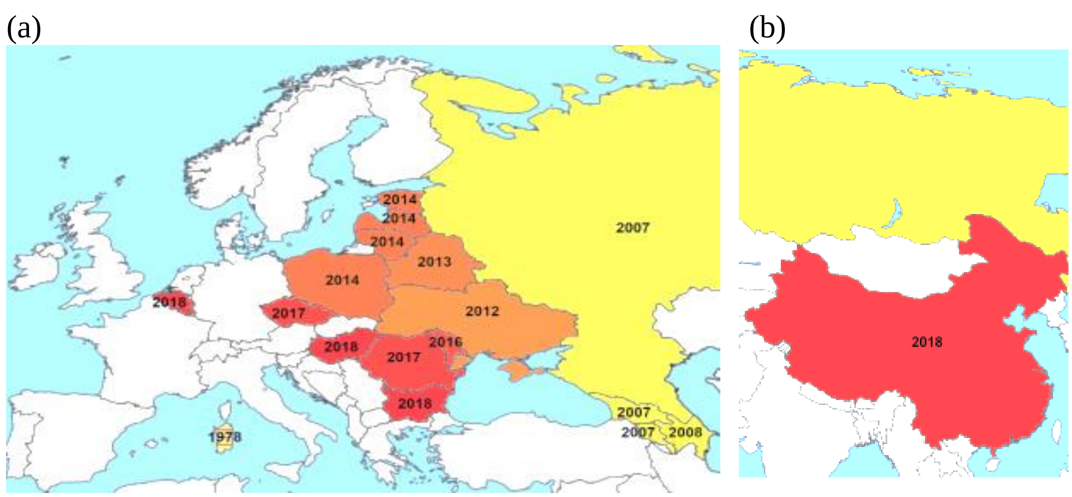

Figure 4: Map of the ASF outbreak by years in Europe (a) and China (b)
Source: Author's illustration based on Olasz et al. (2019)

Beltrán-Alcrudo et al. (2017) state that ASF is a transboundary infection with a fatality rate of almost 100% and is brought on by the *Asfarviridae* virus family. Although there is no evidence that pigs harm people's health, ASF harms swine numbers and the farming sector (Dixon et al., 2019). The virus spreads across both domestic and wild hog populations (Beltrán-Alcrudo et al., 2017). Direct contact between healthy animals and sick animals, as well as contact with virus-contaminated materials (meat products, cars, vehicles, and other infectious objects), and vector insects are the primary routes of infection (Guinat et al., 2016). Rapid and accurate diagnosis of ASF virus in pigs is essential for disease control and preventing financial losses because of the seriousness and high mortality of ASF, as well as the lack of viable vaccinations and antiviral medications (Pakotiprapha et al., 2023).

2.3.1. Economic and Supply Chain Consequences of African Swine Outbreak

Pig meat production in the Philippines and Vietnam suffered losses as a result of ongoing ASF-related issues on certain farms (Statista, 2023). According to a study by Nguyen-Thi et al. (2021), in addition to having social and economic repercussions, these events may also have an impact on food safety issues, consumption trends, and other important participants in the value chain, including traders, slaughterhouses, and retailers. The World Organization of Animal Health (hereinafter, OIE) (2023) claims that ASF is to blame for the significant losses in pig output. In recent years, this infectious disease has become a major crisis for the pork industry and has altered some aspects of the global value chain; the virus is currently affecting some regions worldwide, which affects not only biodiversity and farmer livelihoods but also the global supply chain and economy (Nguyen-Thi et al., 2021). Following Ohouko et al. (2020), the economic cost of the impact of ASF in Benin between the evaluated years of 2014 and 2018 was USD 1,513,340. Because of the high mortality rate (91%) in 306 farms, the pandemic in Nigeria cost USD 941,492 in 2001 (Babalobi et al., 2009). In Tanzania, the illness cost USD 41,065 (Kivumbi et al., 2021). 20% of pigs in Vietnam perished or were put down in the first five months following the epidemic, according to Nguyen-Thi et al. (2021), and the economic impact in 2019 was estimated to be between USD 880 million and USD 4.4 billion. An estimated USD 37.32 million was lost in India as a result of animal infections between April 2020 and June 2021 (Mohan et al., 2021). Food prices have increased globally as a result of the viral outbreak, according to the FAO study (2022), therefore by February 2021, we can see an upward trend.

The findings indicate that to stop future outbreaks and economic downturns, it may be essential to implement prompt ASF containment and prevention measures (Brown & Bevin, 2021). Two interrelated global economic models are used to analyse the effects of the epidemic at different sizes on pig prices as well as the costs of other food types and animal feeds (Mason-D’Croz et al., 2020). The research concludes that pig prices will increase by 17% to 85% globally as a result, and other meat prices will also rise as a result of unfulfilled demand; the price increase and health concerns cause demand for pork to fall, while other nations’ output rises, and imports could make up half of China’s losses (Mason-D’Croz et al., 2020). Brown and Bevins’ research (2021) suggests that imported sick livestock may be connected to ASF outbreaks. Millions of pigs have been killed in impacted nations to stop the spread of ASF. For instance, more than 6 million pigs, or almost 20% of the country’s total herd, were killed in Vietnam in 2019 (Nguyen-Thi et al., 2021). ASF caused millions of pigs to be culled in China, the greatest producer of pork in the world, resulting in a 40–50% reduction in the national herd at the height of the outbreak, affecting each party in the supply chain (Salling, 2025).

2.3.2. Case Study on African Swine Fever Disruption in China

In August 2018, ASF first appeared in China, where over half of the world’s pigs are raised Beltrán-Alcrudo et al., 2017). As of April 2019, China had officially registered more than 100 cases (Ma et al., 2021); these instances occurred in almost every province, autonomous region, and town in China. ASF has been able to spread quickly in China due to the absence of an early detection system (Mason D’Croz, 2020). China’s pig farms bought feed additives produced from pigs’ processed tissue, therefore, there is a possibility that active ASF hidden in these foods caused some of the ASF cases in pigs, furthermore, an initial outbreak in 2018 and 2019 killed millions of hogs and produced a significant drop in meat production that stunned worldwide markets, raising the possibility of an epidemic and an incurable sickness plaguing China (Ma et al., 2021). According to studies by Ma et al. (2021), the virus is still spreading, especially during the winter, although Chinese farms have greatly improved their operational procedures and hygiene. The speed at which a farm or pig company manager responds and learns about the effects of a viral infection may be a crucial remedy (Mason D’Croz, 2020). The ASF pandemic in China started in 2018 and has had a major impact on the pork industry in the nation, according to a study by Ma et al. (2021). Scholars claim that the cost of feed, medical care, epidemic control, and other hog farming-related expenses skyrocketed once the ASF pandemic reached China (Dixon et al., 2019; Ma et al., 2021). In August and September of 2018, 25 outbreaks were reported in eight provinces (Sur, 2019). Following that, ASF outbreaks increased dramatically, reaching a peak of 53 cases in October and November, representing a 112% increase over the preceding two months. In addition, there were eighteen provinces (Sur, 2019). Furthermore, between December 2018 and January 2019, there were 26 outbreaks in 13 provinces; following this period, the number of outbreaks decreased by 50.9%, and the number of provinces affected by outbreaks decreased by 27.8%; 12 outbreaks were subsequently reported in February and March by eleven provinces. The number of epidemics decreased by 53.8%, indicating a 40% decrease, even though outbreaks happened in three more provinces. Additionally, in April and May of 2019, outbreaks were reported in 20 provinces, including Inner Mongolia, Heilongjiang, Shenyang, Liaoning, Zhengzhou, Henan, Lianyungang, Jiangsu, Wenzhou, Zhejiang, Wuhu, Anhui, and others (Sur, 2019).

A lack of pork, apprehension among pig farmers, and fraudulent sales of medications and vaccines were among the issues caused by the outbreak in China (Chinese Ministry of Agriculture and Rural Affairs (hereinafter, MARA, 2019). Between the initial report and November 22, 2019, 160 ASF outbreaks were reported in China, resulting in 11,930,000 pigs being killed (MARA, 2019); the outbreak has resulted in substantial losses for pig farms and the entire country. For instance, two large-scale pig farms were cleared: one with 73,000 pigs in Mingshui, Heilongjiang, and another with 68,969 hogs in Siyang, Jiangsu (MARA, 2019). **Table 4** shows the precise number of hogs for the specified period as reported by the National Bureau of Statistics of China (henceforth, NBS).

Table 4: Livestock of China's market

	2015	2016	2017	2018	2019	2020	2021	2022	2023
Number of Hogs at Year-end(10000 heads)	45802.89	44209.17	44158.92	42817.11	31040.69	40650.42	44922.42	45255.73	43422.27

Source: Author's illustration based on NBS (2024)

The table shows a significant decline from 2018 to 2019, which is also evident in the aforementioned graphs. Between 2018 and 2019, there was a significant drop in both livestock and consumption trends. According to the data, it is crucial to preserve and grow the pork supply to ensure national food security and economic and social stability (Huang et al., 2021). You et al. (2021) state that researchers are adopting an output and input model to assess the potential consequences and economic losses of the outbreak between August 2018 and July 2019. The results indicate that economic harm is equivalent to a 0.78% decline in China's GDP (You et al., 2021). According to research, farmers in China typically reared pigs with low infrastructure and low space utilization rates, resulting in poor pig quality (Huang et al., 2021). Piglets were transported even if confirmed positive for the ASF epidemic, according to a diagnosis report released by the Yunnan Animal Disease Prevention and Control Center on March 2, 2021. Of the 36 piglets in the automobile, six were dead and six were ill (Wang & Wang, 2020). To prevent or lessen the spread, a quick implementation was required, along with an emergency plan that comprised the culling and innocuous treatment of all piglets as well as the thorough cleaning and disinfection of appropriate sites, surrounding roadways, and transport vehicles (Wang & Wang, 2020). The state of the epidemic is continuously being investigated and monitored (MARA, 2019). Using a specific dataset of weekly provincial pork prices and a novel spatial network model, Ma et al. (2021) looked at the 2018 ASF outbreak in China as a pattern of potential market integration. they also measured the degree of market cooperation across provinces and regions before and after the ban. Death and massacre in the Chinese provinces resulted in an average direct financial loss of USD 8.7 million per region, with over 50% of the regions suffering losses of over USD 4.5 million. With USD 55 million in losses, the Liaoning region was the most severely affected financially by ASF (MARA, 2022). According to official data from MARA and the Infrastructure Investment Bank of Asia, the estimated economic loss from reduced breeding owing to ASF mortality and the culling of breeding pigs is USD 681 million (MARA, 2024; Professional Pig Community, 2024). According to another study, manufacturers in all 149 sectors of the Chinese economy are estimated to have experienced indirect economic losses of USD 14.5 billion, with the range varying from USD 1.4 million in Qinghai province to USD 2.2 billion in the Guangdong region (Ma et al., 2021). The average indirect economic cost to producers was USD 467.8 million per province, whereas losses in other areas or regions ranged from USD 100 to USD 900 million (Huang et al., 2021). According to these results, the swine industry and almost every other area of the economy have been impacted by the ASF disease, which has resulted in significant financial losses (FPMA, 2022).

Pork prices have grown considerably over the years due to unanticipated transitory circumstances, in the years of 2019-2021; due to the ASF outbreak in 2019, a large number of small and medium-sized farmers were forced out of the market, which negatively impacted farmers' attitudes throughout the market and caused the supply of pork to drop off quickly (Liu, 2022). The National Bureau of Statistics reports that the cost-cutting campaign has driven pork prices to all-time highs (NBS, 2024). A correlation between the annual average pig price per kilogram and the data gathered on pig production is shown in **Figure 5**.

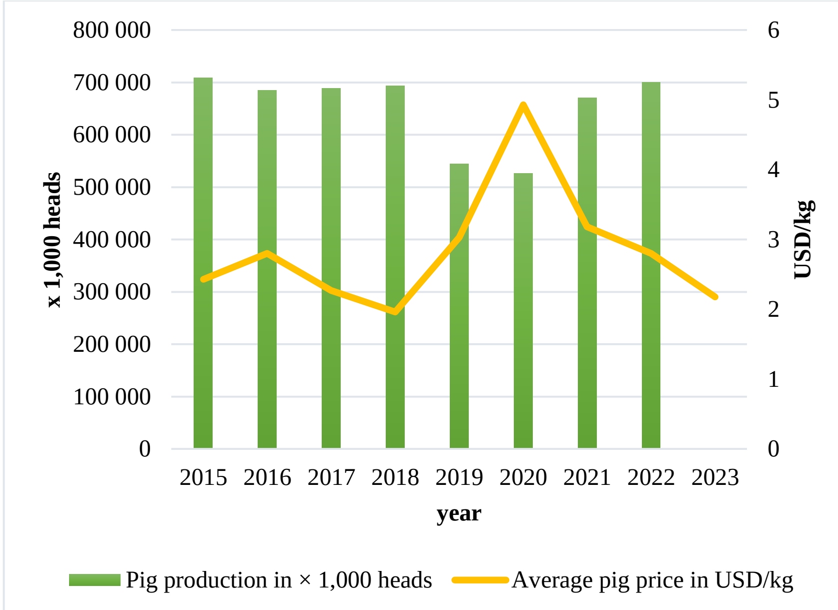

Figure 5: Annual pig production, and annual price of pig per kilogram in USD between the years 2015- 2023

Source: Author's illustration based on data from the Ministry of Agriculture (hereinafter, MOA), Professional Pig Community, and Salling (2025)

A total of 428,171,000 pigs were counted in 2018. The number decreased from 428 million in 2018 to 310 million in 2019. The overall pig production for the same year in 2020 shows an increasing disparity. Between 2019 and 2020, 406,500,000 pigs were counted. As a result, it increased the next year. Between 2020 and 2021, there was an exact 43 million rise in numbers. Both total pig production and total pig pricing are negatively correlated with one another. The graph indicates that in 2015, the average price per kilogram of pigs was USD 2.43. The average price of a kilogram of pork in 2017 was USD 2.27, USD 0.16 less than in 2015, and USD 0.53 less than in 2016. The price of pigs per kilogram increased significantly in 2020; the price difference between 2019 and 2020 increased by USD 1.9 in a single year. The average price of a kilogram of pig in 2020 was USD 4.93, which was a significant increase from the average of USD 3.03 in 2019. ASF significantly impacted swine production in China by raising livestock prices from roughly 13 RMB/kg to 38 RMB/kg (Huang et al., 2021), or three times the price of a live hog (Salling, 2025). Based on findings of Salling (2025), three assumptions were tested through empirical analysis: (i) the Chinese market was significantly damaged by the ASF virus outbreak; (ii) a negative relationship between the level of hog meat prices and the reduction in pork production can be seen as a result of the disruption caused by the viral outbreak; (iii) a shift in the price level is likely to result in a demand change.

2.3.3. African Swine Fever Outbreak in Hungary

Romania reported 460 infected domestic pigs. Serbia also shows an increased number of 32 heads. This is important in the case of bordering Hungary. In terms of wild boars, Hungary is the leading country with a headcount of 2,251 (Trela, 2021). According to the webinar of Trela (2021), it is observable from **Table 5** that in Europe, the number of ASF outbreaks is increasing.

Table 5: Reported cases in some European countries, data is on 04 June 2021

Country	Domestic pig	Wild boar	**Total**
Bulgaria	0	169	**169**
Germany	0	850	**850**
Estonia	0	27	**27**
Latvia	0	112	**112**
Lithuania	0	67	**67**
Moldova	0	0	**0**
Poland	2	1,659	**1,661**
Romania	460	723	**1,183**
Serbia	32	43	**75**
Slovakia	0	1,135	**1,135**
Ukraine	5	1	**6**
Hungary	0	2,251	**2,251**
Total	**499**	**7,037**	**7,536**

Source: Author's illustration based on the webinar of Trela (2021)

Referring to **Figure 6** and the report of the Department for Environment, Food and Rural Affairs (2024), in northern Italy and much of eastern Europe, ASF is still present in wild boar.

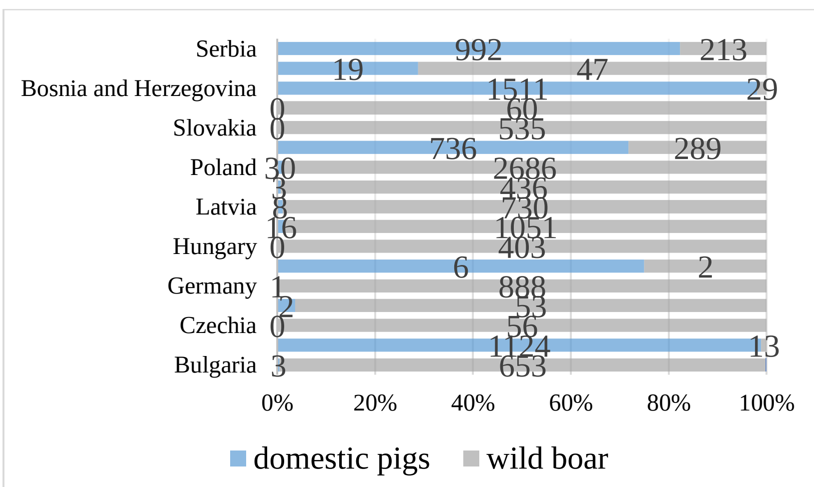

Figure 6: Availability of ASF-reported cases in European counties in 2023
Source: Author's illustration based on EFSA (n. d.); Department for Environment, Food and Rural Affairs (2024)

For the first time, domestic pig outbreaks have significantly increased throughout Europe, even if the number of domestic pig outbreaks and cases reported in wild boar declined significantly in 2022.

Europe saw a sharp rise in ASF outbreaks in the summer of 2023, with about 1,000 reports. Due to the disease's quick spread among domestic pig populations in Bosnia and Herzegovina and Croatia, this is the highest number of reports of ASF outbreaks in domestic pigs in Europe in recent years (**Figure 6**). In April 2018, an ASF virus outbreak happened in Heves County, Hungary (Boklund et al., 2014), and was then discovered in Szabolcs-Szatmár-Bereg County in May. The ASF virus was discovered in another Hungarian county in October 2018. An infected region was established, and as of October 31, there had only been 48 cases in wild boars and no outbreaks in farmed pigs; although there is currently no verified proof of the ASF source or the route of the ASF spread in Hungary, the infection likely began with the natural spread of wild boars from Ukraine (Boklund et al., 2014).

Hungary faced export restrictions after the announcement of ASF; as a result, shipments of live pigs decreased quantifiably from 2017 levels (National Food Chain Safety Office, hereinafter, Nébih, 2024). On the other hand, it's interesting to note that sales prices decreased over the 2018 summer, but by 2019, this tendency had reversed (Nébih, 2024). Additionally, they stated that the number of cases is declining annually, with the authority detecting 698 cases in 2022 and just 444 in 2023 around Europe (Boklund et al., 2014). Eszék-Baranya County in Croatia, which borders Hungary, verified that domestic pig herds were infected with ASF (Nébih, 2023). 20,000 animals have been affected, and there have been more than 1,000 breakouts since the Croatian pandemic started in the summer. In addition to urging tourists to exercise caution and responsibility, Nébih also requests that pig producers in the southern counties adhere to the priority disease management measures. Additionally, ASF made an appearance in Croatia in the summer of 2023 (Trela, 2021). After first affecting Croatia's borders with Serbia and Bosnia and Herzegovina, the virus quickly spread (Trela, 2021). As of December 4, 2023, information on the Nébih website indicates that certain districts in Borsod-Abaúj-Zemplén, Fejér, Hajdú-Bihar, Heves, Komárom-Esztergom, Nógrád, Pest and Szabolcs-Szatmár-Bereg are currently under tight swine fever restrictions (Nébih, 2024). According to the outbreak updated data of the Department for Environment, Food & Rural Affairs (2024), thirty further instances of ASF in wild boar, totalling 32 animals in Hungary, have surfaced since June 17, 2024. Three major case clusters have been identified: one is located immediately north of Budapest, seven kilometers away; another is in Salgótarján; and the last is near Debrecen. The Slovakian and Romanian borders are comparatively near to the clusters (Trela, 2021).

Livestock purchases typically cost 405 HUF/kg; however, in 2018, that amount dropped by 10% to 364 HUF/kg, which can be explained by the ASF outbreak that affected wild boar in Hungary in 2018 (Marczin, 2021). Slaughterhouses in Hungary killed more than 4 million pigs in 2019, a 1.8% decrease from the previous year (Marczin, 2021). 542 thousand tons of animals were killed, and 437 thousand tons of carcass weight—or 80.6% of the total weight of the pigs killed—were left behind after slaughter (Fekete, 2020). 2021 is an uncertain threat for the pork industry: the price of feed grains soared by 50-70% in the first half of the year, live pig prices have risen by 25% in only a few weeks in a few weeks, and the trend seemed to be slowing down. African swine disease might have resulted in negative effects in Hungary, Europe (particularly Germany), and China; therefore, the process was far from finished (Marczin et al., 2023).

Nonetheless, the ASF, which has resulted in sharp price increases, export restrictions, has caused the swine population to stagnate in the years 2018, 2019, and 2020 in Hungary as well (Anon., 2021). Mészáros et al. (2019) dealt with the fact of ASF, which reached Hungary in 2018, the consequent ban on exports, and the decrease in demand. With its effects on production, consumption, and commerce, the emergence of ASF in China is currently the most important factor influencing the global meat industry, including Hungary as well (Vida & Szűcs, 2020).

2.3.3.1. Restrictions on Hungarian Pork Export and the Interconnection with the China Market

According to the MARA (2023), China's agricultural strategy is divided into the following categories: some goods must be produced domestically, while others are provided through imports and trade agreements. Over 90% of the nation's basic food needs are met by domestic production, including grain, poultry, pork, eggs, and vegetables. According to the MARA (2024), the remaining 10% is imported from outside markets. With a shipment of 26.68 tons of frozen pork knuckles, Hungary became the 15th country in the world to enter the pork market and the 22nd country in the world to enter the Chinese meat market, according to Agrobusiness (2015). China has limited pork imports from its primary Eastern European suppliers due to the virus's spread; with 42.74 tons sold in 2013, Poland accounted for 7.3% of China's pork imports, ranking as the country's sixth-largest importer (Agrobusiness, 2015). All pig products are now prohibited from the Chinese market due to the African swine fever outbreak after the virus appeared in the Hungarian wild boar population (Nébih, 2024). Until the Chinese authorities remove the restriction, no pork products can be shipped to China (MARA, 2024). According to Keszthelyi's (2015) research and **Figure 7**, Hungary exported pork products to China in 2015 for a total value of USD 25.1 million.

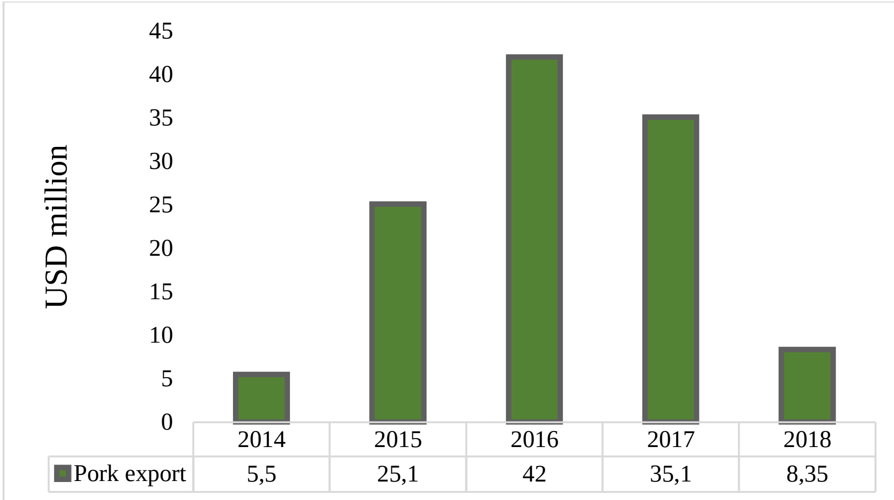

Figure 7: Hungarian pork exports (in USD million) to China (fresh, chilled, frozen)
Source: Author's illustration based on Trading Economics (n. d.), own collection

Within a year, this number nearly doubled, indicating a 67% rise in export goods. However, the value of Hungarian goods sold in China in 2018 was only USD 8.35 million (**Figure 7**). The import ban from China started on 9 May 2019 (Nébih, 2024). Import quarantine permits for pigs, wild boars, or related products coming from Hungary are forbidden. Direct or indirect export of live pigs, wild boars, and products thereof, including raw pork and processed products of wild boar origin, which may spread ASP after processing, is also prohibited. All shipments of live pigs, wild boars, and goods made from their meat that come from Hungary will be seized if they are discovered on an international ship, aeroplane, train, or other mode of transportation that has entered or is passing through China (Nébih, 2024). To sum up, due to the ASF epidemic, even though no infection has yet been registered in domestic pigs in Hungary, there is an export ban towards China.

2.4. Coordination and Mitigation Strategies in Supply Chains

Businesses are at serious risk from supply chain interruptions, which can result in higher expenses and lower profitability (Kim & Tomlin, 2013). The implications of the disruptions and supply chain structure on the option coordination criteria are next examined in the paper of Wan et al. (2021). The research first presents the explicit option coordination conditions for the disturbed supply chain under two supply chain configurations. Understanding how demand is distributed can help coordinate the interrupted supply chain (Wan et al., 2021). Live fish, fresh meat, fresh vegetables, and fresh fruits are examples of fresh agricultural items that are essential to human life and have a significant market share, therefore, to guarantee market supply and price stability, supply chains must operate extremely efficiently (Wan et al., 2021). Option contracts have previously been included in supply chains for fresh agricultural products as a useful instrument for risk hedging (Turvey, 2001). In the pull (distributor-led) and push (producer-led) models, Xiao and Chen (2012) examined the ideal order amount, delivery quantity, and retail price for a fresh product supply chain. They demonstrated that the pull model outperforms the push model for both the members and the chain. To investigate the profit allocation and channel coordination issues for a dairy supply chain, Qian et al. (2013) used the three-stage revenue contract model to coordinate a fresh agricultural product supply chain under a cost and loss interruption stage revenue sharing contract model. The study of Yu et al. (2021) determines the ideal wholesale price, marginal profit, food safety investment, and government subsidies, moreover, it also creates a three-stage game model between the government and a two-stage food supply chain with one supplier and one processor, in which the government provides subsidies to processors to invest in food safety initiatives. The findings indicate that while demand-based payment can help suppliers grow their product’s market share, supply chain participants may not always gain from this strategy (Yu et al., 2021). Yu et al. (2021) also suggest that government subsidies might motivate risk-averse individuals to increase their safety investments and enhance social welfare in supply chain players. Li et al.’s (2021) study examines a retailer that faces a transportation disruption while selling fresh, perishable goods directly to consumers via an internet channel. The retailer may adopt freshness-keeping measures to lessen quality loss during transportation to balance the compensation price given to customers as a result of quality losses (Li et al., 2021). Bottani et al. (2019) offer a framework for assessing significant risks in food supply chains using a hybrid grey-based Decision-Making Trial and Evaluation Laboratory model, taking into account the interactions among diverse hazards. The resilient design challenge for a food supply chain is also addressed in, which is based on a bi-objective mixed-integer programming model and a multiple sourcing strategy (Bottani et al., 2019). This ensures business operations continuity in the face of supply-side disruptions and demand-side fluctuations. Hossain et al. (2017) suggest an ideal vendor-buyer cooperative policy of reorder point, order amount, and the number of shipments, taking into consideration a stochastic lead time and a penalty cost for delayed shipments in a single-vendor–single-buyer inventory model.

Wu et al. (2024) provide opportunities to lessen the impact of supply chain interruptions on corporate operations, which were made possible by digital supply chain management. The study offers economic methods to evaluate the impact of implementing digital technology from the two previously described perspectives. They discovered that using digital technology resources could help businesses function better during the COVID-19 pandemic, for instance (Wu et al., 2024). Additionally, one kind of business asset that companies may use to attain end-to-end transparency and further lower demand uncertainty during high-impact events is digital technology (Ivanov et al., 2019). According to Yan et al. (2017), companies that had more digital technology assets, such as blockchain, cloud computing, big data analytics, the Internet of Things, and artificial intelligence, performed better in their supply chains throughout the crisis. Strong bonds and trust are found to be essential for effective information exchange, underscoring the necessity of establishing and preserving trust to promote candid dialogue. Reynolds (2024) states that the importance of technology is highlighted, with the Internet of Things (IoT), blockchain, and digital platforms being named as major facilitators of safe and effective information sharing. The study concludes that improving supply chain resilience requires developing a supportive organisational culture, leadership dedication to openness and cooperation, and customisation of information-sharing tactics to particular supply chain circumstances (Reynolds, 2024).

For pork production mitigation, to plan production for a vertically integrated setup with three supply chain echelons—a feed mill, fattening farms, and a slaughterhouse—the study of Nakrachata-Amon et al. (2024) suggests an optimisation-based methodology. The approach uses a Lagrangian heuristic model to create coordinated production plans and a mixed-integer linear programming model for the pig supply chain (Nakrachata-Amon et al., 2024). The significance of quality management systems for supply chain integration and boosting customer confidence is demonstrated in the study of Trienekens and Wognum (2013). To coordinate information exchange in the supply chain and logistics concepts based on cutting-edge measuring technologies at the slaughtering stage, the study also provides improvements in information system integration in a vertically integrated chain (Trienekens and Wognum, 2013). The study provides public-based quality management systems and private-based quality management systems as an essential step to overcome supply chain disruptions (Trienekens and Wognum, 2013).

2.4.1. Response from the Government and Entrepreneur

Response plans, like the US HPAI Response Plan (USDA, 2015), are regularly reviewed, especially when a disease incidence has occurred. Mu and McCarl (2010) and Egbendewe-Mondzozo et al. (2013) compared the costs of depopulation control and US vaccination control strategies in the context of simulated HPAI outbreaks in Texas. Although statistics were constrained by the relatively modest magnitude of the 2004 Texas outbreak, Mu and McCarl (2010) concluded that depopulation was the more economical control technique. To ensure the welfare of the surviving live birds, depopulation preparation involves feed, water, and utilities to regulate the house temperature; depopulation strategy is determined by the quantity of birds, facility infrastructure, production type, and resource availability; infected carcasses and other potentially contaminated materials are disposed of; and the site is cleaned and disinfected (Elbakidze, 2008). HPAI eradication involves a combination of depopulation, disposal, and virus elimination activities on poultry farms, among others (Seeger et al., 2021). Zamani et al. (2024) found that the chicken industry might concentrate on surveillance, removing sick birds, and making sure that impacted locations are properly disinfected. Usually, a mix of surveillance, culling, vaccination, public awareness campaigns, and international collaboration is used in these approaches (Duan et al., 2023). The governments of impacted nations, including Thailand, Vietnam, and Indonesia, carried out extensive culling of exposed and infected chicken populations during the 2003–2004 H5N1 avian influenza outbreak in Southeast Asia, to stop chickens from moving, quarantine zones were created (Duan et al., 2023). Leiss and Nicol (2006) evaluated how well the Canadian governments communicated the risks associated with salmon contamination and BSE. They discovered that, in the instance of BSE, the messages did not adequately convey the type and extent of the risk, but, in the case of salmon, the message was unclear (Leiss & Nicol, 2006). In terms of ASF, the disease seems to have been restricted to a small area in Sweden thanks to the steps taken thus far, including fencing, depopulation, movement restrictions, and surveillance (Department for Environment, Food and Rural Affairs, 2024).

The research of Pereira et al. (2023), animal tracking has substantial applications in a variety of economic fields, including livestock husbandry, agriculture, and animal population conservation. The fields of logistics, localisation, and product tracking are where RFID technology is most commonly used. Notably, there has been a notable increase in the use of this technology in the field of animal tracking in recent years. Livestock management was the most often addressed problem category, followed by animal monitoring and traceability. The most often observed animal species are mammals, particularly cattle. A high degree of biosecurity had been put in place on the majority of farms, according to the biosecurity inspection in Germany, referring to the research of Klein et al. (2024). The results found that the fences and the separation of clean and dirty areas on the farm grounds and in the anteroom were the regions with the most deficiencies. The farmers believed that one of the biggest obstacles to putting biosecurity measures against ASF into place was the farm layout. The findings did, however, also imply that legislative requirements and farmer attitudes were important determinants. Even though pig farmers were well-informed about ASF and the required biosecurity precautions, current information and ongoing guidance are crucial for managing disease risk (Klein et al., 2024).

2.4.2. Mitigation of African Swine Outbreak in China on the Governmental and Entrepreneurial Level

The Chinese political system underwent a major transformation in 2018 (MARA, 2019). The coordination between different ministries and departments under the unified leadership of the central government is evident in every stage of the ASF prevention and control and pork supply recovery process, including prevention, the removal of infected pigs, pig culling subsidies, pig farm restoration, and pig allocation (Ding and Wang, 2020). Governmental measures were implemented to keep an eye on and stop the virus's spread. These included putting in place crucial preventative measures, raising the degree of biosecurity protection, and putting preventative measures in place in pig farms (Sur, 2019). Additionally, to standardise the two-part quarantine management for establishments that produce live pigs. Above all, the strict application of the quarantine management system is supervised by the MARA. The second part, which stipulates that illegal certification of authorised quarantines will be harshly punished, is implemented by the MARA and the Ministry of Public Security to enhance the distribution of live pigs and related products, as well as transportation management. Between 2018 and 2020, the costs of feed, medical care, and epidemic prevention increased by an average of 3.9% and 13.6% annually for large-scale hog production compared to small- and medium-sized farms; the results show that hog farming does not entirely fit the definition of economies of scale. Because market risk increases with farm scale, the Chinese pig industry is affected both domestically and internationally (Sur, 2019; MARA, 2019, Ding and Wang, 2020).

2.4.3. Biosecurity Mitigation in Hungary for Preventing African Swine Fever

To stop and prevent the ASF outbreak, the European Union and Hungary have put in place several rules and limitations (Nébih, 2024). 2002/60/EC governs the ASF control directive, which covers inspections, notifying impacted businesses and persons, and other eradication actions, as a key mitigation method of information flow (Nébih, 2024). The government has mandated and regulated, among other things, the active search and screening of dead wild boars and the census of the pig population in domestic pig farms to stop the spread of the ASF virus. It controls unlawful animal transportation and pig farming. At eastern border crossings, stringent baggage and package inspections are conducted, and undercooked pork items are seized. Trucks and passenger cars entering the nation must be disinfected to prevent illness (Nábrádi et al., 2008). However, it should be noted that in Hungary, infection has only been found in wild boars thus far. (Nébih, 2021). **Figure 8** shows the zone distribution of Hungary.

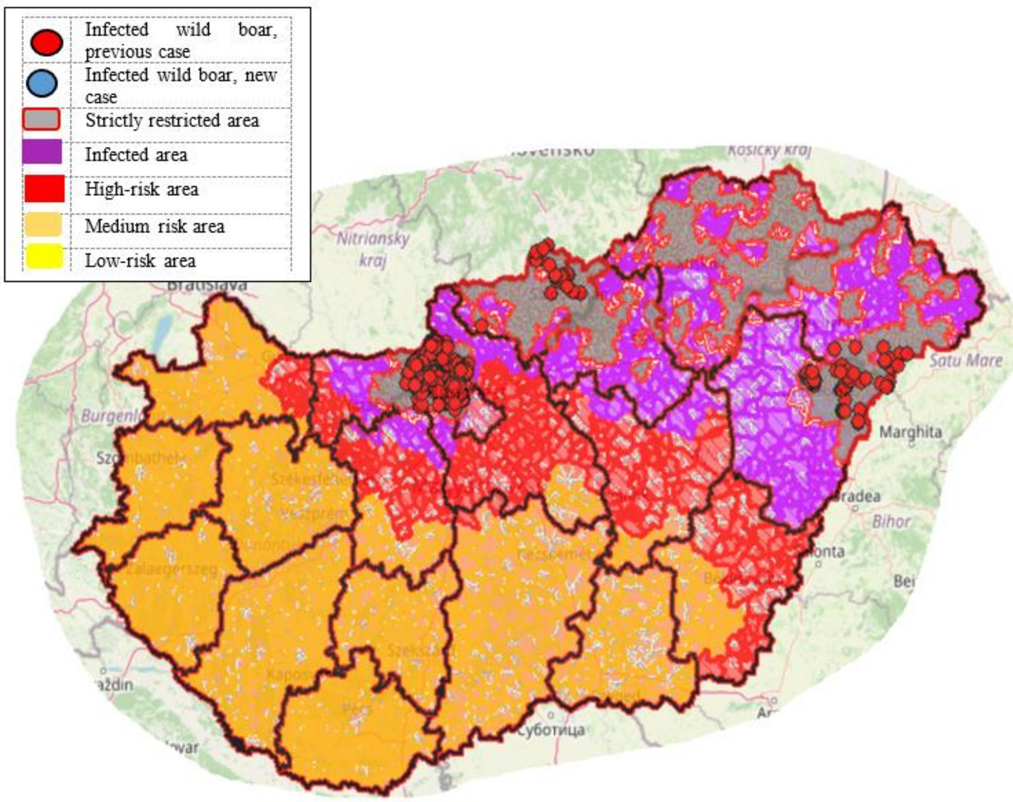

Figure 8: Author's illustration based on the interactive map of Nébih
Source: Nébih (n. d.; retrieved at: 09. 12. 2024.)

According to risk characteristics, the nation is separated into various zones (**Figure 8**). Nébih (2021) ordered the Agricultural Sector that although the ASF virus has considerably slowed down in Hungary over the past two years in wild boars, pig producers must nonetheless adhere to stringent disease control measures. Only with a permit obtained from the district office can the body be used locally for private consumption if it turns out that the animal is not sick; otherwise, all bodies must be disposed of. To reduce the chance of spreading the disease, the Hungarian veterinary authority has still implemented strict disease control measures. Even though the bustling summer tourist traffic has subsided, Hungarians travelling to Croatia still need to exercise more caution (Nébih, 2023). According to Nébih (2024), 98/2003. (VIII. 22.) The FVM Decree regulates the ASF control directive, which involves conducting exams, notifying impacted companies and persons, and taking additional eradication actions. The government has mandated and regulated, among other things, the active search and screening of dead wild boars and the census of the pig population on domestic pig farms to stop the spread of the ASF virus. It controls unlawful animal transportation and pig farming. At eastern border crossings, stringent baggage and package inspections are conducted, and uncooked pork-based food is seized. Trucks and passenger cars entering the nation must be disinfected to prevent illness. However, it should be noted that in Hungary, infection has only been found in wild boars thus far (Nébih, 2021). Nevertheless, farms are closely monitoring the virus and taking precautions to stop its spread. **Table 6** gives a summary of the measures and actions of surveillance and prevention of ASF.

Table 6: Summary on 98/2003. (VIII. 22.) FVM Decree on the control of African swine fever in domestic pigs

Scope	(1) all natural and legal persons keeping pigs, as well as organizations without legal personality. (2) shall be applied to the prevention of ASF and, in the event of its occurrence, to the eradication of the disease.
Application	pig, sentinel pig, wild boar, holding, diagnostic manual, suspected pigs, the occurrence of ASF, an outbreak of ASF, area infected, the primary outbreak in feral pigs, contact holding, pig keeper, disposal, killing, slaughter, tick vector
	Actions stages
African swine fever announcement	immediate report to veterinary associations in case of any suspicious case
Measures to be taken in case of suspicion of African swine fever	preventive actions, veterinary inspections, licensing, total control, zone applications
Measures to be taken in the event of detection of African swine fever	veterinary inspections, laboratory testing, culling, objects that spread the epidemic must be destroyed, total disinfection
Measures to be taken in contact farms	preventive actions, veterinary inspections, licensing, total control, zone applications
Epidemiological investigation	
Designation of protection zone, surveillance zone	

Source: Author's illustration based on 98/2003. (VIII. 22.) FVM Decree

2.5. Consumer Behaviour and Food Consumption Patterns Due to Disruptions

Choosing what to eat is a complicated human process (Chen, 2007). Consumer research has made extensive use of a multi-attribute model that posits an individual's attitude toward an object is based on the sum of their beliefs (Fishbein, 1963). Consumer behaviour and social infrastructure are changing in the twenty-first century as a result of digitalisation and intelligence, which is the cause of significant changes (Rahman, n.d.). Solomon (2024) examines how people or groups are chosen, acquired, and used to fulfil their needs and desires, or the procedure used to discard a good, service, concept, or encounter. Other specialists believed that people's eating choices were mostly influenced by their life experiences, including their values, personal traits, resources, and so forth (Frost & Hartl, 1996). Additionally, one of the other factors influencing people's buying intentions is food risk (Prati et al., 2012). Outbreaks of animal diseases, for instance, have a significant influence on the production, consumption, and trade sectors of the economy (Çakır et al., 2018). Verbeke et al. (2010) present that there were several noteworthy ($p < 0.05$) sociodemographic variations in the choices and preferences for hog meat. Compared to men, women reported consuming pork meat in all categories much less frequently. While consumers in urban and rural regions with low densities of pig production were more likely to consume prepared pork-based foods, consumers in locations with higher levels of pig production were far more likely to consume fresh and minimally processed pork meat. Fresh pork was consumed more frequently by those with more money, whereas processed pig items and prepared pork-based meals were preferred by those with less money. Charcuterie, or meat items made from pork, were consumed more often by obese people than by non-obese people (Verbeke et al., 2010).

When buying meat in a retail establishment, the majority of customers regarded pricing as the most crucial consideration (Rani et al., 2013). After pricing, they take the product's quality into account (Rani et al., 2013). Consumers' choice of protein source when buying meat was influenced by their income, according to the research of Rani et al. (2013). Customers' reasons for not buying mutton meat were similarly related to their source of income. The majority of customers, roughly 34%, preferred mutton but chose not to purchase it because it was too expensive in comparison to other protein sources. Customers also complained that most stores do not carry mutton since it is frequently not fresh, and the freshness of the meat is a good sign of its quality. Consumers' preferences for mutton meat sections were considerably influenced by factors such as age, education level, employment, income source, and total monthly income. Consumers' assessments of meat quality are influenced by their monthly income. Their judgment was found to be influenced by their level of education and occupation level (Rani et al., 2013).

2.5.1. Theories of Consumer Behaviour During Crisis

Consumers who buy unusually large quantities or a wide variety of products in the run-up to, during, or following a disaster or perceived disaster, or in anticipation of a significant price increase or upstream shortage, are known to engage in panic buying (Yoon et al. 2017; Yuen et al. 2020). In reaction to the coronavirus, Yuen et al. (2020) did research that identified four major elements that contribute to panic buying: perception, fear of the unknown, coping behaviour, and social psychology. Consumer purchasing behaviour is drastically changed by psychological and sociological aspects during times of crisis. Fear of scarcity and a loss of control are the root causes of panic buying, which causes people to irrationally hoard necessities like food, toilet paper, and medical supplies. This was evident during COVID-19, when sales of toilet paper in the US increased by 845% after lockdown announcements (Loxton et al., 2020). This behaviour is further exacerbated by herd mentality, in which people imitate the acts of others to minimise uncertainty. As a result of perceived social pressure, people may even hoard non-essential commodities (such as salt during Japan's Fukushima crisis) (Loxton et al., 2020. Sensationalised reporting by the media feeds panic, with news stories mentioning "out-of-stock" coming right before stockpiling surges (Loxton et al., 2020). Perception, coping mechanisms, social psychology, and dread of the unknown are some of the factors influencing consumer behaviour during a crisis. Consumers are driven to engage in self-protective behaviours, such as panic buying, to reduce perceived risk when they believe that the likelihood and consequences of getting an illness are high (Yuen et al, 2020). When consumers channel their ignorance about crises into actions viewed as reassuring, secure, or stress-relieving, their fear of the unknown manifests itself in panic buying behaviours or changing consumption patterns (Elmore 2017). Rather than being based on logical cognitive conclusions, consumer reasoning is frequently overpowered by worry (Loewenstein et al. 2001). Mass media, for instance, are crucial in shaping, reshaping, and guiding public opinion in the information era (Yang et al. 2019). In times of crisis, when the media can use headlines to enlighten and dispel frenzy or false information, this relationship is even more evident (Ghassabi & Zare-Farashbandi, 2015). Due to media amplification, consumers overestimate risks, which causes them to hoard supposedly "safe" substitutes (such as poultry during AI outbreaks) (Yuen et al., 2020, as referenced in Loxton et al., 2020).

Food choices that are at risk have also been subject to the Theory of Planned Behaviour (TPB) framework (Cook et al., 2002). Three dimensions—behavioural beliefs, normative beliefs, and control beliefs—combine to define human behaviour according to the TPB paradigm (Ajzen, 1991). Positive or negative attitudes toward behavior are produced by behavioral beliefs, while normative beliefs relate to perceived social influences or subjective norms (such as the expectations of coworkers, family members, and friends, medical professionals, religious institutions, etc.); and control beliefs result in perceived behavioral control (i.e., encountering barriers and limitations when carrying out the intended action) (Cook et al., 2002; Ajzen, 1991).

Forbes (2017) investigated short-term and immediate consumption habits during a natural disaster crisis in the wake of the 2011 Christchurch earthquake. Products that addressed basic physiological needs for survival (such as water, non-perishable foods, baby care, heat, and light), products that provided communication services (such as telephones and radio batteries), and products for cleaning and reestablishing normal life (such as paper towels and rubber gloves) were the most popular purchases made by consumers in the first week following the event (Forbes, 2017). Understanding how consumers make decisions is essential when looking at examples of how their behaviour changes in reaction to financial crises or natural disasters. Maslow's Hierarchy of Needs (1943) could be applied. The pyramidal hierarchy illustrates how consumer behaviours are categorised and which categories are thought to be most important for human existence (Lester 2013). Beginning at the base of the pyramid as described by Lester (2013), these five categories are as follows: (1) physiological needs; (2) safety, consumer protection, and well-being; (3) love and belonging; (4) self-esteem; and (5) self-actualization or personal development. According to the hierarchy, during times of crisis, customers typically prioritise meeting their fundamental physiological demands before progressing to higher levels and more upscale, discretionary behaviours (Forbes, 2017). Both developed and emerging economies exhibit comparable changes in consumer behaviour, even though Maslow's hierarchy is scaled according to the economic markets in which it is used (Samli 2012). For instance, in 2008, consumer expenditure on durable luxury goods, such as investments in machinery and equipment, was significantly more volatile than consumption of non-durable necessities since Maslow's higher order demands are usually postponed during times of crisis (Black & Cusbert, 2012). Mass media are crucial in shaping, reshaping, and guiding public opinion in the information era (Yang et al. 2019). Pieri (2018) found this provocation to be particularly true of pandemics in the form of media panic and speculation in their examination of the response to the H1N1 Swine flu of 2009 and the Ebola outbreak of 2014–15. In the United States, the prevalence of foodborne illnesses is still rising (Tack et al., 2020). Research has indicated that customer behaviour is likely to be influenced by the psychological impression of risk rather than the actual danger (Ferrer and Klein, 2015). Additionally, studies have demonstrated that consumers frequently overestimate danger when the true risk may be modest because they react uniformly to many forms of food safety uncertainty (Miles & Frewer, 2003; Miles et al., 2004).

2.5.2. Shifts in Protein Consumption During Disruptions

Numerous animal diseases, including avian influenza, mad cow disease (Bovine Spongiform Encephalopathy, or BSE), and others, have had multifaceted economic effects in recent decades, necessitating an efficient governmental response (Rich et al., 2011). Additionally, they have caused customers to worry about the quality and safety of food, which could result in a decline in the market share of food (Knox, 2000). Foster and Just (1989) looked at the welfare losses related to information about *heptachlorin* contamination of milk in Hawaii in 1982. According to their research, consumer welfare losses first increased dramatically before declining more quickly and steadily. About 36 million pounds of milk were taken off the market after this finding; therefore, the consumption of milk drastically declined (Foster & Just, 1989).

In the case of avian influenza (also referred to as HPAI), some experts concluded that mistrust hurts chicken consumption and reaffirmed that neither risk-perception elevating nor risk-perception reducing information is being used to prevent the decline in chicken consumption, perhaps as a result of China's low level of trust in positive information (Zhou et al., 2019). The amount of poultry produced in the country increased from 13,510,000 tons in 2004 to 16,561,000 tons in 2010. Additionally, it dropped to 17,088,000 tons in 2011, 18,230,000 tons in 2012, and 17,980,000 tons in 2013. Meanwhile, according to data from the China Animal Husbandry Association, China's poultry industry suffered yearly economic losses of up to CNY 1000 billion in 2013 as a result of H7N9. Nearly one million people in the industry chain, thousands of businesses, and over 40 million poultry producers have been impacted by the devastation (Wen et al., 2019). From the standpoint of consumer mindset, there is a positive and statistically significant effect, meaning that customers will buy fewer chicken products the more they think doing so could endanger their health (Wan et al., 2019). It was found by Wan et al. (2019) that there is a statistically significant correlation between purchase intentions and the following factors: perceived risk of contracting avian influenza, media coverage, the provenance of chicken products, pessimism, and potential health threats. Among these, consumers' propensity to buy chicken products is greatly influenced by their expectations regarding the goods' quality and safety. Customers are less likely to purchase chicken products during the avian flu outbreak if they believe that they could be harmful to their health. In other words, consumers typically have poor levels of faith in the quality of chicken meat when it comes to avian flu. They think purchasing fresh chicken could be harmful to your health. By disseminating information concerning things like avian flu, animal diseases, and food contamination, the mass media will affect and alter customers' propensity to buy chicken products (Wen et al., 2019).

According to the research of Taha (2007), customers' concern that consuming poultry meat could expose them to avian influenza caused a significant drop in the market, especially for imported poultry, both cooked and uncooked. In several nations, consumer anxieties negatively impacted poultry consumption, which resulted in fewer exports of poultry meat, lower local pricing, and decreased output. These cuts turned out to be temporary, as prices, exports, output, and consumption all quickly recovered to their pre-outbreak levels. The demand for cooked poultry grew globally as customers became more assured that poultry was safe when handled and cooked correctly. In 2006, HPAI H5N1 outbreaks, this time in Europe, put pressure on the global poultry sector once more (Taha, 2007). Zamani et al. (2024) note an overall rise in retail prices for the retail markets for chicken, eggs, and turkey; the results provide useful background data that enhances the government-reported data now in place and validates findings from other studies regarding the existence of concurrent factors influencing pricing dynamics (Muhammad et al., 2023). The emphasis should be on bolstering supply chains' resilience through the promotion of alternate distribution channels, diversified sourcing, and producer-retailer alliances; this can keep costs and availability steady for customers and lessen the effects of localised supply interruptions during outbreaks (Zamani et al., 2024). The elasticity of supply and demand, as well as the curvature of the supply and demand curves, determine how the external shock of epidemics affects end users (Weyl & Fabinger, 2013).

In the study of Hsu et al. (2008), data analysis was done using multivariate analyses. The results of this study showed that respondents with relatively high risk perceptions and greater awareness of avian influenza were more likely to avoid crowds and birds. Given the potential threat of avian influenza outbreaks, respondents with relatively low levels of awareness were inclined to prefer not eating any chicken at all. In the event of avian influenza epidemics, respondents with low risk perception levels would be more inclined to continue eating chicken as usual than those with high risk perception levels. Contributions of this study include revealing behavioural changes in chicken consumption in an area where avian influenza is a pandemic and offering fresh perspectives on knowledge and risk perceptions of the disease (Hsu et al, 2008).

Near public frenzy was sparked by official declarations of BSE (Burton & Young, 1996). In Britain and around Europe, beef sales plummeted, sparking what could turn out to be one of the decade's most expensive public policy catastrophes (Ratzan, 1999). The financial expenses, which one estimate places at around USD 10 billion globally, are only one aspect of this exorbitant cost, but also a significant decline in public confidence in the political system, the costs of which are hard to calculate (Ratzan, 1999). Both short- and long-term consumer expenditure allocations among meats were significantly impacted by media indices associated with BSE, according to Burton and Young (1996). Referring to the research of Lloyd et al. (2006), there was a negative correlation between the retail and producer prices of beef in the UK market and a media scare index associated with coverage of the BSE outbreak. Mazzocchi et al. (2004) assessed the welfare losses to consumers in Italy as a result of learning about a BSE fear, as did Foster and Just (1989); they discovered that, depending on the period thought to represent accurate perceptions of the safety level of beef, the predicted monthly loss per person varied from 12 to 50% of the entire amount spent on the meat group. In Canada, despite the 2003 announcement of BSE cases, data indicated that Canadians have faith in the Food Inspection Agency and did not anticipate that anyone in the country would contract the disease (Ding et al, 2013). Domestic beef consumption in Canada rose in both 2003 and 2005 (Ding et al., 2013). The effect of the BSE epidemic on the UK's appetite for beef and other meats was examined by Bessler et al. (2008). A theoretical model was created by Burton and Young (1996) to account for how consumers might react to the widely disseminated food safety information. Piggot and Marsh (2004) analysed consumer purchasing patterns after the initial identification of BSE cases in the United States in 2003. They discovered that the consumption of beef has decreased significantly. Likewise, in France, a study revealed that shortly after French consumers were made aware of the connection between the BSE and the fatal human disease Creutzfeldt-Jakob disease, their consumption of beef declined precipitously by 22.1% (Schlenker and Villas-Boas, 2009a). Related to the study, over 30 months, they found changes in attitudes and frequency of intake related to BSE for beef and some other proteins. The BSE crisis has had a significant impact on the UK in several areas, including politics, consumer confidence, and agriculture (Hinde et al., 2001). The discovery of a BSE-positive cow in the United States and the following surge in public awareness of food safety issues coincide perfectly with the timing of this structural change (Taylor et al., 2016).

2.5.3. Consumption Patterns Changes Due to African Swine Fever Disruption and the Case of U.S. and Chinese End-Users

According to Lee et al. (2023), even though ASF is not a food safety concern, 46% of pork consumers would not buy pork if there were an outbreak in the United States. Previous studies have also shown that consumers' intent to buy food goods is impacted by their lack of faith in the food supply chain and their ignorance of food quality and safety (Franc-Dąbrowska et al., 2021; Robinson et al., 2020). According to estimates from the Centers for Disease Control and Prevention (2023), eating pork causes 82 fatalities, 2,900 hospitalizations, and 525,000 illnesses annually, however, there is no proof that ASF poses a threat to food safety, even though it is extremely contagious and lethal to pigs (USDA APHIS, n. d.). Vietnam, for instance, had a 20–30% surge in pork prices in 2019, making it unaffordable for many customers (Nguyen-Thi et al., 2021), therefore, many consumers resorted to other protein sources, including beef, poultry, and seafood as pork grew costly and scarcer. Because of its comparatively reduced cost and availability, demand for poultry in particular rose. Concerns regarding food safety also contributed to the change, as some consumers shunned pork out of concern for contamination, even though ASF is not contagious (Chuong et al., 2025). A main ingredient in many traditional Vietnamese recipes, pork is a staple of the Vietnamese diet; pork's diminished supply and increased cost upended culinary customs and altered household meal planning (Nguyen-Thi et al., 2021). Pork consumption in Germany did not drastically drop, in contrast to Vietnam, where it is a staple food ("Germany continues the downward trend of its pork sector", 2024). Germans often eat pork, although their diet is more varied overall, with a large intake of beef, chicken, and plant-based proteins, pork became more affordable domestically as a result of the export prohibition, and there was no discernible rise in consumption ("Germany continues the downward trend of its pork sector", 2024). Despite the low direct risk, studies on ASF reveal that even in unaffected areas, people consume less pork out of fear of contamination (FAO, 2019).

Kashyap et al. (2024), research estimates a shift in pork consumers' willingness to pay during an ASF outbreak in the United States using a methodology similar to that of Lee et al. (2023). Using survey data from 2020 and contingent valuation techniques, Lee et al. (2023) examine whether consumers' opinions of ASF and, in the event of an ASF outbreak in the United States, their choices about pork purchases are influenced by the way the news concerning ASF is presented. Their willingness to pay estimates implies that people's decisions to buy are influenced by their prior knowledge of the illness, and that people with less understanding are more affected by the way information is presented. As the world's largest animal disease epidemic to date, the latest ASF outbreak has increased the likelihood of outbreaks in formerly disease-free nations like the United States. An ASF outbreak's immediate effects in the United States, the biggest pork decrease in exports from the exporting nation, would boost domestic pork supplies and, in the short term, drive down prices. Although ASF is nearly always fatal to pigs, it does not pose a threat to food safety, and eating pork products after an epidemic is entirely safe. According to the one-and-one-half-bound (hereinafter, OOHB) dichotomous choice contingent valuation (hereinafter, CV) technique, the ASF outbreak causes the demand for unprocessed pork (processed pig) goods to decline by 32.31% to 30.38%. The welfare results are that pork producers lose \$35.35 billion, while consumers lose \$24.11 billion (Kashyap et al., 2024).

According to the research of Salling (2025), pork consumption in China between 2015 and 2021 changed drastically, following the August 2018 ASF epidemic. Chinese people's eating habits have changed as a result of the virus outbreak, which has also had an impact on output. Due to changes in the supply and demand chain, there has been a discernible trend in the demand for poultry as a pork alternative throughout the years, particularly in 2019 and 2020. In other words, while pig consumption declines, poultry consumption rises. Consumption of sheep and beef did not differ much in dietary practices, especially after the outbreak that had a significant impact on the pig market (Salling, 2025).

Figure 9 demonstrates the patterns of pork consumption in China from 2015 to 2023, expressed in thousands of tons.

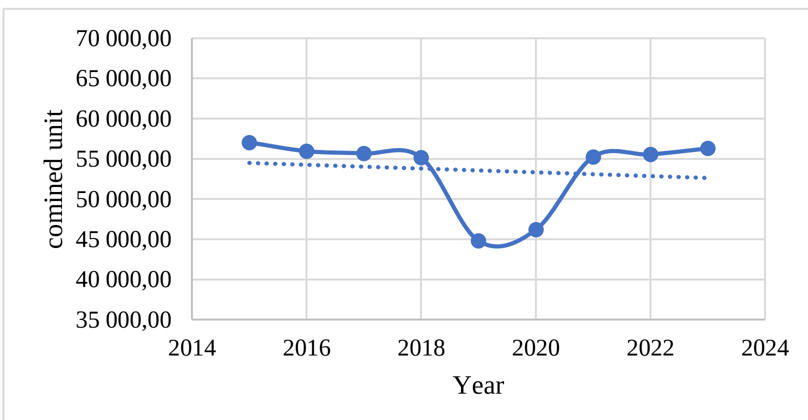

Figure 9: China pork consumption tendency in a combined unit of measure: tons, carcass weight equivalent, thousands, 2015-2023
Source: Author's illustration based on OECD/FAO data (2024)

The graphic shows that there was a steep fall in the amount of pork consumed in 2018. After 2021, there was a tiny increase in consumption, but it was still declining. The quantity of swine devoured was 57,030.33 thousand tons in 2015. There was a minor decrease in the amount consumed following 2015, with 55,155.14 thousand tons of pig meat consumed in 2018. Nevertheless, 44815,36 thousand tons of swine meat were recorded in 2019, a 19% decrease, meaning 10,339,78 thousand tons less pork meat were consumed. The fact that fish, chicken, and beef prices increased 26.4%, 9.4%, and 4.1%, respectively, in April despite a 21.4% year-over-year fall in hog prices provides the best indication of the influence of demand switching factors (MARA, 2020). Referring to the research of Liu (2022), many individuals no longer view pork as necessary, as evidenced by the shift toward lighter consumption and the downward trend in meat prices. If pig prices increase in the future, more individuals will have the opportunity to purchase substitutes, and in the setting of light food consumption, such substitutes will grow more potent and quickly spread across society. Pork consumption fell by more than 20% in 2019. The research shows that China's consumption of pork altered when the ASF outbreak occurred in August 2018 (Liu, 2022; Salling, 2025). The viral outbreak in China caused changes in people's eating patterns, which also had an impact on output levels. Due to the shift in the demand-supply chain caused by the pork interruption, there has been a noticeable trend in the demand for poultry over the years, particularly in 2019 and 2020 (Salling, 2025).

2.5.4. The Pork Consumption Patterns of Hungarians

Recently, the domestic pork industry has been facing market disturbances (Marczin, 2023). Gergely et al. (2019) prove that pork consumption is decreasing. In Hungary, the average annual intake of pork was 40 kg in the early 1990s, but it has since dropped to about 24 kg (KSH, 2024). **Table 7** summary based on the KSH (2024) shows that after chicken, pig meat is one of the most popular meats on a domestic level.

Table 7: Amount of annual meat consumption per capita according to income tenths (deciles) in kg, 2015-2020

Meat	2015	2016	2017	2018	2019	2020
beef and veal	0.697171	0.609287	0.962104	1.053728	0.971451	1.063087
pig	16.31943	18.53764	17.04221	18.33363	19.21365	19.15686
poultry	19.21727	19.27506	19.99732	20.91608	23.09409	25.17883
salami, sausage, ham	8.057011	8.097514	8.440236	9.655426	11.04384	8.719075
other butcher's shop meat	11.21825	11.76356	9.445399	8.601058	9.489	9.067958
intestines	2.945687	2.785777	2.314532	2.179915	2.157156	2.328387
frozen meat products, canned meat	2.111813	2.080032	2.746262	2.803833	2.700607	3.002046
sheep, goat, rabbit, other	0.227986	0.19593	0.116981	0.225322	0.110115	0.128
TOTAL	60.79462	63.34479	61.06505	63.76899	68.7799	68.64424

Source: Author's illustration based on KSH data (2024)

According to the data, Hungary's average annual meat consumption from 2015 to 2020 was 64.33 kg per person, which includes both fresh, and raw meat and meat that has been frozen, chilled, or canned. This means that an individual typically consumes 60–70 kg of meat per year. Pork accounts for 28% of meat consumption in 2020, excluding processed meat. According to Medve's research (2022), in Hungarian households, the average annual pork intake per person was 19.2 kg in 2019. Data from the KSH (2024) show that between 2002 and 2019, per capita pork consumption increased by two kg or 11.6%. In 2010, Hungary's per capita consumption of pork was 25.3 kg/person; this number remained stable until 2016, when it started to rise and peaked in 2018 and 2019, surpassing the EU average. Citing research from the Institute of Agricultural Economics (hereinafter, AKI) (n. d.), the study asserts that even in cases where customers are aware of high quality and a good price-to-quality ratio, they are unable to purchase premium products because most Hungarian consumers are highly sensitive to price rather than origin.

Vida (2013) found some interesting differences between male and female consumers, and a significant difference was apparent. Pork products are consumed by 49% of male customers at least once a week, 32% more regularly in a month, and 19% infrequently or once a month. Among female customers, who eat pork at a rate of 37% once a week or more, 33% more than once a month, and 30% seldom or occasionally, this amount was more fairly distributed. According to another report by Vida (2013), customers believe that smaller meat stores or the local butcher are the safest and most reliable places to get fresh hog meat (45.36%). The second-highest rate of fresh pork purchases was found in supermarkets and hypermarkets for buying meat from farms or residences. Based on the responses to the hypothesis-related question, the research concluded that 28.3% of consumers genuinely believe that chicken meat is healthier than swine meat. These are listed in decreasing order: freshness, cost, fatness, domestic product, wholesome diet, agricultural circumstances, packaging, and advertising, in case of importance, when purchasing pork goods (Vida, 2013).

According to a previous study by Kárpáti and Torda (2009), the majority of respondents do not believe that marketing campaigns have a significant impact on their consumption of pork. However, it is encouraging that a small but increasing percentage of respondents in 2008 acknowledged the influence of these campaigns. The pork was cited by 53.6% of respondents as their favourite meat. While 34.8% of respondents eat fish first, 50% of respondents eat beef first. Among others, four responders played the wacky game. Due to their fondness for two kinds of meat, some individuals developed two marks (Bodnár and Privoczki, 2023). Customers claim that although pork is not the healthiest or most contemporary meat, it is a staple of traditional Hungarian cuisine, appearing on every table in some form multiple times a week, and will continue to do so as long as stew and fried meat are among the most well-liked "Hungarian dishes" (Vida and Szűcs, 2016b).

Similar findings came from a 2013 study on eating habits conducted by GFK Hungária, which indicated that 89% of Hungarian consumers enjoy pork, ranking it as the tenth most popular food overall. Approximately one-third of Hungarians consume pork many times each week, and men also consume it more frequently than women. Only 67% of women eat pork weekly, compared to 85% of men. Pork consumption is highest among those who work by hand, have big families, and reside in tiny communities. Pork consumption is lower than normal among those with higher education, and when broken down by age, it is evident that the desire for red meat is considerably lower than usual among those under 30 and greater than average among those over 40 (GFK Hungária, 2013). According to Szakály et al. (2009), who conducted a study with 494 participants, customers have a positive perception of fresh pork and do not object to its availability or cooking methods. In essence, it is a traditional, tasty product with a macho appearance. The product is not regarded as healthy by consumers because of its high cholesterol content, which they link to its fatty quality. Pork has a fairly old, dull, and "ageing" image as a product overall. The study also looked at the respondents' relationships with pork. Consequently, it was linked to an elderly, obese, and less educated man who stays away from sports and lives in the country. Pork-related relationships were also investigated by Szigeti et al. (2014) (n=1000); the findings show that pork is readily available (56.5%), palatable (49.3%), and can be served in several ways (75.1%). Nonetheless, a much smaller percentage of respondents rated pork as low-fat (5.3%), high vitamin (2.9%), or healthy (7.6%). A more thorough examination of the data showed that the older age groups—those in the 50–59 and 60+ age ranges—thought pork was healthier than those in the 50–59 and 60+ age ranges. Chop, loin, and rib are the three most popular and commonly consumed cuts of fresh pork, according to data from earlier studies conducted in Hungary (Szakály et al., 2009).

More than 80% of respondents have favourable opinions about domestic pork and pig products, believing that domestic pork is superior to imported pork (Vida & Szűcs, 2016b). By examining the long-term time series, it is also possible to demonstrate substitutability by showing that, while the amount of pork consumed per person has declined, the amount of poultry meat has increased. The intake of white meat (fish and poultry) appears to be on the rise as a result of dietary guidelines that prioritise health (AKI, 2014a). Poultry's favourable connections with a healthy lifestyle and, most likely, its reduced cost are the reasons for its popularity (Vida & Szakály, 2023). Based on the most recent data, the coronavirus and ASF epidemic conditions in Hungary caused consumption to drop to 29.1 kg/person in the year 2020 (KSH 2024; Vida & Szakály, 2023).

3. MATERIALS AND METHODS

The data specification, the study's methodological component, and the approach to be taken are all covered in this chapter. This chapter examines the theoretical underpinnings and empirical instruments that can be used to debate and examine the research topic while considering the research problem and the methods currently available for its investigation. This chapter outlines the methodology to be employed in this investigation and presents the case for a suitable methodological approach.

In order to focus on the data that needed to be gathered for the research, the present research was eventually divided into two sections when writing the doctoral thesis: an analytical framework, a research question and hypotheses. One of the most popular criteria for classifying information in a system is whether or not data collection was done during a particular market study. This distinction essentially sets primary and secondary market research apart. This chapter also includes the methodological approach of primary research (**Figure 10**).

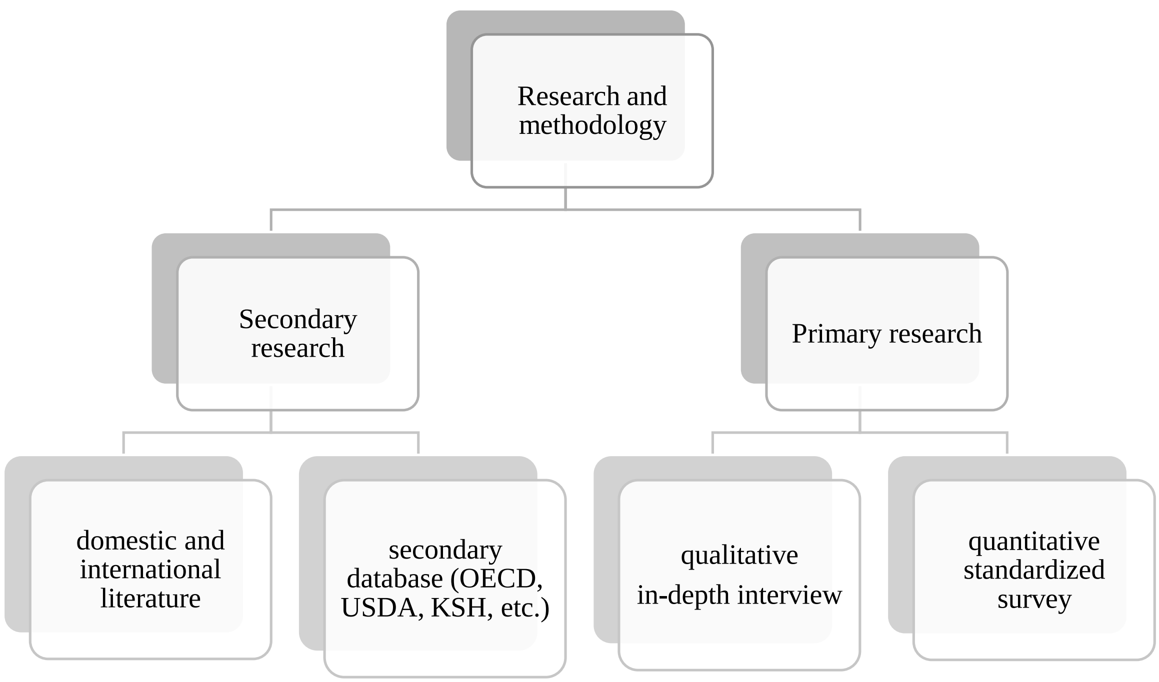

Figure 10: Structure of methodology
Source: Own research, 2025

3.1. Structure and Procedure for Gathering Secondary Data

Primary market research is defined as the activities and projects that involve obtaining important information through data collection, regardless of the method used. Secondary market research does not use data collection; instead, we mainly look for and gather already available data. The main goal of secondary data collection is to find, gather, organise, and synthesise existing data. In Chapter 2, there is a sort of triad in the logic of the method taken in the literature part, since further segmentation is carried out under each major topic concerning the world, China and Hungary to maintain clarity and logical consistency. The raw data were mainly utilised from FAO, USDA, OECD, AKI, KSH, MOA, and MARA for the analysis of secondary data in the subject matter, respectively, at both national and international levels. Statistical indices, trend analyses, base and chain ratios, and comparisons with similar datasets are evaluated. A time series was created spanning China and Hungary, during the secondary research, but aside from that, the market, consumption, and situation of pork are presented mainly from 2015 onwards; however, previous literature was also analysed. The strategy for the review consists of a broad and focused search of various sources across multiple disciplines: scholarly journal articles, books, and electronic media. Key sources from the search include libraries, websites, and journals, among others. The literature review involved reviewing more than 200 relevant sources. The study includes reviewed references published between 2010 and 2023, and also references published in 2010 or earlier. The keywords searched: *meat industry, global meat consumption, pork production, China's pork market, Hungary's pork consumption, supply chain disruptions, preventing disruptions, responding to disruptions, African swine fever, viral disease, and mitigation,* among others.

Numerous studies were conducted to ascertain the nature of disruption in the supply chain with a specific focus on the ASF, its existence in the Chinese and Hungarian markets, and the disease's influence on the price distribution of pig meat and other meat types, consumption pattern changes, to develop a comprehensive defence for the examination of the subject matter. Food supply relations (e.g., pork supply, i.e., pork production and trade processes, quality relations, attitudes related to pork, etc.); and subjective and objective factors influencing consumer behaviour (nutritional-physiological effects, connections with diseases, cultural traditions, customs, and consumer beliefs and misconceptions related to pork) are among the factors determining the quantity and structure of food consumption. In the literature chapters, one can find both objective and subjective factors determining the quantity and quality of food demand (e.g., population, market changes, disease facts and their impact on pork consumption, price relations of pork and products made from it, etc.). Since our consumption is largely determined by the available products, the literature analysis is also presented by examining economic factors, including the production side in China and Hungary. A sub-heading was also created, which explains different consumer pattern changes due to disruptions, as well as focusing on mitigation processes on a managerial level.

In order to determine which sources, primarily both domestic and foreign, were pertinent to the topic of the pork market, supply chain disruptions, and mitigation, as well as which aspects each study highlighted, a literature search was conducted for the thesis dissertation. Subsequent sections then go into greater detail about the two primary categories as well as the ideas, methods, and components that are relevant to our research and its subfields. **Table 8** displays the grouping that was produced using a range of methods and resources.

Table 8: Systematic literature review on the topic and sub-areas

Main areas examined	Sub-areas examined
The supply chain of the fresh produce swine industry and the fact of disruption	Supply chain management-related literature Fresh produce supply chain-related literature Pork supply chain-related literature Pork market-related literature
ASF outbreak as a case study	Viral outbreaks-related literature Impact-related literature on China and Hungary market-related literature
Mitigation of disruptions	Mitigation-related literature on the governmental and entrepreneurial level
Consumer pattern changes	Consumer consumption-related literature Pattern changes due to disruptions-related literature

Source: Own research, 2025

The main subfields and additional subfields that have been proposed serve as the foundation for the systematic literature research. Relevant literature was considered that addressed at least some of the areas touched during the study, using graphs and tables to give a deeper glimpse of the topic. The vast literature review serves as the basis of our model formulation.

3.2. Structure and Procedure for Gathering Primary Data

Qualitative and quantitative research were the two categories into which the initial data collection was separated. Firstly, we collected price-related data on the Chinese pork market and the ASF case, which was analysed through different statistical models. The results of Salling (2025) are referred to in the literature part by giving a deep glimpse into consumer changing habits, and those are the author’s primary findings.

3.2.1. Qualitative Research: Hypotheses, Method and Data Analysis

In the Hungarian market, an in-depth interview was conducted on a managerial level with **Bonafarm Group** as qualitative research. The in-depth interview was semi-structured, which means that we let the interviewees express their deep motivation for the subject matter. Since the survey was anonymous at the company's request, the identity, position, and division of the interviewees will not be disclosed either during or after the survey's evaluation. The paper will refer to them as "Interviewee 1", "Interviewee 2", and "Interviewee 3". Three meetings were scheduled. The three-round sessions were held on the following days and times: 9 October 2024, 11:00–12:00; 16 October 2024, 11:00–12:00; and 17 October 2024, 13:30–14:00. These meetings were conducted via an online Teams meeting in the Hungarian language. The questions are summarised in **Annex I,** both in Hungarian and English. The hypothesis and methodology regarding the qualitative research are summarised in **Table 9,** also divided by the objectives.

Table 9: The hypotheses and methodologies of the qualitative research and in-depth interview

OBJECTIVE	HYPOTHESIS	SAMPLING METHOD	TOPIC	ANALYSIS METHOD
O8 **O9**	**H1** The corporate business has set prevention methods and mitigation techniques for possible ASF outbreaks.	Qualitative, in-depth interview	Biosecurity measures	Content analysis
O4 **O7** **O8**	**H2** The Chinese pork market disruption impacted the domestic pork market in the chosen corporate business due to ASF.	Qualitative, in-depth interview	Trade and consumption	Content analysis
O8 **O9**	**H3** Adopting supply chain diversification (e.g. multiple regional sources) and innovation technologies (e.g. Internet of Things) positively impacts consumer trust and mitigates disruption.	Qualitative, in-depth interview	Commerce activities	Content analysis

Source: Own research, 2025

The qualitative research was rewritten and translated conceptually, and provided a complex overview of the subject matter by combining the results received from the survey with those addressing segmented topics. After the in-depth interview with Bonfaram Group was conducted, a draft was sent to the company for approval through email. Only approved information is used in the dissertation. The approval email can be found in **Annex II**.

3.2.1.1. Model Specification

Two scenarios of an ASF epidemic in Hungary were explored using an economic model of domestic demand and supply for pork production in the country. We utilise the model introduced by

Paarlberg et al. (2003) and Kashyap et al. (2024) and reformulate according to our model perspective, as such a model has not yet been formulated in domestic literature. The model can be observed in **Figure 11:** scenarios (a) and (b).

(a) (b)

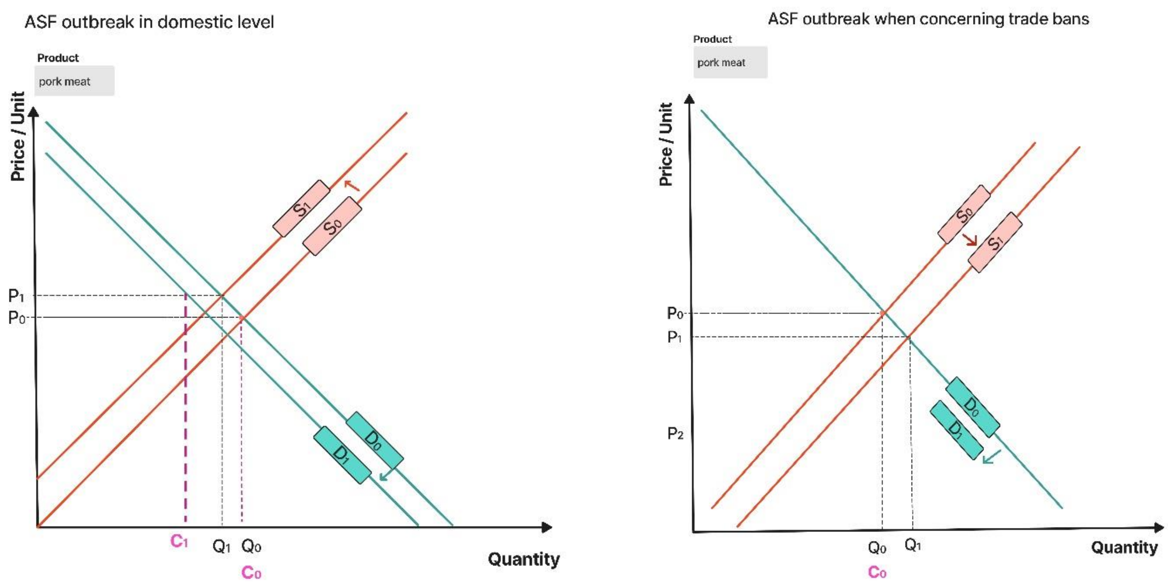

Figure 11: Modelling the economic effects of the ASF outbreak on Hungary's pork supply and demand
Scenario (a): ASF outbreak on the Hungarian pork market, excluding trade factors
Scenario (b): ASF outbreak on the Hungarian pork market concerning export bans
Source: Author's illustration based on Paarlberg et al. (2003); Kashyap et al. (2024)

In **Figure 11**, we start by simulating the supply and demand for pork as a single item. The domestic demand (D_0) and supply (S_0) of pork before an ASF outbreak in Hungary are shown. The equilibrium price (P_0) and quantity (Q_0) supplied were established prior to the ASF epidemic. C_0 is the initial amount that is consumed in the domestic market. In scenario (a), we only check the ASF outbreak in the local pork business. Three distinct impacts are modelled if Hungary has an ASF outbreak. Loss of pork production as a result of quarantine, slaughter, culling, and other control measures is the first effect (scenario (a)). The complete loss of exports as a result of trade restrictions brought on by the ASF outbreak is the second effect (scenario (b)). The third effect is how consumers respond to eating pork (both scenarios (a) and (b)). Consumers in China, for example, respond unfavourably to the outbreak, although ASF is not contagious (please refer to the findings of Salling (2025)). In the event of an ASF outbreak in farmed pigs, we anticipate a decrease in the consumption of pork among the Hungarian people, as the literature review indicates that consumers are responding negatively to other related animal diseases, such as avian influenza or BSE.

In scenario (a), due to the mass culling of pigs and other control measures, supply decreases from S_0 to S_1, and as a consequence, quantity moves to Q_1, which negatively affects price distribution; therefore, we can observe an increase from P_0 to P_1. Since consumers are sensitive to price increases and because of the fear of ASF, a decrease can be observed in consumption (C_1). Consumers suffer a welfare loss because of the higher commodity price and reduced surplus. In scenario (b), we use the scenario presented by Kashyap et al. (2024), who simulate the economic effects of an ASF outbreak in the United States and take into account closing overseas markets to U.S.-produced pork. In our case, we formulate a model concerning the Hungarian pork market due to an export ban. In this case, the amount will now be available for sale on the domestic market, which will result in an abrupt rise in the domestic supply of pork (Q_1). This is one immediate effect of the ban on Hungarian pork exports; therefore, the supply curve shifts outward from S_0 to S_1. The price will drop to P_1 to sell the surplus among domestic consumers. However, if some consumers reject consuming pork due to the fear of ASF disruption, we expect a negative inward shift in D_1, and the price decreases further to P_2. There can be observed a producer-magnified welfare loss, while the demand welfare loss is ambiguous. Although the price drop is advantageous, the quantity eaten decreases as a result of the demand shift.

3.2.2. Quantitative Research: Hypotheses, Method and Data Analysis

Secondly, to perform the quantitative investigation, we decided to use a questionnaire survey. A heterogeneous snowball sampling approach was employed, initiating with a seed population of Óbuda University students and peers, who then referred additional participants through their personal networks. This non-probability method was selected due to the niche nature of the target population (pork consumers during hypothetical disease outbreaks), budget and time constraints for rapid data collection, the need to access hard-to-reach consumer segments to capture diverse pork consumers across Hungary. With the seed's initial participation, we were able to increase the sample size and collect data on a national level. Quota monitoring were conducted, meaning regular checks were to prevent overrepresentation of any single demographic. No exclusion criteria were applied, ensuring broad participation but risking self-selection bias (e.g., overrepresentation of younger, educated demographics, network homophily). Since there were no filtering criteria for inclusion in the sample, we employed heterogeneous snowball seed sampling within the snowball technique. A standardised, pre-tested online questionnaire (in Hungarian) targeted pork consumers, focusing on behavioural intentions during a hypothetical ASF outbreak, was used as the sampling instrument. For validation, pre-testing with a pilot sample (20 respondents) refined question clarity and reduced ambiguity.

However, the lack of probabilistic sampling limits inferential generalizability. The survey's unique scope—pork-specific consumption and consumption shifts under crisis—required hypothetical scenarios, which may introduce hypothetical bias (divergence from real-world behaviour). It was an unintentional one-time survey, published on various online platforms and questionnaire-filling groups on social media to target a nationwide sample population. Learning about consumer behaviour, its causes, and the elements that influence it are some of the key objectives of the consumer survey. By analysing these, we aim to forecast the anticipated responses of customers regarding pork, especially when the ASF outbreak disrupts the supply chain in the Hungarian market. By assuming a certain consistency between past, present, and future behaviour, estimating the future from the past and present, and enquiring about future intentions, we can gain insight into consumer reactions in the case of the ASF outbreak in the swine market. Since consumer behaviour and decisions are constantly based on the qualities of the consumer, the socioeconomic features of the consumers are crucial during the survey. Although social desirability bias (e.g., underreporting price sensitivity) and hypothetical bias (difference from actual behaviour) are still limitations, the pre-tested questionnaire evaluated consumption intentions under a hypothetical ASF outbreak. In order to account for confounding effects, socioeconomic indicators were gathered. Notwithstanding its limitations, this approach laid the foundation for future probabilistic sampling by offering crucial early insights into behavioural changes brought on by crises.

Therefore, our questionnaire was created to administer the survey, and we collected 331 respondents to complete it. For ethical considerations, the study protocol included consent procedures, data anonymisation and ethical approval. "*Measuring pork consumption habits*" is the title of the questionnaire, and the full survey can be found in **Annex III,** both in Hungarian and English. To compare how other authors did their surveys and what kind of methodology they employed, we looked at comparable food consumption surveys in the domestic scientific literature while choosing the approach. The study consistently applied the best methodological approach from both domestic (Vida, 2013; Bodnár and Privoczki, 2023; Szakály et al., 2009; Szigeti et al., 2014; Vida and Szűcs, 2016b) and international (Kashyp et al., 2024; Verbeke, 2005; Verbeke et al, 2010) scientific literature as a guide; these findings were highlighted in the previous chapter. The idea of research follows the study of Kashyap et al. (2024). Kashyap et al.'s (2024) research highlights a hypothetical ASF outbreak in the U.S. and measures the consumer eating habit changes due to a hypothetical situation of an ASF outbreak. Kashyap et al. (2024) found that 23% of the respondents would stop buying pork products in case of an ASF outbreak. A survey experiment was used to investigate how American pork consumers see food safety, how their consumption patterns change following a fictitious ASF outbreak in the nation, and whether consumers' reactions are influenced by the information they receive. Responses from consumers were elicited for a hypothetical scenario using a stated preference methodology, which is only possible in a controlled setting (Kashyap et al., 2024).

Primarily, closed-ended questions were utilised when creating the questionnaire. The questionnaire could be divided into two parts. The first part was organized using the traditional 4Ps model, therefore, it begins with the product (i. *Product*), followed by questions about its knowledge, popularity, preference, frequency of consumption, and differentiation from other products made from pork, followed by questions about the product's place of purchase (ii. *Place*), price (iii. *Price*), and advertising (iv. *Promotion*). The second part is a hypothetical situation, where we also follow the model of 4Ps and consumer behaviour. After the basic background information of the ASF, the announcement of the hypothetical text was eradicated. Respondents were told to answer the subsequent questions, hypothesising an ASF outbreak. This enables us to inform consumers about the outbreak by using various information sources, something we would not be able to do in the real lives of the respondents otherwise, since in Hungary, the ASF outbreak has not been eradicated yet among domestic pigs. General knowledge, filter, transition, reminder, and control questions are also included in the questionnaire. The closed-ended questions contained both nominal (single- and multiple-choice selective questions) and metric level questions as well (Likert and semantic differential scales). Scaling measures range from 1 to 4. The odd (1–5) scale's middle value (3) is an escape route for respondents, and the existence and potential overrepresentation of indifferent consumers who select the middle value complicates the segmentation process from a statistical and professional standpoint. Consequently, we chose an even scale, which will encourage the respondent to adopt a more stringent attitude and help the segmentation process run more smoothly by eliminating the middle value. Likert scale measurement measures the level of agreement with statements with unipolar (degree of agreement) options, while the semantic differential scale measures connotative meaning of a concept with bipolar (opposite adjectives) options.

To separate consumers into groups during processing based on a variety of characteristics (gender, age, marital status, educational attainment, economic activity, settlement size, and income position), group creation is used. Google Forms software was utilised to develop the online survey. Following the questionnaire's preparation, some computer and smartphone test completions were conducted. Prior, 10 people were tested on the survey. The hypothesis and methodology regarding the qualitative research are summarised in **Table 10** and provide an overview of the specifications.

Table 10: The hypotheses and methodologies of the quantitative methods and standardised survey

OBJECTIVE	HYPOTHESIS	TOPIC	SURVEY QUESTION	LEVEL OF MEASUREMENT	METHOD OF ANALYSIS
O3	**H4:** There are characteristic differences in meat consumption among age groups, specifically with the young generation consuming more chicken.	General meat consumption	III/1	Nominal	Chi-squared test; Adj. Res.
O3	**H5:** Segments formed based on pork consumption frequencies can be well-defined based on primary characteristics.	Pork consumption trends	III/3	Nominal	Chi-squared test; Adj. Res.
O3	**H6:** Consumers' pork purchasing behaviour is segmented by income level, with lower-income groups prioritising cheap prices and bulk purchases, while higher-income groups focus on quality.	Pork consumption trends	III/4, 5, 8	Interval (1-4)	ANOVA, descriptive statistics
O3	**H7:** Age correlates with the importance placed on freshness and Hungarian pork origin, with the older generation putting more importance on them than the younger aged.	Pork consumption trends	III/4, 5, 8	Interval (1-4)	ANOVA, descriptive statistics
O3	**H8**: The source of pork is determined by the type of place of living, specifically village areas, showing a stronger preference for home-breeding and direct-from-producer sourcing.	Pork consumption trends	III/6, 7	Nominal	Chi-squared test; Adj. Res.
O4 **O6**	**H9**: Individuals who believe that ASF poses a health concern are more likely to stop or discontinue their pork purchases.	Pork consumption pattern changes due to disruption	III/9	Interval (1-4)	ANOVA, descriptive statistics
O4 **O6**	**H10:** Attitudes towards pork consumption after an ASF outbreak can be segmented based on (1) health concerns, and continued purchase to (2) prior pork consumption frequency.	Pork consumption pattern changes due to disruption	III/9	Interval (1-4)	ANOVA, descriptive statistics
O4 **O6**	**H11:** Consumers' continued pork purchase after an ASF outbreak can be segmented based on typical sourcing, with home-breeding and direct-from-producer sourcing tend to exhibit more resilient patterns, while retail purchasers are less resilient.	Pork consumption pattern changes due to disruption	III/9	Interval (1-4)	ANOVA, descriptive statistics
O4 **O5** **O6**	**H12:** Price sensitivity during an ASF among consumers can be characterised and segmented, with consumers either ceasing purchases or adjusting demand in response to price fluctuations.	Pork consumption pattern changes due to disruption	III/9	Interval (1-4)	ANOVA, descriptive statistics; Hierarchical Cluster, Factor and Cluster analysis
O4 **O5** **O6**	**H13:** During an ASF outbreak, lower-income consumers (especially those struggling financially) are significantly more willing to purchase reduced-price pork—both raw and processed—than higher-income consumers, as price outweighs perceived health risks.	Pork consumption pattern changes due to disruption	III/9	Interval (1-4)	ANOVA, descriptive statistics
O4 **O5** **O6** **O9**	**H14:** The source of information flow about the ASF outbreak has a significant impact on consumers' choice to stop or continue purchasing pork during the ASF outbreak.	Pork consumption pattern changes due to disruption	III/9	Interval (1-4)	Dichotomisation; ANOVA, descriptive statistics

Source: Own research, 2025

331 evaluable questionnaires were produced as a consequence of the nationwide questionnaire survey, which was carried out as part of a research project between 20 January 2025 and 20 March 2025. The socio-demographic information is presented in **Table 11**.

Table 11: Summary statistics of respondents, socio-demographic variables, N=331

Variable	Category	Statistics	Percentage
Gender	Female	211	63.75%
	Male	120	36.25%
Age	18-29	209	63.14%
	30-39	62	18.73%
	40-49	33	9.97%
	50-59	19	5.74%
	60+	8	2.42%
Education	Maximum elementary school	3	0.91%
	Vocational training, vocational school	15	4.53%
	High school	151	45.62%
	Higher education diploma	162	48.94%
Economic activity	Active intellectual	150	45.32%
	Active physical	29	8.76%
	Maternal leave	9	2.72%
	Retired	7	2.11%
	Household	8	2.42%
	Student	124	37.46%
	Unemployed	2	0.60%
	Other inactive earner	0	0%
	Other dependent	2	0.60%
Type of place of living	Capital city	141	42.60%
	County town, capital of county	69	20.85%
	Other city	69	20.85%
	Other settlement (village, municipality, farm, etc.)	52	15.71%
County	Budapest (főváros)	141	42.60%
	Bács-Kiskun	8	2.42%
	Baranya	9	2.72%
	Békés	4	1.21%
	Borsod-Abaúj Zeplén	3	0.91%
	Csongrád-Csanád	31	9.37%
	Fejér	6	1.81%
	Győr-Moson-Sopron	2	0.60%
	Hajdú-Bihar	9	2.72%
	Heves	6	1.81%
	Jász-Nagykun-Szolnok	5	1.51%
	Komárom-Esztergom	11	3.32%
	Nógrád	5	1.51%
	Pest	75	22.66%
	Somogy	4	1.21%
	Szabolcs-Szatmár-Bereg	2	0.60%
	Tolna	3	0.91%
	Vas	1	0.30%
	Veszprém	4	1.21%
	Zala	2	0.60%
Marital Status	Single	138	41.69%
	Lives with a partner	104	31.42%
	Married	77	23.26%
	Divorced	5	1.51%
	Lives separately from spouse	4	1.21%
	Widow	3	0.91%
Subjective income	Constantly have livelihood problems	5	1.51%
	Sometimes it is not even enough for living	9	2.72%
	It is just enough for living, but cannot save	33	9.97%
	It is enough for living, but can only save a little	147	44.41%
	Can make a very good living from it, and can even save	94	28.40%
	Do not know, do not want to answer	43	13.00%

Source: Own research, 2025

Throughout the analysis, we merged our data for better understanding and segmentation. Age group (Young 18-29, Middle-aged 30-49, Older 50+), Education (Low Education, High School, Higher Education), Economic activity (Employed, Not-working, Student), County (Pest, Northern

Great Plain, Southern Great Plain, Northern Hungary, Central Transdanubia, Southern Transdanubia, Western Transdanubia), Marital status (Committed relationship, Not-currently married), Income (Struggling, Stable, Comfortable, Unknown/Prefer not to say). The merged detail can be found in **Annex IV/Table 37.**

For quantitative data, statistical and mathematical tools suitable for the task (SPSS 27.0) were used to process data modelling. The survey had to be coded properly to conduct the different analyses. Using SPSS 27.0 software, the quantitative findings were processed, and the hypotheses were tested using descriptive statistics, bivariate, and multivariate analyses. The analysis of variance (ANOVA) approach for comparing multiple sample means was utilised to look at the correlation of the data measured on the metric scale. The F-statistic, or the coefficient of variance of the means within samples, was used to analyse internal correlations and compare group means. For some assumptions, the Chi-square test was used, and the internal relations were measured with the Adjusted Residuals crosstab approach, interpreted as follows: Adj. Res. >1.96: with 95% confidence, a positive deviation from the expected value; Adj. Res. ≥3: with 99% confidence, a positive deviation from the expected value. Only the groupings of background variables that showed significant associations at a 95% confidence level are described, though. In terms of segmentation, factor and cluster analysis were conducted with varimax, and Kaiser-Meyer-Olkin (KMO) index testing in multivariate statistical studies. Segmentation was run with K-means cluster analysis. In addition, to analyse the correlation between a Likert scale and a semantic differential scale, we first dichotomised the semantic differential scale and then conducted ANOVA testing. The summary of testing methods is in **Table 10**, above.

4. RESULTS AND FINDINGS

4.1. Qualitative results

The daily work of many food manufacturers is influenced by large quantities of production of impeccable quality and safe, and competitive production. As these challenges must be solved in the best and fastest possible way, the Bonafarm Group has developed one of the largest vertically integrated food farms in the region to ensure smooth operation and market supply. Vertical integration facilitates the production of raw materials for the finished product, as well as its precise coordination and management, thus ensuring a high-quality, diverse product layer for consumers. The main goal of the company group is to become the most successful food industry group in the region by supplying consumers in Hungary and other countries with fresh, domestic food, and by ensuring impeccable quality with dedicated professionals, continuous expansion of knowledge and technological development. Their daily goals include the continuous development of products and production. There is a special focus on animal health, food safety and sustainability.

4.1.1. Vertical Integration at Bonafarm Group

In the figure below, we can observe the vertical integration of the Bonafarm Group, which in the case of the research, is limited to the pig industry, but it is worth mentioning that in the field of animal husbandry, dairy cattle breeding and poultry farming are also involved. Since the research concerns the pig industry, the interview and survey are limited to this topic, ignoring the areas mentioned above, as well as the dairy and winemaking branches, which the company group can also boast of. Based on the answers of Interviewee 1, Interviewee 2 and Interviewee 3, an illustrated flowchart can be observed of how the supply chain of the Bonafarm Group is structured (**Figure 13).** The expansion and details of **Figure 12** are summarised in **Annex IV/Table 38**. The company group covers and coordinates the delivery of products to consumers, starting from crop production.

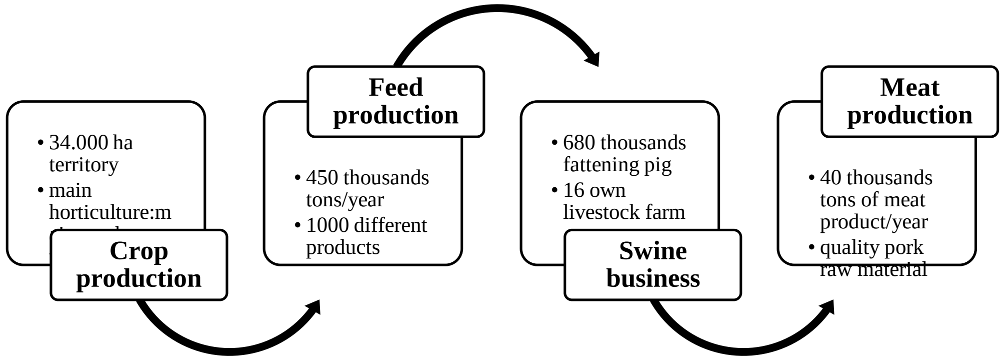

Figure 12: Bonafarm Group's vertical integration flowchart
Reference: Own research, 2025

The crop production and feeding can be considered the first and second steps in the supply chain of the Bonafarm Group. The cultivation of various crops and the production of fodder occur on 34,000 hectares of arable land. With modern technologies and under the rules, they ensure the harvest of abundant crops, as well as external sales. Animal husbandry is a particularly important branch of the company, as the food processing department and the livestock farms of their own and their integration partners are responsible for the supply of raw materials of impeccable quality, as well as for the provision of slaughter pigs. On pig farms, modern husbandry technology and methods are used, providing the right environment and precautions for raising animals. The pig sector consists of 16 own livestock farms: a central boar farm (semen supply farm), two nucleus farms (rearing of great-grandparent herd, F1 genetic supply using Danbred genetics), seven commodity sow farms, two gilt rearing farms and four fattening farms. Based on annual data, the pig farm provided more than 680,000 fattening pigs in 2019, placed 599,150 fattening pigs on the market in 2023, and the plan for 2024 focused on 660,000-680,000 pigs.

The next stage in Bonafarm's internal supply chain is meat processing and the production of meat products. As pork is one of the traditional ingredients of Hungarian cuisine, demand is outstanding at the company group. The product raw material is provided by one of Bonafarm's member companies, MCS Slaughterhouse Zrt. every day. MCS Slaughterhouse Zrt. ensures the supply of processed pork per the rules and conditions, with strictly controlled slaughtering activities, and in compliance with animal health and food safety requirements. Under the supervision of the Bonafarm Group, the slaughterhouse covers the entire meat industry product chain and supply chain, from the slaughter of live animals to the wholesale and retail trade of meat and meat products, and ensures the safety, delivery and traceability of products from livestock farms to store shelves. Most of the animals slaughtered at the slaughterhouse are provided by the Bonafarm Group and integration sites. The slaughterhouse continuously researches and explores market needs to ensure supply, applying and adhering to a flexible adaptation and higher value-added production strategy.

4.1.2. Commerce Activities of Bonafarm and the Decline Due to Disruption

According to Interviewee 2, ASF disruption is a very interesting topic, which has not yet been researched by many scholars, but it has serious impacts both on an economic and consumer level. At the Bonafarm Group, treatment and prevention have become a daily routine, with continuous innovation and regulatory expectations. MCS Slaughterhouse performs the processing by determining weekly numbers and basing the number of purchased pigs. In terms of procurement, they work from three sources, 70-80% of which is provided by the Bonafarm Group, and the remaining percentage is purchased from external contractors and free market sources, all cases controlled. Data for 2024 shows that an average of nearly 17,000 pigs are sent to the slaughterhouse every week, but they have experienced a decline since the appearance of ASF, mainly after 2021. In processing, this was not so obvious at the time, because the entire quantity was tied up, and they worked with contracted quantities. Before ASF, market needs were also taken into account. Bonafarm is exported to the Far East, including China, but since the appearance of ASF, there have been regulations in force regarding delivery, especially when it comes to delivery to China. If, for example, an increased import duty is imposed on Spanish pork imports, which are currently still exempt from ASF, it will also be felt at the global economic level, and it will bring about a dumping situation in the territory of the European Union. In the past, processing and quantity were more predictable, but now the demand is very hectic on the retail side, so it is difficult to keep track of it, and the loss of the Chinese market also worsened predictability. Since exports to the Far East have stopped, Bonafarm tried to reach the volumes in the domestic regions, but this level could not be maintained; market opportunities are far narrower. China was mostly supplied with by-products, such as ears, bones, tails, tongues, etc., but the market suddenly collapsed. The emergence of COVID-19 has also changed consumer habits even more, so it is currently less possible to model it. The appearance of the ASF and the export regulations to the Far East have changed Bonafarm’s procurement strategy and structure. Chicken consumption is trendy and more widespread among young people and women anyway, which practically destroys the market share of pork. Looking at the price differences, a kg of chicken breast is much cheaper than, for example, a kg of pork chops. From all directions, a kind of pressure can be observed, which is the reason for the declining demand for pork. The pig industry is a very complex phenomenon because it is influenced by many things, including trends, marketing, the world economy and world economic events.

MCS Slaughterhouse continued to experience growth in 2018 following the emergence of ASF. The contractual quantity was raised in 2019 out of concern that there would be a shortage of live animals due to the spread of ASF, which would allow for a bigger market to be supplied. Regretfully, this did not work out, particularly because of the Far East's export bans and the ASF outbreak in Germany. The slaughterhouse's desire to lower unit costs and acquire a market with more competitive prices seemed a good idea to justify the rising volume in 2020. However, Bonafarm has entirely shifted to the aforementioned free market equilibrium since 2021.

Additionally, one of the biggest markets for mangalica meat was Japan. Previously, Bonafarm also processed mangalica meat, which was primarily exported to Japan. However, because of the Far Eastern market's isolation, the main market niche for mangalica meat was also closed. The government attempted to raise the number of mangalica pigs, but because the equipment used for slaughter was more complex, demand also decreased, and Bonafarm stopped processing mangalica. Since it was not feasible to sell mangalica meat in such large amounts on the local market, Bonafarm has currently stopped processing it entirely.

4.1.3. Biosecurity Measures at Bonafarm

In order to provide businesses of all sizes and consumers with products of the highest calibre, the Bonafarm Group also complies with laws pertaining to food safety and animal health. Even before ASF, tremendous care was taken to stop outbreaks in accordance with the laws. Special measures, hygienic guidelines, and matrices are followed to stop potential viruses and other pathogens from entering the farms. Bonafarm has developed and maintains its own epidemic control and hygiene regulations, in which the processes are regulated. Security fences enclose pig farms, which are divided into “white”, “black”, and “grey” zones. Any area outside the colonies is referred to as the “black zone”. The two fence sections in a double fence system on a farm are referred to as the “transition” or “grey zone”. The actual livestock buildings and the large number of animals are situated in the so-called “white zone”. Animal movement, car traffic, and passenger traffic are all tracked and managed. Carcass handling is also governed. In order to adhere to animal health conditions, the regulations attempt to cover as much ground as feasible. Additionally, certain entrance requirements apply to suppliers, service providers, and contracted partners. Basic criteria include keeping entry logs of any arrivals and individual movement for traceability. External visitors are prohibited from visiting zoos, farms, or slaughterhouses and are subject to a 72-hour pig-free policy. Additionally, visitors who wish to enter the “white zone” must utilise the black and white changing rooms, disinfect their hands and shoes, and change completely. They must also wash their hair and take a bath. The company supplies gloves, safety gear, headgear, and protective clothing. Asset imports are likewise subject to regulations. The gadgets that can be imported are disinfected using UV lights, surface disinfectants, or germicidal lamps.

Vehicles used for handling, animal pickup, and livestock transportation are subject to a similar regulation. Wheel disinfection pools and disinfection gates are available at the depots. Beyond, secondary disinfection techniques like sprayers, foamers, and double disinfection of the wheels and chassis are also employed. The truck can only enter the “grey area”; it is forbidden to enter the white zone. No method can guarantee 100% safety yet, but with these steps, they can prevent and mitigate the onset of a viral infection, whether it is ASF or other diseases.

Modern technology, artificial intelligence, and conventional surveillance are all used to coordinate pig registration. Every plant uses chip ear tags. In certain sow farms, automatic feeding systems are used. Sows are identified using contemporary technology and a form of artificial intelligence, a daily ration is given, and feed is distributed based on an IoT of chips and AI technology. In certain situations, it is feasible to individually calculate how much ration and feed the system should deliver to the specific animal throughout the day by using automatic feeding stations. In addition, it can be identified if the sow or pig has not taken the recommended daily dosage, which may indicate an infection. The recommended temperature range for sows is 38.7 to 39 °C. Although 39.5 °C is still a suitable temperature, pigs may not consume their daily ration or eat regularly. Fever above 41 °C can be regarded as concerning and critical in the case of ASF. It should be noted that the Bonafarm Group requires that the temperature of a certain number of animals be measured before sales. Infrared thermometers or standard handheld thermometers are used to detect body temperature. According to the national ASF measures, the region is separated into high-risk areas and zones. The northern Bonafram colonies are classified into purple zones, according to Interviewee 1. Therefore, reports and ASF samples are sent for laboratory testing from every farm each week. According to the regulation, 29 blood samples must be collected from the transported pigs and sent for ASF testing from farms that are located in high-risk zones or are subject to their restrictions. To guarantee continuous monitoring, the farm manager or veterinarian must also complete a weekly cleanliness and disease management checklist for each farm. *Cloudfarms* includes the registration of identification number, vaccine type and dose, patient history and treating physician. *Cloudfarms* is an IT software that facilitates data analysis and data extraction. Furthermore, this type of data is easier to check and scan than a paper diary.

There are restrictions on pigs from different zones that can be processed in national slaughterhouses. Purple zone pig specimens must be processed, imported, and exported separately, and they are processed on a different day (the guidelines for proceeding are also available on the Nébih website, along with an interactive map of the high and medium-risk zones and other important information). There are no official or specific disease management limitations in medium-risk zones; however, in the purple zone, pigs can only be transported with a valid veterinary permit, where 29 blood samples are required.

Additionally, MCS Slaughterhouse Zrt. keeps up a well-established defence system. Workers can only enter the entire area of the plant in the clothes provided by the slaughterhouse. Trucks also go through a cleaning procedure and are randomly inspected. AI technology is used to count the herd when it gets to the slaughterhouse. At the pick-up locations, a counting camera system gate is installed. To differentiate between a human and a pig, the cameras track the movement and contour of the body. They can also determine which pig has already walked through the gate, preventing duplicate counts. The camera system has nearly perfect accuracy in identifying the stock component. Additionally, the camera records video, which may be viewed and examined whenever necessary. It can also save labour, which is another very beneficial feature.

4.1.4. Trade and Consumption Decline at Bonafarm

Interviewee 1 claims that Bonafarm may have impacted or piqued their interest in pig sales concerning the Asian export prohibition and other trade restrictions impacting the nation. The commercial difficulties were eventually explained by Interviewees 2 and 3. The approach that has been primarily employed since the ASF to address the decline in trade and consumption is that there is no committed quantity for slaughter because, since ASF appearance, Bonafarm has used option contracts (no committed quantities), which is an ideal coordination technique in case of supply chain disruption.

Interviewee 3 claims that Bonafarm began trading with China in 2016 and that the company's pork exports, which mostly consisted of by-products (bones, tail, kidneys, ears, head, back fat, tongue, etc.), were still shipped from the slaughterhouse. Bonafarm were able to deliver pork products until the middle of 2018 when ASF made its first appearance in Hungary. Although ASF infection has already been found on domestic pig farms in Croatia, it is currently only found in wild boar populations in Hungary. Because the Mohács area is close to the affected Croatian region, Bonafarm has been concerned about the disease's spread. Since the emergence of ASF, pork cannot be shipped to China in any way, either from Hungary or from regions infected with the virus.

Several Far Eastern nations have also placed limitations on nations that have been tainted by ASF. Japan, the Philippines, and South Korea also impose import restrictions on pork. Since Denmark, the Netherlands, and Spain are not yet ASF-infected, they can export pork to China. Since ASF infection cannot be found in domestic pigs in Hungary, it cannot be regarded as a direct consequence, so the decrease in demand in the local consumer market is considered marginal due to ASF. It is not yet possible to draw broad conclusions on the ASF impact and domestic customer behaviour; however, there was undoubtedly some media coverage during the ASF outbreak, and the stagnation in pork consumption is more a reflection of contemporary eating patterns and trends. In any case, the decline can alert marketers, and the case can be a guide in innovation management.

4.2. Quantitative Results

4.2.1. General Meat Consumption

Our findings show that chicken is the most popular meat consumed by the respondents; pork is the second option. **Figure 13** presents how meat priority is distributed among the respondents in the Hungarian nation.

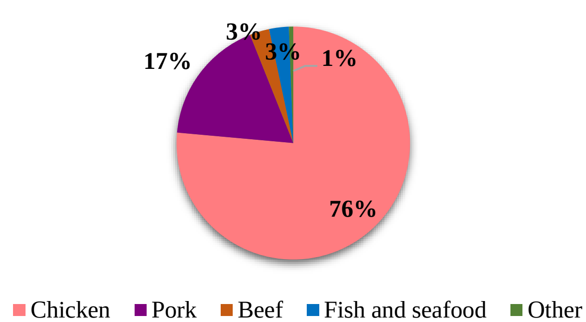

Figure 13: Most consumed meat type (in %, N=331)
Source: Own research, 2025

Chicken is the most popular meat, consumed by the majority of respondents (76.4%). With 17.5% of respondents, pork is the second most popular food source, followed by beef and fish, with

2.7% each. At just 0.3% each, duck and turkey are the least consumed. The findings align with previous research, meaning that in Hungary, chicken is the first choice.

Besides the most consumed meat type, the second choice includes pork as the main group, fish and seafood, and beef. Other meat types, such as turkey, rabbit, and lamb, can also be found on the respondents' tables. Our findings correlate with KSH's (2024) statistics and Vida's (2013) findings about meat consumption distribution among Hungarians. **Figure 14** below shows how other meat choices are distributed among respondents.

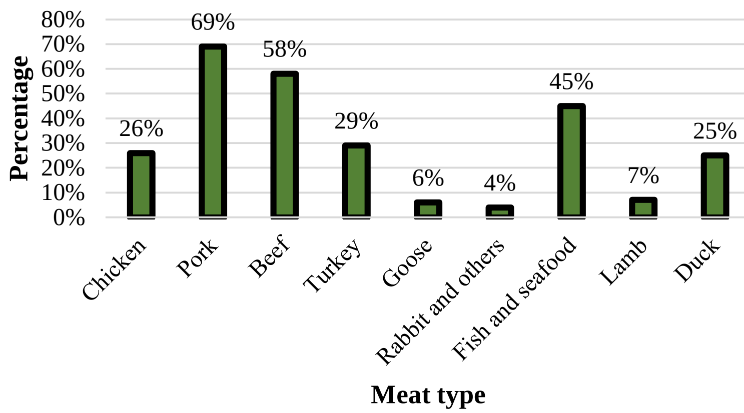

Figure 14: Other meat choices (in relative %, N=331)
Source: Own research, 2025

The graph shows that pork is a leading meat choice, besides the first choice. Almost 250 answers out of 331 selected pork with a relative percentage of 69%. Beef (accounts for 200 out of 331) and fish and seafood (150 out of 331) tower compared to other selections, 58% and 45%, respectively; however, among respondents, a vast diversity of meat types can be found in daily consumption. The graphs show us and provide an insight how meat is distributed among consumers with a specific view that pork is the second most popular meat choice among respondents.

Age group and **preferred meat type** are significantly correlated, according to the results of the chi-square test (**$\chi^2 = 24.762$, df = 4, $p < 0.001$**). The null hypothesis is rejected since the p-value is less than 0.05, suggesting that age groups have different preferences for meat. According to the research, pig consumption is more evenly distributed across age categories, but younger people (18–29) appear to like chicken the most. Nevertheless, 22.2% of the anticipated counts fall below 5, which could compromise the accuracy of the findings. The summary of internal relations and results can be observed in **Table 12**.

Table 12: Crosstbulation of meat preference by age groups

Meat type↓	Age group→	Young (18-29)	Middle-Aged (30-49)	Older (50+)	TOTAL
	Count	175	63	15	253
	Expected Count	159.7	72.6	20.6	253.0
Chicken	% within Meat	69.2%	24.9%	5.9%	100%
	% within Age	83.7%	66.3%	55.6%	76.4%
	Adj. Res.	**4.1***	**-2.8***	**-2.7***	
	Count	13	6	1	20
	Expected Count	12.6	5.7	1.6	20.0
Other Meat	% within Meat	65.0%	30.0%	5.0%	100%
	% within Age	6.2%	6.3%	3.7%	6.0%
	Adj. Res.	0.2	0.1	-0.5	
	Count	21	26	11	58
	Expected Count	36.6	16.6	4.7	58.0
Pork	% within Meat	36.2%	44.8%	19.0%	100%
	% within Age	10.0%	27.4%	40.7%	17.5%
	Adj. Res.	**-4.7***	**3.0***	**3.3***	

*Note: Adj. Res. = Adjusted Residuals; * indicates |Adj. Res.| > 1.96 (p < 0.05). % within Meat = Row percentage; % within Emp = Column percentage*

Source: Own research, 2025

Table 12 presents that a significant correlation between meat type and age group was found by a crosstabulation analysis (**χ^2 = 24.762, df = 4, p < 0.001**). While middle-aged (30–49) and elderly persons (50+) consumed more pork than anticipated (Adj. Res. = +3.0 and +3.3, respectively), young adults (18–29) disproportionately favoured chicken (83.7% of their age group; Adj. Res. = +4.1). In other words, young adults strongly prefer chicken, whereas middle-aged and older persons strongly favour pork over other meats. In other words, key trends reveal distinct generational differences, with the aspect that young people tend to choose chicken as their first choice.

4.2.2. Pork Consumption Trends

The frequency of pork consumption shows that pork is consumed several times a week in the largest ratio. **Figure 15** presents how pork consumption frequency differs among respondents.

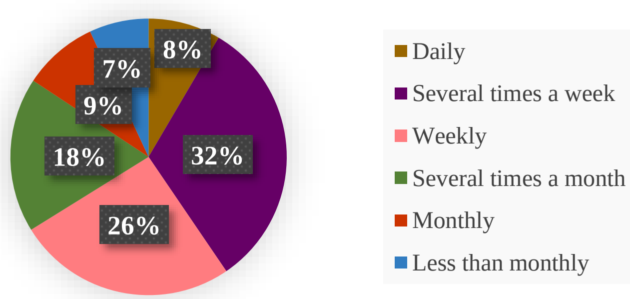

Figure 15: Frequency of pork consumption (in %, N=331)
Source: Own research, 2025

Most respondents eat pork frequently, with 25.7% eating it once a week and 32% eating it many times a week. Monthly consumption (8.8%) and several times a month (18.1%) are the least common trends. Merely 6.9% of people eat pork fewer than once a month. It can be concluded that the majority of respondents eat pork several times per week. This insight can generate marketing decisions in the pork market.

Pork **consumption frequency** and **gender** are significantly correlated, according to the chi-square test (**χ^2 = 13.776, df = 2, p =0.001**). While women were more likely to be occasional (Adj. Res. = +2.2) or rare (Adj. Res. = +2.0) consumers, men were overrepresented among frequent consumers (Adj. Res. = +3.6), which can be observed in **Table 13**.

Table 13: Crosstabulation of pork consumption frequency by gender

Consumption frequency↓	**Gender→**	**Female**	**Male**	**TOTAL**
Frequent consumers	Count	70	64	134
	% within freq	52.2%	47.8%	100%
	% within gender	33.2%	53.3%	40.5%
	Adj. Res.	**-3.6***	**3.6***	
Occasional consumers	Count	40	12	52
	% within freq	76.9%	23.1%	100%
	% within gender	19.0%	10.0%	15.7%
	Adj. Res.	**2.2***	**-2.2***	
Rare consumers	Count	101	44	145
	% within freq	69.7%	30.3%	100%
	% within gender	47.9%	36.7%	43.8%
	Adj. Res.	**2.0***	**-2.0***	

*Note: Adj. Residual = Adjusted Residual; * indicates significant difference (|Adj. Res.| > 1.96, p < 0.05). % within Frequency = Row percentage; % within Gender = Column percentage*

Source: Own research, 2025

Males are substantially more likely than females to consume pork frequently (53.3% vs. 33.2%; Adj. Res. = +3.6). Women are more prone to be: occasional eaters (19.0% against 10.0% of men; Adj. Res. = +2.2), Adj. Res. = +2.0; Rare Consumers (47.9% vs. 36.7% of males), based on the results in **Table 13**. Gender is a key driver which distinguishes pork eaters, with a specification of men eating pork more frequently than women.

Pork **consumption frequency** and **education level** are significantly correlated, according to the chi-square test (**χ^2 = 14.142, df = 4, p = 0.007**). While participants with medium education exhibited the opposite pattern for regular consumption (Adj. Res. = +2.1), those with low education were overrepresented among frequent consumers (Adj. Res. = +3.3) and underrepresented among regular consumers (Adj. Res. = -2.9). There were no appreciable departures from the expected frequencies in the higher education group. This implies that dietary decisions may be influenced by educational attainment (**Table 14**).

Table 14: Crosstabulation of pork consumption frequency by gender

Consumption frequency↓	**Education→**	**Higher education**	**Medium education**	**Low education**	**TOTAL**
Frequent consumers	Count	65	55	14	**134**
	% within freq	48.5%	41.0%	10.4%	100%
	% within educ	39.9%	36.7%	77.8%	40.5%
	Adj. Res.	-0.2	-1.3	**3.3***	
Occasional consumers	Count	30	20	2	52
	% within freq	57.7%	38.5%	3.8%	100%
	% within educ	18.4%	13.3%	11.1%	15.7%
	Adj. Res.	1.3	-1.1	-0.6	
Rare consumers	Count	68	75	2	145
	% within freq	46.9%	51.7%	1.4%	100%
	% within educ	41.7%	50.0%	11.1%	43.8%
	Adj. Res.	-0.8	**2.1***	**-2.9***	

*Note: Adj. Residual = Adjusted Residual; * indicates significant difference (|Adj. Res.| > 1.96, p < 0.05). % within Frequency = Row percentage; % within Education = Column percentage*

Source: Own research, 2025

Because there are just 18 people in the Low Education group, the results are not as trustworthy. Despite their borderline significance, the regular consumption variations between Medium and Higher Education (50.0% vs. 41.7%) can have practical significance. Both gender and education fall into socio-demographic aspects which could shape one's eating pattern.

4.2.2.1. Influencing Factors when Purchasing Pork

Several factors shape decisions when purchasing raw pork meat and processed pork. The table below summarises the descriptive statistics on the semantic differential scale responses on the importance of some aspects when purchasing pork meat and processed pork products (**Table 15**).

Table 15: Descriptive statistics on influencing factors when purchasing pork (N=331)

Descriptive statistics→ / **Attitudes↓**	**Raw pork meat**		**Processed pork products**	
	Mean	**Standard deviation**	**Mean**	**Standard deviation**
Freshness	**3.79**	**0.57**	**3.72**	**0.63**
Food safety	**3.53**	**0.76**	**3.53**	**0.76**
Price (HUF/kg)	**3.43**	**0.76**	**3.48**	**0.73**
Packaging	**3.13**	**0.84**	**3.27**	**0.84**
Breeding conditions	2.91	0.95	2.92	0.96
Hungarian product	2.86	0.94	2.84	0.94
Brand	/	/	2.67	0.96
Opinion, suggestion of friends	2.5	0.95	2.47	0.99
Ads, media messages	1.71	0.80	1.82	0.88

Source: Own research, 2025

The key elements of the findings are that consumers' top priorities are freshness (highest mean: 3.79 for raw, 3.72 for processed) and food safety (3.53 for both raw pork and processed pork). Additionally, price has a high rating (~3.4–3.5), suggesting that it is an important factor. Factors of moderate importance, those of mid-tier factors, include breeding circumstances (~2.9), Hungarian-origin products (~2.8–2.9), and packaging (~3.1–3.3). The least important factors for the respondents or the least influential factors are friends' opinions (~2.5) and advertisements/media messages (lowest mean: 1.7–1.8). While not a major factor, brand (only mentioned for processed goods, mean=2.67) is somewhat significant. Consistent responses show low standard deviations (for example, freshness: 0.57–0.63), indicating that its significance is widely acknowledged. Divergent views are indicated by higher variances (e.g., breeding conditions: ~0.95). When buying pig products, consumers place a higher priority on price, freshness, and food safety than they do on advertising or social impact. Compared to raw meat, processed foods place a little more emphasis on packaging and brand. **Figures 16** and **17** are a percentage overview of the important factors towards pork meat purchase, which shows that freshness, price and food safety are among the most important factors shaping purchasing behaviours.

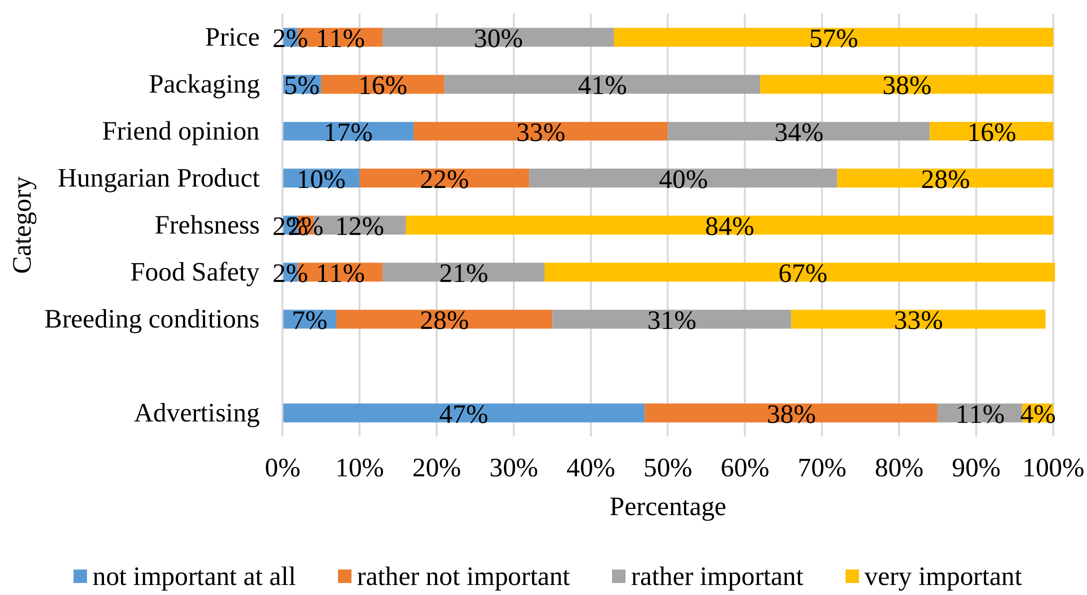

Figure 16: Factors when buying raw pork (in %, N=331)
Source: Own research, 2025

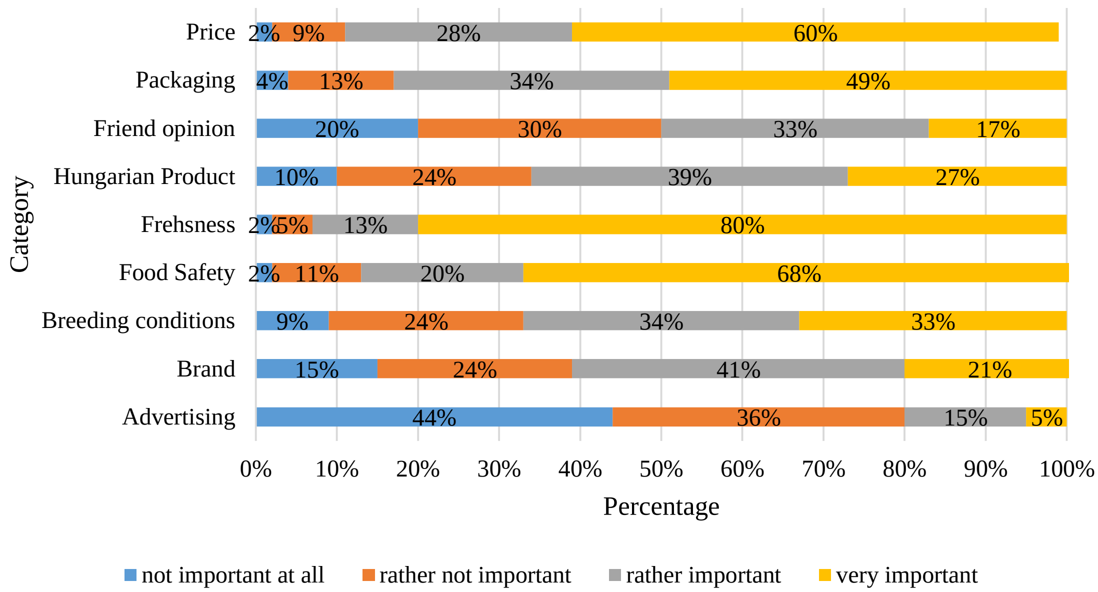

Figure 17: Factors when buying processed pork (in %, N=331)
Source: Own research, 2025

Figures 16 and **17** show that freshness, price and food safety are among the most important factors shaping purchasing behaviours. It can provide us with an insight into the key drivers which are considered when buying pork products.

Table 16 provides an overview and summary of general attitudes towards pork consumption and purchasing, including cheaper pork over quality, bulk buying and freshness associations, among others.

Table 16: Descriptive statistics on attitudes towards pork consumption (N=331)

Descriptive statistics→ / Attitude↓	Mean	Standard deviation
I always make sure to choose the freshest product.	**3.47**	**0.70**
I prefer pork of Hungarian origin over foreign-origin pork.	**3**	**0.98**
I am willing to buy new products over tried and tested products if they are more affordable.	2.6	0.91
During a sale, I am willing to buy more than I actually need.	2.5	1
When buying pork products, I always choose the lower-priced product, regardless of its quality rating.	2.07	0.91
I'm afraid there will be a food scandal with pork too in Hungary.	2	0.95
In restaurants, I usually choose dishes made with pork.	1.96	0.9
I also insist on preparing pork dishes during holidays and larger family events.	1.87	0.92

Source: Own research, 2025

Respondents tend to purchase the freshest product (mean = 3.47). The high mean (3) of Hungarian origin indicates that respondents prefer local-origin pork products over foreign-origin. In terms of quality and price, a sensitivity factor can be observed. "I always choose the lower-priced product, regardless of quality": the mean is 2.07. Which means that the majority of responders oppose putting price before quality. "During a sale, I buy more than I need." 2.5 is the mean, varying behaviour, with some being impacted by sales. "I buy new products if they're more affordable." Mean = 2.6 (leaning somewhat in the direction of agreement). Although sales have a minor impact, consumers are more concerned with quality and freshness than with low prices. In other words, freshness and local Hungarian provenance are given priority by respondents, despite price sensitivity and sales having considerable influence on purchasing behaviour. This suggests that quality and proximity are more important factors when it comes to meat purchases, other than price.

Price is a major consideration for most buyers, as indicated by the majority of respondents (57.4%), who believe it to be essential and 29.9%, who regard it to be somewhat important. This suggests that consumers' decisions on raw pork are significantly influenced by price. In terms of processed pork products, most respondents (60.1%) think it is extremely important, and 29.3% think it is somewhat important. This suggests that consumers' decisions to purchase processed pig products are significantly influenced by affordability. The association between **household income** and **price** attitudes was measured by a one-way ANOVA test. The results show significance level and are summarised in **Table 17**.

Table 17: The statistically significant assumptions between attitudes toward pork consumption and income level (N=331)

Attitude list	Income level	N	Mean	Standard deviation	F	p-value
Price of pork HUF/kg	Comfortable	94	3.19	0.820	6.985	<0.001
	Stable	147	3.52	0.655		
	Struggling	47	3.72	0.615		
	DK/do not want to say	43	3.30	0.914		
	Total	331	3.43	0.757		
When buying pork products, I always choose the lower-priced product, regardless of its quality rating.	Comfortable	94	1.79	0.890	11.101	<0.001
	Stable	147	2.04	0.835		
	Struggling	47	2.68	0.980		
	DK/do not want to say	43	2.12	0.823		
	Total	331	2.07	0.910		
During a sale, I am willing to buy more than I actually need.	Comfortable	94	2.30	0.960	4.404	0.005
	Stable	147	2.50	1.003		
	Struggling	47	2.94	0.978		
	DK/do not want to say	43	2.44	1.007		
	Total	331	2.50	1.004		
I am willing to buy new products over tried and tested products if they are more affordable.	Comfortable	94	2.35	0.888	9.823	<0.001
	Stable	147	2.57	0.876		
	Struggling	47	3.19	0.825		
	DK/do not want to say	43	2.63	0.133		
	Total	331	2.60	0.050		

Source: Own research, 2025

Price sensitivity (**F = 6.985, p < 0.001**), preference for low prices over quality (**F = 11.10, p < 0.001**), sale-driven stockpiling (**F = 4.40, p = 0.005**), and willingness to try inexpensive new products (**F = 9.82, p < 0.001**) were among the significant income-based differences in pork purchasing attitudes that were found by a one-way ANOVA. "Struggling" households (Mean = 3.72 ± 0.615) expressed the greatest concern over pork costs. The "DK" (3.30 ± 0.914) and "Stable" (3.52 ± 0.655) groups were in the middle. The least price-sensitive households were the "comfortable" group (3.19 ± 0.820). Pork costs are seen as more onerous by lower-income groups, indicating that consumers' perceptions of pork pricing are influenced by household income level. Those with "struggling" are more likely to view pricing as "very important," whereas those with higher incomes exhibit a more diverse distribution of importance levels. The price of pork has less of an impact on households with higher incomes ("Comfortable"), meaning that quality mostly takes higher importance among them, rather than a cheaper price. The trend points to a negative correlation between income level and pork price sensitivity. There are differing views among people with steady incomes since most of them either slightly agree or somewhat disagree with the statement. The majority of people in the comfortable income bracket strongly disagree, indicating that their decisions are not much influenced by decreasing pricing; they would rather choose quality over price tags. Respondents in the lower income category, on the other hand, are more likely to fully agree, suggesting that reduced pork prices have a greater impact on them. The distribution of opinions in the unknown/prefer not to say category is comparatively balanced.

The preference for **cheaper pork over quality** and **household income** is significantly correlated, according to the one-way ANOVA results (**F = 11.101, p < 0.001**). While individuals who are struggling financially are more likely to put money above quality (mean = 2.68 ± 0.980), respondents with comfortable income levels are more likely to disagree with the idea of always selecting cheaper pork (mean = 1.79 ± 0.890). The struggling income category has the largest percentage of respondents who fully agree with emphasising low prices, indicating that financial constraints have a substantial impact on pork purchasing decisions, prioritising affordability over quality.

An interesting result regarding bulk buying during sales was found. The **household income** and **purchasing pork in bulk** are statistically significantly correlated (**F = 4.404, p = 0.005**). While respondents from the "Comfortable" and "Stable" income groups are more evenly dispersed across all response levels (mean ~2.30–2.50), individuals from the "Struggling" income groups exhibit a greater propensity to agree with bulk purchases (mean = 2.94 ± 0.978). This implies that consumers' desire to purchase pork in greater quantities may be influenced by their financial security. Meaning that the income level could truly impact how people purchase pork, but differs regarding bulk buying during sales.

The results found that people tend to try new pork products if those are cheaper than the ones they used to buy out of habit. The desire for **new and cheaper pork** and **household income** are statistically significantly correlated, according to the one-way ANOVA test (**F = 9.823, p < 0.001**). While respondents in the comfortable income groups were more similarly split among the response categories (mean = 2.35 ± 0.888), those in the struggling income group were more likely to agree with the idea that affordability should be prioritised (mean = 3.19 ± 0.825). This implies that consumers' economic standing affects how much they value affordability while buying pork. Lower-income consumers are more open to unfamiliar but cheaper products.

To sum up, there were notable differences in pork-buying habits based on wealth, according to the post-hoc Tukey HSD analysis. Most significantly, low-income households showed price sensitivity for raw pork was 52% higher than that of comfortable households (MD = 0.53, p <.001). 89% more likely to choose affordability before quality (MD = 0.89, p <.001). 64% higher propensity to buy in bulk during sales (MD = 0.64, p =.002).

All these findings present that price is a driving factor, especially among those people whose subjective income is not very satisfying. People who fall into struggling groups tend to buy in bulk during sales, and try new but cheaper products. These all can be used as a guide in the market.

Freshness is strongly preferred (mean=3.47). When buying raw pork, people place a high value on freshness. Of those surveyed, 84.3% think it is extremely important, and 11.8% think it is somewhat important. Just 3.9% of respondents believe that freshness is less important. This suggests that freshness plays a significant role in customer decisions and probably affects how they perceive quality and safety. When buying processed pork, customers place a high value on freshness, with 80.1% saying it is very important and 13.3% saying it is somewhat important. Just 5.1% of respondents think it is somewhat unimportant, and 1.5% don't think it is significant at all. This suggests that the freshness of processed pig products is highly valued by most customers. Local pork is greatly preferred by a sizable segment. A subset of values local origin (Hungarian product) and freshness, plays an important role when purchasing pork products. A noteworthy 31.8% of respondents believe it is not significant or rather not important, despite 40.2% finding it to be very important and 28.1% viewing it as extremely important. This implies that although a significant percentage of consumers do not give Hungarian-origin pork top priority when making judgments about what to buy, many do value it. Hungarian-origin processed pork is comparatively well-liked by consumers, who rate it as rather significant (38.7%) and extremely important (27.5%). Nonetheless, a sizable percentage (23.9%) believe it is not very important, and 10.0% do not think it is important at all. This implies that although a significant portion of consumers do not give provenance top priority when making purchases, many do favour pork that is supplied locally. **Table 18** summarises statistically significant assumptions.

Table 18: Significant assumptions between freshness and Hungarian origin of pork products and age (N=331)

Attitude list	Age-group	N	Mean	Standard deviation	F	p-value
Freshness (raw pork)	Young (18-29)	209	3.75	0.595	2.024	0.134
	Middle-Aged (30-49)	95	3.82	0.565		
	Older (50+)	27	3.96	0.192		
	Total	331	3.79	0.566		
Freshness (processed pork)	Young (18-29)	209	3.64	0.695	5.201	**0.006***
	Middle-Aged (30-49)	95	3.84	0.512		
	Older (50+)	27	3.93	0.267		
	Total	331	3.72	0.630		
Hungarian product (raw pork)	Young (18-29)	209	2.72	0.882	9.696	**<0.001***
	Middle-Aged (30-49)	95	3	1.021		
	Older (50+)	27	3.48	0.753		
	Total	331	2.86	0.939		
Hungarian product (processed pork)	Young (18-29)	209	2.69	0.910	11.611	**<0.001***
	Middle-Aged (30-49)	95	2.95	0.993		
	Older (50+)	27	3.56	0.577		
	Total	331	2.84	0.943		

*Note: * indicates significant difference (|F| > 2, p < 0.05)*

Source: Own research, 2025

These results in **Table 18** demonstrate how age clearly influences consumer preferences, with younger respondents showing higher price sensitivity and being more receptive to non-local products, while older groups place more value on local origin and freshness.

The **age group** and the value placed on processed pork **freshness** appear to be statistically related, according to the test (**F = 5.201, p = 0.006**). Young adults (18–29) demonstrated lower and more erratic evaluations of freshness (processed pork: mean = 3.64, SD = 0.70), while senior customers (50+) reported the highest scores for both raw (mean = 3.96) and processed pork (mean = 3.93). **Age group** and desire for pork of **Hungarian origin** are statistically significantly correlated, according to the results of one-way ANOVA (**F = 9.696, p <0.001; F = 11.611, p <0.001**). Younger respondents (18–29 years old) are more likely to say that Hungarian pork is “not important at all” or "rather not important," whereas middle-aged and older respondents are more likely to say that it is "rather important" or "very important." The substantial p-value indicates that consumer perceptions of Hungarian pork are influenced by age. Preferences by national origin revealed a distinct age gradient. Young adults had a neutral-to-moderate preference for Hungarian products (raw pork: mean = 2.72; processed pork: mean = 2.69), whereas older customers had a high preference for them (raw pork: mean = 3.48; processed pork: mean = 3.56).

4.2.2.2. Source of Pork

In terms of pork sources, there are various options for people can buy fresh meat or processed pork products. In our survey, we also asked about people's purchasing patterns towards pork sources. **Figure 20** below presents the source of purchasing. Some of the respondents purchase pork at hypermarkets or at butchers; however, there are people sourcing pork meat and pork products from home-breeders.

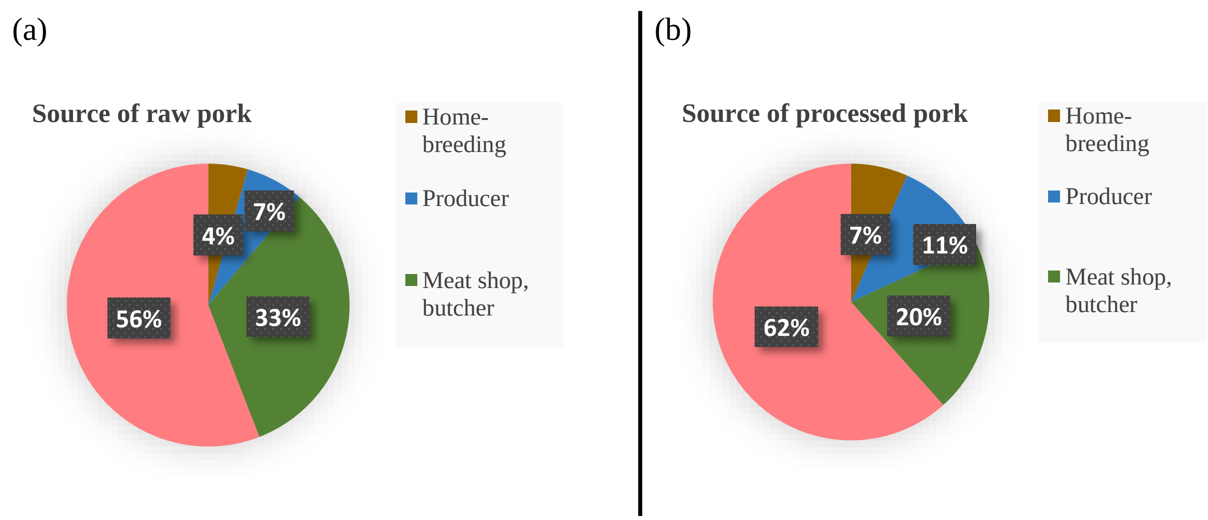

Figure 18:Source of (a) raw pork meat; (b) processed pork (in %, N=331)
Source: Own research, 2025

While 32.9% of customers prefer meat stores or butchers, the majority of consumers (55.9%) buy raw pork from supermarkets, hypermarkets, or other retail locations. Pork is only obtained from producers directly by a limited percentage (6.6%) or through home breeding (4.5%). This implies that conventional butcher shops continue to have a significant presence, indicating that accessibility and convenience are important factors in purchase decisions. While 20.2% prefer meat stores or butchers, the majority of respondents (61.3%) buy processed pork from supermarkets, hypermarkets, or other retail locations. A lesser percentage obtains pork from home breeding (6.6%) or directly from producers (11.5%). This suggests that processed pork is most commonly seen in supermarkets and retail establishments, most likely due to convenience and variety. The fact which can be observed is that buying from butchers is more popular among raw pork (33%), rather than processed pork (20%).

The **type of settlement** and the **source** from which customers buy raw pork are significantly correlated, according to the chi-square test (**$\chi^2 = 26.134$, df = 9, p = 0.002**). While people in rural areas exhibit a comparatively stronger preference for home-breeding and direct producers, residents in the capital primarily purchase their goods from supermarkets. The findings imply that, whereas rural consumers have a variety of buying patterns, including traditional sources like butchers and home production, urban consumers are more dependent on retail establishments (**Table 19**).

Table 19: Assumption of source of pork by settlement type (N=331)

Raw pork source↓	**Settlement type→**	**Capital**	**County town**	**Other town**	**Other settlement**	**TOTAL**
Home-breeding	Count	4	3	3	5	15
	Expected Count	6.4	3.1	3.1	2.4	15
	% within source	26.7%	20%	20%	33.3%	100%
	% within set. type	2.8%	4.3%	4.3%	9.6%	4.5%
	Adj. Res.	-1.3	-0.1	-0.1	1.9	
From producer	Count	7	6	3	6	22
	Expected Count	9.4	4.6	4.6	3.5	22
	% within source	31.8%	27.3%	13.6%	27.3%	100%
	% within set. type	5%	8.7%	4.3%	11.5%	6.6%
	Adj. Res.	-1.1	0.8	-0.9	1.5	
Meat shop, butcher	Count	33	22	34	20	109
	Expected Count	46.4	22.7	22.7	17.1	109
	% within source	30.3%	20.2%	31.2%	18.3%	100%
	% within set. type	23.4%	31.9%	49.3%	38.5%	32.9%
	Adj. Res.	**-3.2***	-0.2	**3.2***	0.9	
Hypermarket, supermarket, or other retail	Count	97	38	29	21	185
	Expected Count	78.8	38.6	38.6	29.1	185
	% within source	52.4%	20.5%	15.7%	11.4%	100%
	% within set. type	68.8%	55.1%	42%	40.4%	55.9%
	Adj. Res.	**4.1***	-0.2	**-2.6***	**-2.5***	

*Note: Adj. Res. = Adjusted Residuals; * indicates |Adj. Res.| > 1.96 (p < 0.05). % within source = Row percentage; % within settlement type = Column percentage*

Source: Own research, 2025

The data shows that rural and urban areas have different procurement trends. 55.9% of total purchases were made at hypermarkets or supermarkets, with a notably high percentage in capital cities (68.8%, adjusted residual = +4.1). In rural areas, this source was substantially underestimated (40.4%, adjusted residual = -2.5). In other towns, 49.3% of purchases were made via meat shops or butchers (adjusted residual = +3.2). The percentage seen in capital cities (23.4%, corrected residual = -3.2) was almost doubled.

These findings indicate a pronounced pork procurement disparity between urban and rural areas, as urban consumers prefer modern retail channels. Traditional market relationships are stronger in smaller cities, other settlements. Local sourcing and direct production are more prevalent in rural areas. This trend most likely reflects variations in market accessibility, infrastructure, and cultural preferences among settlement types.

4.2.3. Pork Consumption Pattern Changes Due to a Disruption of the African Swine Fever Outbreak

A hypothetical situation of an ASF outbreak was given, and respondents provided answers according to their beliefs and driving factors on pork consumption changes in the case of a disruption of ASF impacting domesticated pigs. **Table 20** provides an overview of attitudes towards pork purchase during an ASF outbreak in different scenarios. The majority of statements had low means (1.84–2.22), indicating neutrality or disapproval with the continuation of regular pork purchases. “Under no circumstances would I buy raw pork/processed pork...” has the highest means (~2.7). Mean = 2.77 and Mean = 2.72, respectively. This suggests that there is moderate to strong support for staying away from pork completely throughout the outbreak.

Table 20: Descriptive statistics on attitudes towards pork purchase after an ASF outbreak (N=331)

Descriptive Statistics→ Attitude lists↓	**Mean**	**Standard deviation**
Under no circumstances would I buy raw pork (minced meat, chops, thighs, etc.) during the outbreak.	2.77	1.12
Under no circumstances would I buy processed pork products (sausages, bacon, salami, etc.) during the outbreak.	2.72	1.12
I would buy processed pork products (sausages, bacon, salami, etc.) in the same way as before the outbreak of African swine fever.	2.22	1.03
I would buy raw pork (minced meat, loin, thighs, etc.) the same way I did before the African swine fever outbreak.	2.10	1.02
I would still buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak even if their prices had increased than before the African swine fever outbreak.	1.88	0.95
I would be willing to buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	1.86	0.92
I would still buy raw pork (minced meat, loin, thighs, etc.) even if its price had increased during the African swine fever outbreak than before the African swine fever outbreak.	1.86	0.92
I would be willing to buy raw pork (minced meat, loin, thighs, etc.) during the African swine fever outbreak if the price was lower than before the African swine fever outbreak.	1.84	0.95

Source: Own research, 2025

Price sensitivity showed that respondents were somewhat more inclined to purchase pork if prices dropped (means ~1.84–1.86) as opposed to rising (means ~1.86–1.88). Even with discounts, these means all fall below 2, indicating poor agreement. Somewhat higher means for processed foods (such as bacon and sausages) than for raw pork, suggesting a slightly stronger propensity to purchase processed foods (Mean = 2.22) as opposed to raw pork (Mean = 2.10). Low standard deviations (0.92–1.12) indicate that there is moderate agreement among the responses, which cluster around the mean.

In other words, the results show low agreement, with mean ratings persistently below neutral (≤2.77), indicating substantial customer reluctance to buy pork during an ASF outbreak. Overall resistance remained, particularly for raw pork, even though price reductions marginally enhanced willingness (means ~1.84–1.86), indicating that safety concerns exceed price incentives during health crises. Due to their perceived lower risk, processed items experienced slightly less reluctance.

In **Figure 19**, we can observe the percentage responses on attitudes after an ASF outbreak. Of those surveyed, 61.9% strongly disagree that they would purchase raw pork in the same manner as they did before the ASF outbreak. This suggests that the ASF outbreak had a substantial impact on consumer behaviour because it shows a great reluctance to continue buying raw pork as previously.

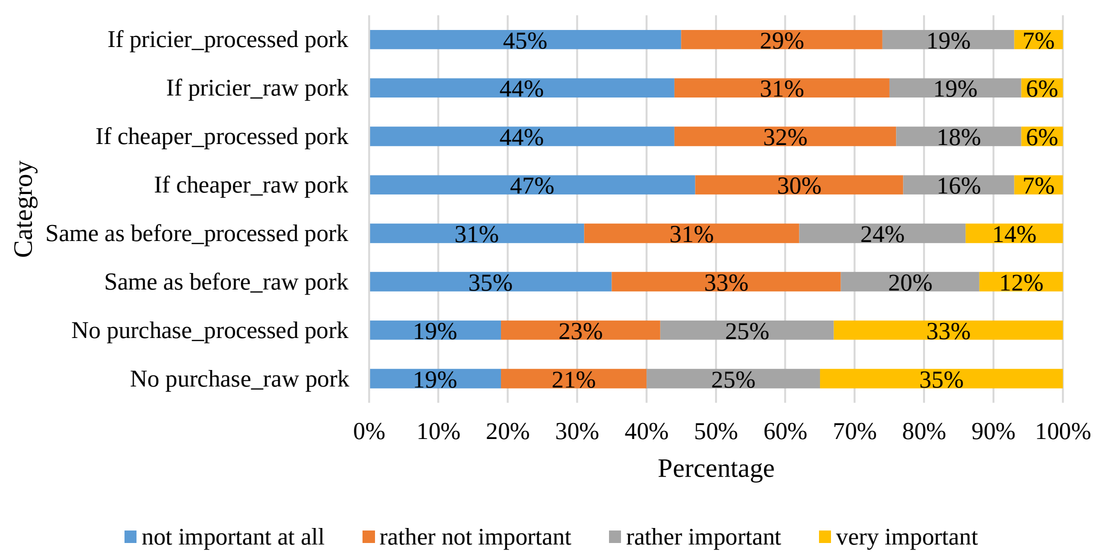

Figure 19: Consumer purchasing attitudes towards pork after an ASF outbreak, percentage (in %, N=331)
Source: Own research, 2025

66.7% of respondents are completely opposed to purchasing processed pork in the same manner as before the ASF outbreak, followed by 28.6% who are indifferent and only 4.8% who agree. According to the figure, 61.9% of respondents strongly disagree with paying more for raw pork during the ASF outbreak. This suggests that only a tiny percentage of consumers are willing to spend more for raw pork in such circumstances, with the majority not even considering it. 61.9% of respondents are completely opposed to purchasing processed pork at a reduced cost during the ASF outbreak, for instance, compared to 28.6% who are indifferent and just 9.5% who agree. This implies that when buying processed pork during a disease epidemic, the majority of consumers still put health concerns ahead of price savings.

To conclude, during an ASF outbreak, over 60% of customers strongly oppose buying pork (raw and processed), and only a small percentage accept price reductions. This suggests that health and safety concerns take precedence over financial factors when making purchases.

Figure 20 provides an insight into how respondents rate personal beliefs on ASF posing a health risk.

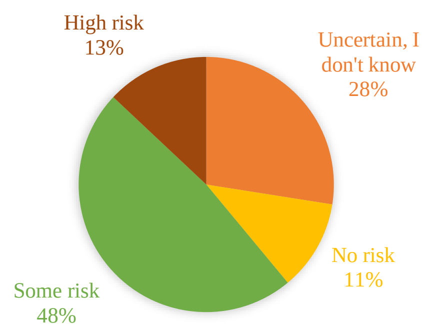

Figure 20: **Considering the ASF poses a risk to personal health (in %, N=331)**
Source: Own research, 2025

While 13.0% of respondents believe that ASF poses a considerable risk to their health, the majority of respondents (48.0%) believe that it carries some risk. On the other hand, 27.5% are unsure, and 11.5% think there is no risk. According to these results, a considerable percentage of people are still unaware of the true effects of ASF on health, even though many recognise it as a possible hazard. **Table 21** presents significant results on purchase pattern changes due to disruption.

Table 21: Assumptions between pork consumption and purchase pattern changes during ASF by health risk perception (N=331)

Attitude list	Health risk concern	N	Mean	Standard deviation	F	p-value
I would buy raw pork (minced meat, loin, thighs, etc.) the same way I did before the African swine fever outbreak.	High risk	43	1.77	1.020	8.985	<0.001
	Some risk	38	2.82	1.087		
	No risk	159	2.09	0.940		
	Uncertain, I do not know	91	1.96	0.999		
	Total	331	2.10	1.019		
I would buy processed pork products (sausages, bacon, salami, etc.) in the same way as before the outbreak of African swine fever.	High risk	43	1.84	1.067	6.674	<0.001
	Some risk	38	2.82	1.111		
	No risk	159	2.22	0.952		
	Uncertain, I do not know	91	2.14	1.028		
	Total	331	2.22	1.033		
I would be willing to buy raw pork (minced meat, loin, thighs, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	High risk	43	1.63	1.001	5.848	<0.001
	Some risk	38	2.39	1.054		
	No risk	159	1.84	0.931		
	Uncertain, I do not know	91	1.71	0.820		
	Total	331	1.84	0.947		
I would be willing to buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	High risk	43	1.56	0.765	5.825	<0.001
	Some risk	38	2.34	1.072		
	No risk	159	1.90	0.922		
	Uncertain, I do not know	91	1.75	0.838		
	Total	331	1.86	0.919		
I would still buy raw pork (minced meat, loin, thighs, etc.) even if its price had increased during the African swine fever outbreak than before the African swine fever outbreak.	High risk	43	1.53	0.855	5.191	0.002
	Some risk	38	2.26	0.921		
	No risk	159	1.92	0.934		
	Uncertain, I do not know	91	1.74	0.854		
	Total	331	1.86	0.918		
I would still buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak even if their prices had increased than before the African swine fever outbreak.	High risk	43	1.60	0.955	3.835	0.010
	Some risk	38	2.21	1.018		
	No risk	159	1.95	0.947		
	Uncertain, I do not know	91	1.74	0.867		
	Total	331	1.88	0.947		
Under no circumstances would I buy raw pork (minced meat, chops, thighs, etc.) during the outbreak.	High risk	43	3.02	1.165	6.088	<0.001
	Some risk	38	2.08	1.100		
	No risk	159	2.83	1.074		
	Uncertain, I do not know	91	2.85	1.105		
	Total	331	2.77	1.123		
Under no circumstances would I buy processed pork products (sausages, bacon, salami, etc.) during the outbreak.	High risk	43	2.98	1.123	4.266	0.006
	Some risk	38	2.16	1.151		
	No risk	159	2.74	1.069		
	Uncertain, I do not know	91	2.80	1.128		
	Total	331	2.72	1.118		

Source: Own research, 2025

The table summarises that regardless of price changes, consumers who perceive high health risks from ASF are significantly less likely to buy pork (raw or processed) (means 1.53–1.77), whereas consumers who perceive some risk are more price sensitive (means up to 2.82), demonstrating that during disease outbreaks, safety concerns take precedence over financial incentives. This sums up the main conclusion: price reductions among less concerned populations are the only mild exception to the rule that risk perception promotes avoidance.

The association between people's willingness to refrain from buying raw pork (**no purchase**) and their perception of the **health hazards** associated with ASF is assessed using the one-way ANOVA test (**F = 6.088, p <0.001**). This implies that people's perceptions of the health hazards associated with ASF have an impact on their desire to abstain from raw pork. While those who "do not agree at all" exhibit greater diversity in their risk perception, those who "totally agree" with avoiding raw pork are more likely to view ASF as a high or moderate danger to their health. These results demonstrate how consumer behaviour around raw pork is impacted by ASF health concerns. One-way ANOVA test regarding the connection between people's willingness to refrain from buying (**no purchase**) processed pork and their perception of the **health concerns** associated with ASF also shows statistically significant results (**F = 4.266, p = 0.006**) at the 5% level. This implies that people's perceptions of the health hazards associated with ASF have an impact on their decisions to purchase processed pork. People who "do not agree at all" had a more mixed or ambiguous view of ASF, whereas those who "totally agree" with avoiding processed pork typically view it as a high or moderate danger. The results show a strong correlation between processed pork consumer behaviour and ASF health issues. In other words, those respondents who think ASF poses a high risk or some risk to their health are more likely to refuse to purchase pork after an ASF outbreak.

Concerns about food safety greatly impacted consumer behaviour during the ASF outbreak, as evidenced by the large percentage of respondents who think food safety is essential and strongly agree with not buying processed pork. The highest avoidance for raw pork (mean = 3.02, SD = 1.17) and processed pork (M = 2.98, SD = 1.12) was among consumers who felt ASF posed a high risk to their health. The group that did not take any risks exhibited the least amount of avoidance (raw pork: mean = 2.08; processed pork: mean = 2.16). A few risk and unclear groups clustered close to the overall mean (~2.7–2.9), indicating intermediate avoidance.

The ANOVA analysis presents the significant correlation between the assumptions of **continued purchase** and **health concerns** (raw pork: **F =8.985, p <0.001**; processed pork: **F =6.674, p <0.001**). The risk-bare (no risk) group has the highest mean for raw pork (2.82) and processed pork (2.82), indicating that those consumers maintain pre-outbreak consumption levels, while the high-risk group reflects reduced consumption (mean = 1.77 and 1.84). A significant assumption can be measured between **purchase if cheaper** and **health concerns** (raw pork: **F = 5.848, p <0.001**;

processed pork: **F = 5.825, p <0.001**). If pork costs less, a price sensitivity can be observed among respondents considering whether ASF poses a risk or not. The least affected group are people who think ASF poses a high risk to their health, with a mean of 1.63 and 1.56, because they are more likely to avoid pork purchase in any case if ASF happens. Those people who fall in the no-risk group are impacted by the price changes and are more likely to buy pork products if prices drop (mean = 2.39 and 2.35). The ANOVA analysis presents the significant correlation between the assumptions of **purchase if pricier** and **health concerns** (raw pork: **F =5.191, p = 0.002**; processed pork: **F = 3.835, p = 0.010**). According to the results, people fall in no risk group are most willing to purchase pork prodcuts if those price increase (raw pork: mean = 2.26; processed pork: mean = 2.21), while those people who fell in high-risk group are the least impacted by price increase, since they would completely avoid pork purchase in case of ASF (raw pork: mean = 2.26; processed pork: mean = 2.21). Behaviour is driven by risk perception; regardless of price changes, customers who view ASF as high risk consume less pork. Furthermore, different risk groups have different price elasticity. Respondents who answered that ASF has no risk to personal health are sensitive to price decreases and increases, but still willing to purchase pork. The high-risk group is indifferent to price and puts safety first; they are more likely to stop purchasing pork products. With high-risk consumers being the least price-sensitive and most avoidant, the study demonstrates that ASF risk perception has a substantial impact on pork consumption behaviour.

To sum up, health concerns outweigh price sensitivity during disease outbreaks, as evidenced by the strongest avoidance of pork among consumers who view ASF as a high health risk, while those who do not perceive any risk are still willing to buy even at higher prices. The study demonstrates a distinct gap in consumer decision-making during health emergencies by confirming that risk perception determines pork consumption behaviour, with low-risk groups reacting to price fluctuations and high-risk groups emphasising safety.

Related to the previous findings, we can conclude that a hypothetical ASF outbreak could impact consumer attitudes towards pork. In **Figure 21,** the pattern changes towards pork meat can be assessed before and after a hypothetical ASF outbreak. It is obvious from the chart that ASF could pose a sharp decline among people.

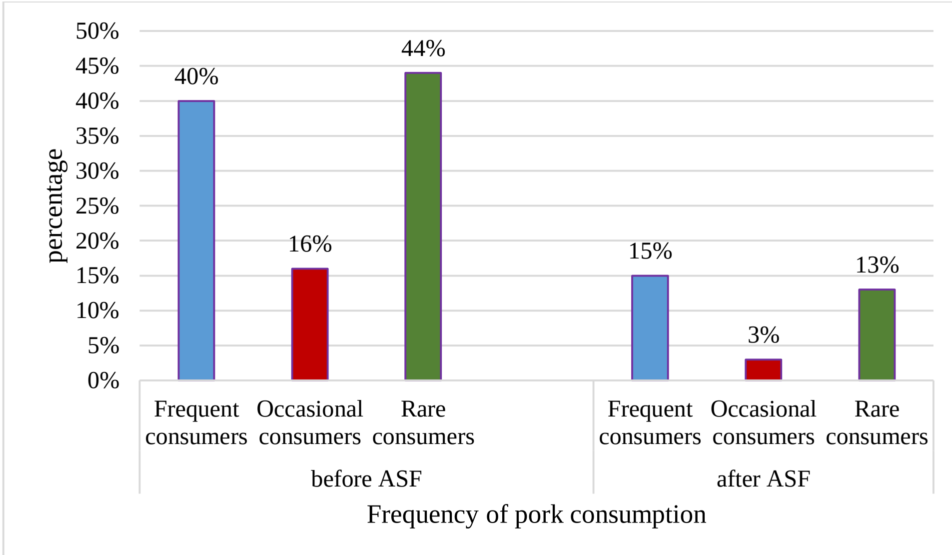

Figure 21: Pork consumption frequency before and after ASF, (in %, N=331)
Source: Own research, 2025

The graph illustrates how pork consumption would decline after a hypothetical ASF outbreak among respondents. The three categories all represent a sharp decrease in pork consumption. The data set was divided into frequent consumers, occasional and rare consumers; all of the representatives presented a decrease in pork purchases. In the case of frequent consumers, only 15% would buy and consume pork meat the same way as before the ASF outbreak. 3% and 13%, respectively, can be viewed in the case of occasional or rare pork consumers. Among frequent consumers, a 60% decline can be described in pork consumption due to the ASF outbreak disruption. Previously, we could observe that the association of ASF posing a risk to personal health affects and impacts pork consumption behaviour. Only a few of the respondents are willing to continue buying pork meat the same way as before the ASF outbreak.

During an ASF outbreak, there is a statistically significant correlation between the **frequency of pork consumption** and the readiness to **keep buying** pork products. The summary of results can be seen in **Table 22**.

Table 22: Assumption of continued pork products purchase in case of ASF disruption by the frequency of pork consumption habits (N=331)

Attitude list	Consumption frequency	N	Mean	Standard deviation	F	p-value
I would buy raw pork (minced meat, loin, thighs, etc.) the same way I did before the African swine fever outbreak.	Frequent	134	2.25	1.051	5.288	0.005
	Occasional	52	1.71	0.848		
	Rare	145	2.10	1.016		
	Total	331	2.10	1.019		
I would buy processed pork products (sausages, bacon, salami, etc.) in the same way as before the outbreak of African swine fever.	Frequent	134	2.30	1.033	3.290	0.038
	Occasional	52	1.88	1.041		
	Rare	145	2.26	1.014		
	Total	331	2.22	1.033		
I would be willing to buy raw pork (minced meat, loin, thighs, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	Frequent	134	2.00	0.958	3.147	0.044
	Occasional	52	1.75	1.027		
	Rare	145	1.73	0.892		
	Total	331	1.84	0.947		
I would be willing to buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	Frequent	134	2.01	0.950	3.408	0.034
	Occasional	52	1.67	0.857		
	Rare	145	1.79	0.897		
	Total	331	1.86	0.919		
I would still buy raw pork (minced meat, loin, thighs, etc.) even if its price had increased during the African swine fever outbreak than before the African swine fever outbreak.	Frequent	134	2.07	0.970	7.063	<0.001
	Occasional	52	1.60	0.823		
	Rare	145	1.75	0.862		
	Total	331	1.86	0.918		
I would still buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak even if their prices had increased than before the African swine fever outbreak.	Frequent	134	2.05	0.968	4.248	0.015
	Occasional	52	1.67	0.923		
	Rare	145	1.79	0.914		
	Total	331	1.88	0.947		

Source: Own research, 2025

At pre-outbreak levels, frequent buyers were most likely to continue buying both raw (M=2.25, SD=1.05) and processed pork (M=2.30, SD=1.03). Conversely, the biggest significant decline in consumption intentions was observed among infrequent consumers (raw pork: M=1.71; processed pork: M=1.88). Between these groups, rare customers' sentiments decreased (raw pork: M=2.10; processed pork: M=2.26). According to these results, the frequency of intake is a strong predictor of how people will behave in the event of a food safety emergency. The findings hold that regular customers exhibit more resilient buying patterns because they are probably more familiar with and trust the product. There are significant ramifications for the price sensitivity gradient between groups. Regular customers responded best to price changes, intending to buy pork when it became expensive (raw pork: M=2.07; processed pork: M=2.05) or less expensive (raw pork: M=2.00; processed pork: M=2.01) due to ASF. Occasional and rare customers may be the group most at risk of permanent market exclusion during food safety emergencies, as they are more likely to avoid pork purchases if the price shifts.

The findings in the table capture (1) the frequency-consumption relationship, (2) price sensitivity differences, and (3) market risk implications in a single evidence-packed sentence. While infrequent consumers showed significant avoidance, frequent pork buyers demonstrated the highest resilience to ASF-related disruptions, maintaining near-pre-outbreak purchase levels and greater price sensitivity. This suggests that consumption frequency predicts crisis response behaviour and market retention risks.

Significant variations in consumption patterns after an ASF outbreak in **continued pork purchase** by **source of purchase** were found by the ANOVA findings (**Table 23**)**.** For raw pork continuity, for instance, home-breeding consumers showed the highest persistence with a mean =2.80, followed by direct-from-producer (M=2.50), while respondents who mostly buy raw pork in supermarkets or other retail shops were least persistent (M=2.00). A similar pattern emerged for processed pork (**F = 2.85, p = 0.037**).

Table 23: Assumption of continued pork products purchase in case of ASF disruption by the source of purchase habits (N=331)

Attitude list	Sourcing	N	Mean	Standard deviation	F	p-value
I would buy raw pork (minced meat, loin, thighs, etc.) the same way I did before the African swine fever outbreak.	From producer	22	2.50	1.10	4.209	0.006
	Home-breeding	15	2.80	1.27		
	Hypermarket, supermarket, other retail	185	2.00	0.96		
	Meat shop, butcher	109	2.08	1.02		
	Total	331	2.10	1.02		
I would buy processed pork products (sausages, bacon, salami, etc.) in the same way as before the outbreak of African swine fever.	From producer	22	2.50	1.06	2.854	0.037
	Home-breeding	15	2.87	1.25		
	Hypermarket, supermarket, other retail	185	2.17	1.00		
	Meat shop, butcher	109	2.15	1.04		
	Total	331	2.22	1.03		
I would be willing to buy raw pork (minced meat, loin, thighs, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	From producer	22	2.23	1.07	3.384	0.018
	Home-breeding	15	2.40	1.12		
	Hypermarket, supermarket, other retail	185	1.79	0.93		
	Meat shop, butcher	109	1.77	0.90		
	Total	331	1.84	0.95		
I would be willing to buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	From producer	22	2.18	1.10	3.454	0.017
	Home-breeding	15	2.47	1.13		
	Hypermarket, supermarket, other retail	185	1.82	0.90		
	Meat shop, butcher	109	1.80	0.85		
	Total	331	1.86	0.92		
I would still buy raw pork (minced meat, loin, thighs, etc.) even if its price had increased during the African swine fever outbreak than before the African swine fever outbreak.	From producer	22	2.27	1.032	3.269	0.022
	Home-breeding	15	2.33	1.113		
	Hypermarket, supermarket, other retail	185	1.79	0.879		
	Meat shop, butcher	109	1.82	0.904		
	Total	331	1.86	0.918		
I would still buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak even if their prices had increased than before the African swine fever outbreak.	From producer	22	2.27	1.077	3.268	0.022
	Home-breeding	15	2.40	0.986		
	Hypermarket, supermarket, other retail	185	1.81	0.918		
	Meat shop, butcher	109	1.84	0.935		
	Total	331	1.88	0.947		

Source: Own research, 2025

Compared to retail consumers (M=1.77- 1.82), direct-from-producer and home-breeding groups were considerably more likely to buy if prices declined (raw pork: M=2.23-2.40; processed pork: M=2.18-2.47, where **F = 3.384** and **3.454; p = 0.018** and **0.017**). When prices rose, this pattern persisted (**$F \geq 3.27$, $p \leq 0.022$**). Direct producer partnerships' intrinsic transparency and trust seem to act as a shield against ASF concerns, as shown by the results. Continuity of consumption through non-retail channels, mostly from home-breeding or direct-from-producer channels. Increased price elasticity, or the capacity to purchase despite price fluctuations, also concentrates mostly on those respondents who source from home-breeding or directly from producers. The dual attitude phenomenon, which may be a reflection of complex risk assessment, occurs when direct purchasers report both high intentions to avoid and high sustained use.

To sum up, consumers sourcing pork directly from producers or home-breeding showed greater price resilience than retail buyers during ASF outbreaks, suggesting that supply-chain transparency and trust mitigate risk concerns and sustain consumption despite price fluctuations. In a single, coherent statement, this encapsulates the crucial analogy, the mechanism of trust, price resilience, and the wider implications regarding supply chains.

4.2.3.1. Price Sensitivity after Price Differences During an ASF Disruption

The desire to purchase **cheaper pork** during the ASF outbreak was statistically correlated with **household income**, according to the one-way ANOVA test (raw pork: **F = 3.616, p = 0.014**, processed pork: **F = 5.928, p <0.001**) and is summarised in **Table 24**.

Table 24: Assumption of decreased pork products due to ASF disruption and income level (N=331)

Attitude list	Income level	N	Mean	Standard deviation	F	p-value
I would be willing to buy raw pork (minced meat, loin, thighs, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	Comfortable	94	1.71	0.969	3.616	0.014
	Stable	147	1.78	0.856		
	Struggling	47	2.23	1.068		
	DK, prefer not to say	43	1.91	0.971		
	Total	331	1.84	0.947		
I would be willing to buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	Comfortable	94	1.67	0.872	5.928	<0.001
	Stable	147	1.83	0.831		
	Struggling	47	2.34	1.128		
	DK, prefer not to say	43	1.88	0.905		
	Total	331	1.86	0.919		

Source: Own research, 2025

The struggling group is most willing to purchase pork, both raw and processed, if it is less expensive (raw pork: M=2.23; processed pork: M=2.34). The group that is most at ease has the least amount of willingness (raw pork: M=1.71; processed pork: M=1.67). Customers in financial hardship were substantially more inclined to buy raw pork than customers in comfort. For processed pork, this tendency was much more pronounced. This suggests that while people in more secure financial situations are generally reluctant to purchase cheaper pork, lower-income groups, especially those who are struggling, are more inclined to place a higher value on pricing than on perceived health hazards, so they would more likely to purchase pork in case of a decresed price of pork during an ASF outbreak.

This implies that in situations involving ASF, purchase decisions are influenced by income status. Financially disadvantaged consumers are more likely to purchase cheaper pork, despite health concerns, whereas affluent consumers are less likely to do so.

When there is a disruption in the pork supply during an ASF outbreak, people tend to shift their food source to other meat or non-meat types. **Figure 22** below presents what kind of source respondents would choose in case of an ASF outbreak disruption in the supply chain of pork.

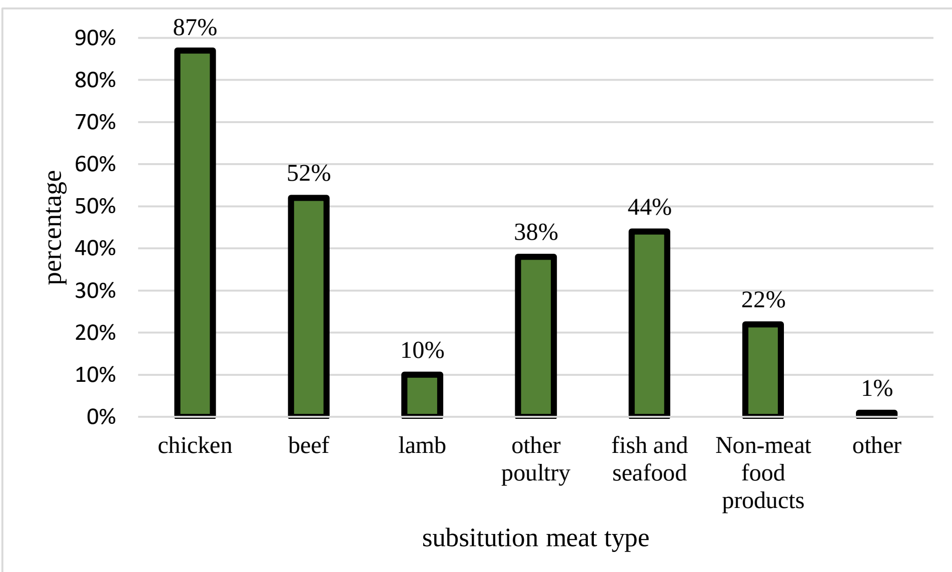

Figure 22: **Substitution source during an ASF outbreak (in relative %, N=331)**
Source: Own research, 2025

The graph shows that chicken is one of the top substitute meat types. 289 answers were collected on chicken meat (87%). This means that almost all 331 observed representatives chose chicken as the substitution. Beef, other poultry, and fish products are also towering in terms of substitution. The graph illustrates that some respondents prefer non-meat sources, while others (indicating rabbits, for instance). The most widely used substitute, probably as a result of its perceived safety, accessibility, and price. Moderate shifts, perhaps as a result of dietary preferences (seafood) or greater costs (beef). less frequent, perhaps due to cultural choices or restricted availability. There was a slight but noticeable movement toward plant-based proteins and tofu, which are examples of non-meat goods, indicating that some consumers shifted to vegetarian options. may involve using unusual alternatives (such as dairy or eggs) or consuming less meat overall.

To sum up, the figure presents that the most popular ASF substitute chicken, which was followed by beef, fish, and other poultry. Plant-based alternatives were adopted somewhat but significantly, indicating that throughout the outbreak, people preferred easily accessible, reasonably priced, and culturally recognisable substitutes.

We divided the consumer base according to pork buying habits using hierarchical agglomerative clustering (HCA). The analysis comprised Euclidean distances, or a proximity matrix (to measure the similarities between two behaviours), an agglomeration schedule that uses Ward's approach (to monitor connection distances and cluster mergers), and a dendrogram to show the cluster hierarchy (**Annex IV/Figure 26**). The cluster analysis findings show that consumers buy raw and processed pork, with a particular emphasis on how price variations (cheaper vs. pricier) affect these behaviours. Greater differences are shown by larger values, and smaller values indicate greater similarities. Cheaper raw pork and cheaper processed pork exhibit the most similar behaviours (value: 79). This implies that consumers who purchase cheaper raw pork behave quite similarly to those who purchase cheaper processed pork. The two behaviours that differ the most are cheaper raw pork and pricier processed pork (value: 287). This suggests that those who purchase processed pork at any price behave quite differently from those who only purchase raw pork when it is less expensive. Raw and processed pork, the two "cheaper" behaviours, merge close together (value: 79), demonstrating their striking resemblance. The two "pricier" behaviours combine at a slightly greater distance (value: 98), indicating that they are comparable to the "cheaper" group but not to the same extent. There is a noticeable difference between the "cheaper" and "pricier" clusters, as they merge at a significantly greater distance (value: 253.500). There is a noticeable difference between price-sensitive consumers and those who are not, as evidenced by the significant distance jump during the final merge. Clusters support the idea that a key component of consumer behaviour is price sensitivity. The wider gaps, which correspond to the agglomeration timetable, show where there are notable variances. In conclusion, we have *price-sensitive* customers, those who only purchase processed or raw pork when costs are reduced (Cluster 1). *Price-ignoring* customers, despite price increases, keep buying pork because they may be committed to the brand, think it's better, or have no other options (Cluster 2).

The key driver of segmentation is price sensitivity, as evidenced by the large gap across clusters (height = 253.500). Price-conscious customers are more likely to react favourably to sales or discounts (**Table 25**).

Table 25: Significant cluster attributes on price sensitivity

Attributes	Cluster 1 (57.7% of sample, N=191)	Cluster 2 (42.3% of sample, N=140)
Settlement type	Primarily living in the capital (73.8%), including Budapest and Pest (99.5%)	People mostly living in counties (49.3%); the Southern Great Plain (42.1%)
Education	Higher education (53.9%)	Medium education (49.3%)
Income	Stable income (42.4%)	Stable income (47.1%)
Age	Young (18-29, 61.8%)	Young (18-29, 65%)
	Strongly price-sensitive	**Price-ignoring**

Source: Own research, 2025

Cluster 1 is highly educated and concentrated in metropolitan areas (county or city capitals), while Cluster 2 is more moderately educated people living in small towns and rural areas (county towns, Southern Great Plains). Age and income may not distinguish behaviour as significantly as location and education, as both clusters are young (18–29) and have stable subjective income. The clusters highlight differences in consumer profiles by geography and education, which are essential for creating successful ASF mitigation plans. The “Price-sensitive” cluster is more about choosing chicken products, by requiring competitive pricing; while the “Price-ignoring” group tend to keep buying pork, and stay loyal to pork.

To sum up, the findings present that based on pork purchasing behavior during the ASF outbreak, the cluster analysis identifies two distinct consumer segments: price-sensitive buyers (Cluster 1, 57.7%), who are mainly urban, highly educated, and responsive to discounts, and price-ignoring buyers (Cluster 2, 42.3%), who are frequently rural, moderately educated, and devoted to pork despite price increases. More than age or income, geographic and educational disparities influence segmentation; during emergencies, Cluster 1 prefers alternatives like chicken, whereas Cluster 2 continues to consume pig at all costs. These results highlight price sensitivity as the primary behavioural separator, which is important for customising ASF mitigation tactics, such as supply-chain trust-building for rural loyalists and targeted discounts for price-sensitive urban consumers. Price elasticity defines market resilience, whereas location and education influence crisis reactions.

4.2.3.2. Customer Segmentation Based on Pork Consumption and Purchasing Habits Changes After an ASF Outbreak

To identify the primary trends influencing pork consumption after a possible ASF outbreak, factor analysis was first performed based on the attitudes of pork purchase in the case of ASF explored above. Knowing the variables, a cluster analysis was then conducted to identify the consumer groups that are present in the market.

After varimax rotation, we were able to use factor analysis to determine two significantly distinct factors based on the eight attitude variables. The set of variables is appropriate for factor analysis since the KMO index value is more than 0.5 (0.766). The variables are not independent in pairs, as indicated by the Bartlett test's significance of 0.000. The total variance is above 50% (77%). The grouping offers a response to the key elements that influence respondents' perceptions on how to modify their consumption patterns in the event of disruption. **Table 26** presents the findings.

Table 26: Factor analysis results based on pork consumption attitudes changes after the ASF outbreak (N=331)

Attitude list	Facors 1	Facors 2
I would still buy raw pork (minced meat, loin, thighs, etc.) even if its price had increased during the African swine fever outbreak than before the African swine fever outbreak.	**0.843**	-0.123
I would still buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak even if their prices had increased than before the African swine fever outbreak.	**0.841**	-0.132
I would be willing to buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	**0.804**	-0.238
I would buy raw pork (minced meat, loin, thighs, etc.) the same way I did before the African swine fever outbreak.	**0.792**	-0.335
I would be willing to buy raw pork (minced meat, loin, thighs, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	**0.786**	-0.233
I would buy processed pork products (sausages, bacon, salami, etc.) in the same way as before the outbreak of African swine fever.	**0.769**	-0.373
Under no circumstances would I buy raw pork (minced meat, chops, thighs, etc.) during the outbreak.	-0.226	**0.938**
Under no circumstances would I buy processed pork products (sausages, bacon, salami, etc.) during the outbreak.	-0.250	**0.936**

Source: Own research, 2025

Based on the table, two distinct characteristics of consumer sentiments regarding the purchase of pork during the ASF pandemic are shown by the factor analysis. The first factor can be called *price-responsiveness*. People who fall into the first factor are more open to continuing to purchase pork even if ASF disrupts the market. There can be seen variations in price differences, but those respondents are more loyal to pork meat than the other group. Represents buyers who modify their purchases in response to price fluctuations (ready to buy whether prices remain the same or rise/fall). We find high loadings on pricier pork (0.843 and 0.841) The second factor is named as *rejectorness*. Respondents fell in the rejector group refuse and completely reject buying pork products in the case of an ASF outbreak, regardless of price.

This contradiction emphasizes how ASF responses divide customers into two groups: steadfast buyers and complete avoiders. Instead of price sensitivity, which is crucial for focused risk communication, crisis behavior divides dramatically along trust/risk lines.

The characteristics of the most significant habit-changing segments must also be known to use the survey results to guide the marketing approach in case of disruption. Because of this, the two criteria were used to conduct a cluster analysis (K-Means Cluster) in the following phase. Two clusters, representing 77% of the sample, were identified by the analysis. The size of each cluster and the centres are displayed in **Table 27.**

Table 27: Cluster distribution and its main socio-demographic attributes (N=331)

		Cluster	
		1 N 193 / % 58%	**2** N 138 / % 42%
Factor	Price-responsiveness	-0.66875	**0.93527**
	Rejectorness	**0.24687**	-0.34525
		Avoidant hesitant buyers	**Price-sensitive active buyers**
Socio-demographic attributes	Gender	Female 73.6% Male 26.4%	Female 50.0% Male 50.0%
	Age	Younger (18-29) 67% Middle-Aged (30-49) 29% Older (50+) 9%	Younger (18-29) 65% Middle-Aged (30-49) 28% Older (50+) 7%
	Income	Stable 49.2% Sturggling 9.3%	Stable 37.7% Struggling21.0%
	Education	Higher Education 53.4% Low Education 4.1%	Higher Education43.5% Low Education 7.2%
	Place of living	Other cities 24.4% Central Transdanubia 8.3%	Other cities 15.9% Central Transdanubia 3.6%

Source: Own research, 2025

Based on the results, we can see that Cluster 1 (N = 193) exhibits a low tendency towards price responsiveness (-0.67), while showing a slight positive tendency towards rejectorness (0.25). Therefore, they are hesitant buyers who have little interaction with pork after an ASF outbreak, although they may not completely avoid buying.

The sociodemographic characteristics of the two clusters differ significantly, with the biggest disparities seen in the distribution of genders, household income, and geographical presence. With a much greater share of respondents reporting steady salaries (64.6% of all "Stable" earners) and higher education (63.2% of all degree holders), Cluster 1 (58.3% of the sample) was primarily female (73.6%). Additionally, this cluster overrepresented Central Transdanubia (+1.7) and smaller city dwellers (adjusted residual +1.9), indicating both socioeconomic advantage and spatial concentration. On the other hand, Cluster 2 (41.7%) showed gender parity (50 percent male and 50 percent female), but it also had a disproportionately high percentage of people who were financially suffering (61.7% of all "Struggling" respondents) and those with lower levels of education (55.6% of the low-education group). Interestingly, Cluster 2 more closely matched capital and county town residences than Central Transdanubia (adjusted residual -1.7). There was little inter-cluster variance in the age distribution and marital status, suggesting that these variables were not the main differentiators. All of the results point to a segmentation in which Cluster 1 represents educated, economically stable women in regional cities, whereas Cluster 2 represents a more financially vulnerable, gender-balanced population with lower levels of education. These differences imply that although Cluster 1 would benefit more from premium or stability-focused offers, interventions aimed at Cluster 2 might need to concentrate on cost-effective alternatives.

Cluster distribution presents a significant association by gender (**p <0.001**) and income level (**p <0.001**). The proportion of hesitant female buyers in this cluster was 73.6% (142/193), which was much higher than anticipated (adjusted residual = +4.4), compared to expected numbers (adjusted residual = -4.4). only 26.4% of respondents were male (51/193). In terms of income level, avoidant hesitant buyers were underrepresented in struggling households (9.3%, adj. residual = -3.0) and significantly overrepresented in households with steady, stable earnings (49.2% of cluster, adj. residual = +2.1).

On the other hand, Cluster 2 (N = 138) presents a high tendency towards price-responsiveness (0.94) and low load on rejectorness (-0.35). Price-elastic customers who actively modify purchases in response to price fluctuations are grouped as *active buyers*. There are equal numbers of men and women (50% each, 69/138), presenting gender parity. In terms of income, Cluster 2 is overrepresented in homes experiencing financial difficulties (21.0% of the cluster, adj. residual = +3.0). Stable-income households are underrepresented (37.7%, adj. residual = -2.1).

To sum up, women were 1.7× more likely to belong to the avoidant cluster (67.3% vs. 42.5%). In Cluster 2, however, men were more likely to be active buyers (57.5% of men compared to 32.7% of women), but their membership was balanced. Significant gender differences in cluster membership were found by crosstabulation ($\chi^2 = 19.36$, $p <.001$), with males exhibiting proportionate alignment with active buying behaviours (50% each group) and females overrepresented in the avoidant group (73.6% vs. 26.4% males; adjusted residual = +4.4). This implies that risk perception in food safety circumstances is mediated by gender. Significant income-based differences in cluster membership were found by the crosstabulation ($\chi^2 = 11.50$, $p = 0.009$). While stable-income families led the avoidant cluster (adj. residual = +2.1), struggling households were overrepresented among price-sensitive active buyers (adj. residual = +3.0). This implies that risk-price tradeoffs during food safety emergencies are mediated by economic fragility.

In addition, health risk perceptions considerably separated consumer categories, according to cluster analysis (p = 0.004). The inverse pattern was seen among active buyers, who were underrepresented among ‘no risk’ believers (6.2%, adj. residual = -3.6), while avoidant, hesitant buyers are overrepresented among no risk believers (18.8%, adj. residual = 3.6). Polarisation implies that behavioural divergence during food safety crises is driven by extreme risk perceptions rather than moderate ones, which has consequences for segmented communication tactics. All the statistically significant attributes are summarised in **Table 28**.

Table 28: Statistically significant attributes of the clusters (N=331)

Attributes		**Avoidant hesitant buyers (Cluster 1)**		**Price-sensitive active buyers (Cluster 2)**		
Total size		193 (58%)		138 (42%)		
		N (%)	Adj. Res.	N (%)	Adj. Res.	p-value
Gender	Female	142 (74%)	**4.4***	69 (50%)	**-4.4***	<0.001
	Male	51 (26%)	**-4.4***	69 (50%)	**4.4***	
Income	Comfortable	58 (30%)	0.8	36 (26%)	-0.8	0.009
	Stable	95 (49%)	2.1	52 (38%)	**-2.1***	
	Struggling	18 (9%)	**-3.0***	29 (21%)	**3.0***	
	DK, do not want to say	22 (11%)	-1.0	21 (15%)	1.0	
Risk perception	High risk	28 (15%)	1.0	15 (11%)	-1.0	0.004
	Some risk	95 (49.2%)	0.5	64 (46%)	-0.5	
	No risk	12 (6.2%)	**-3.6***	26 (19%)	**3.6***	
	Uncertain, do not know	58 (30%)	1.2	33 (24%)	-1.2	

Note: Adj. Res. = Adjusted Residuals; *** *indicates |Adj. Res.| > 1.96 (p < 0.05)*

Source: Own research, 2025

All examined attitudes on buying pork during the ASF outbreak show statistically significant differences (all **p <0.001**) between the two consumer groupings, according to the ANOVA results. When compared to *price-sensitive active buyers* (n=138; means 2.11-3.07), *avoidant hesitant buyers* (n=193) consistently displayed lower mean scores (1.27-3.22), showing distinctly different behavioural tendencies (**Table 29**).

Table 29: Pork consumption and purchase habit changes by the cluster distribution (N=331)

Attitude	Cluster	N	Mean	Standard deviation	F	p-value
I would buy raw pork (minced meat, loin, thighs, etc.) the same way I did before the African swine fever outbreak.	Avoidant hesitant buyers	193	1.49	0.654	320.210	<0.001
	Price-sensitive active buyers	138	2.94	0.817		
	Total	331	2.10	1.019		
I would buy processed pork products (sausages, bacon, salami, etc.) in the same way as before the outbreak of African swine fever.	Avoidant hesitant buyers	193	1.61	0.722	317.338	<0.001
	Price-sensitive active buyers	138	3.07	0.761		
	Total	331	2.22	1.033		
I would be willing to buy raw pork (minced meat, loin, thighs, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	Avoidant hesitant buyers	193	1.27	0.470	336.131	<0.001
	Price-sensitive active buyers	138	2.64	0.871		
	Total	331	1.84	0.947		
I would be willing to buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	Avoidant hesitant buyers	193	1.32	0.519	326.971	<0.001
	Price-sensitive active buyers	138	2.63	0.802		
	Total	331	1.86	0.919		
I would still buy raw pork (minced meat, loin, thighs, etc.) even if its price had increased during the African swine fever outbreak than before the African swine fever outbreak.	Avoidant hesitant buyers	193	1.30	0.513	352.046	<0.001
	Price-sensitive active buyers	138	2.64	0.782		
	Total	331	1.86	0.918		
I would still buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak even if their prices had increased than before the African swine fever outbreak.	Avoidant hesitant buyers	193	1.31	0.537	328.764	<0.001
	Price-sensitive active buyers	138	2.67	0.822		
	Total	331	1.88	0.947		
Under no circumstances would I buy raw pork (minced meat, chops, thighs, etc.) during the outbreak.	Avoidant hesitant buyers	193	3.22	0.992	92.561	<0.001
	Price-sensitive active buyers	138	2.15	0.996		
	Total	331	2.77	1.123		
Under no circumstances would I buy processed pork products (sausages, bacon, salami, etc.) during the outbreak.	Avoidant hesitant buyers	193	3.16	1.010	90.583	<0.001
	Price-sensitive active buyers	138	2.11	0.964		
	Total	331	2.72	1.118		

Source: Own research, 2025

Compared to hesitant buyers (mean = 1.49-1.61), active buyers were almost twice as likely to continue their pre-outbreak buying patterns (means = 2.94-3.07 for "same way as before"). These differences appear to be especially strong for frequent purchasing behaviour, as indicated by large effect sizes (F>300). Despite having essentially different baselines, both clusters demonstrated a response to price increases. When prices changed, the willingness of active buyers varied about neutral (mean = 2.63-2.67). Even at lower prices, hesitant buyers remained consistently unwilling (mean = 1.27-1.32). The sole reverse-coded items indicated that active buyers disagreed with avoidance to a modest degree (mean = 2.11-2.15) while hesitant buyers substantially agreed with avoidance (mean = 3.16-3.22). The qualitative cluster classifications are quantitatively validated by these findings, which demonstrate that, regardless of price conditions, hesitant purchasers exhibit significant, persistent avoidance. Moreover, price adjustments have a moderate impact on the baseline willingness of active buyers. Rather than their level of price sensitivity, the clusters' underlying willingness to buy is where they diverge the most. The practical applicability of this two-cluster method for market segmentation and targeted policy interventions is supported by the incredibly low p-values (<.001) for all comparisons, which demonstrate these segmentations are highly dependable.

To sum up, a clear difference can be derived between cautious consumers who consistently avoided pork regardless of price incentives and active buyers, who mostly maintained pre-outbreak pork consumption despite price fluctuations. This suggests that the main behavioural separator is baseline willingness to eat rather than price sensitivity. The statistically sound segmentation (F > 300, *p* <.001) supports this dichotomy and provides policymakers with a practical framework: use price-based interventions (like discounts) to target active consumers and risk-mitigation messaging to regain the trust of hesitant customers.

4.2.3.3. Trustworthiness of Information Source

The majority of people believe that experts are the most trustworthy, whilst word-of-mouth is viewed as the least trustworthy. In **Table 30,** a summary of the trustworthiness of information sources can be seen. Most reliable sources are official portals, like Nébih, with the highest results (mode = 4, mean = 3.55). Meaning, when it comes to ASF information, respondents have a high degree of faith in official government agencies. Consensus is indicated by a low standard deviation (0.74).

Table 30: Descriptive statistics on the trustworthiness of the information sources regarding ASF outbreak, N=331

Descriptive Statistics→ Attitude lists↓	Mean	Standard deviation
National Food Chain Safety Office (Nébih)	3.55	0.74
Expert (dietitian, gastroenterologist)	3.11	0.89
Pork breeders, producers, and sales entrepreneurs	2.86	0.90
TV and radio news	2.55	0.83
Newspaper, magazines	2.43	0.84
Social media	2.25	0.84
Word of mouth (family, friends, etc.)	1.96	0.87

Source: Own research, 2025

Specialists (gastroenterologists, dietitians) have a mean = 3.11. Experts are slightly less trustworthy than Nébih. A higher variance (0.89) indicates some degree of uncertainty. Sources with moderate trust are breeders and producers with a mean = 2.86. Meaning that potential bias issues (such as profit motives) yet neutral to positive trust. Means are 2.43 for newspapers and 2.55 for TV and radio, presenting a mild trust in them. Word-of-mouth (friends/family) has a mean = 1.96 (lowest). Interpreting a not very reliable source, probably because it is informal and unconfirmed. Therefore, our results show the trust hierarchy of Governmental organisations> Professionals > Sector > Media > Social media > Referrals. To increase public compliance, crisis communication should give Nébih and specialists top priority. Word-of-mouth and social media are viewed with suspicion, which increases the possibility of false information spreading. It is advised to counter rumours through official channels. Although media ambivalence lags behind experts, traditional media (TV, print) are only slightly trusted. Our findings show that the young generation is more likely to trust social media than older generations.

All in all, the table presents that there is a definite hierarchy of confidence in food safety information: word-of-mouth and social media are the least trustworthy, while official organisations and specialists are the most trusted. Social media trust is stronger among younger generations. In order to effectively combat misinformation, crisis communication should give priority to reliable sources.

Figure 23 illustrates how customers view the dependability of several sources of information on food safety. In general, people are more likely to trust formal sources and professional viewpoints than unofficial or social media platforms.

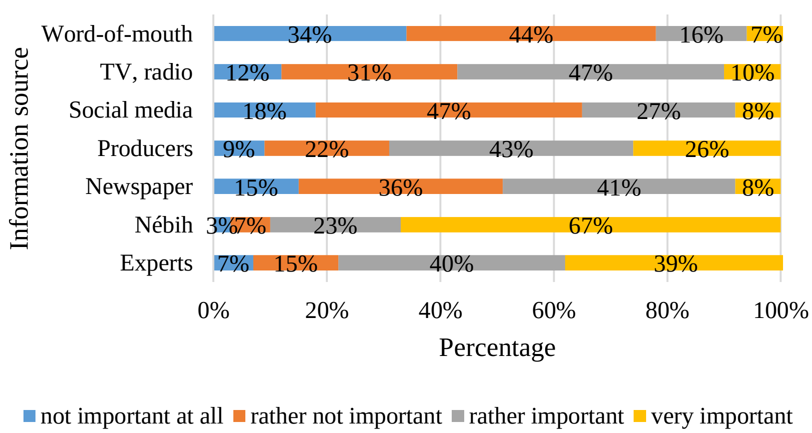

Figure 23: Considering the ASF poses a risk to personal health
Source: Own research, 2025

Regarding food safety, the evidence shows that Nébih is highly trusted. 90.4% of respondents believe Nébih to be a reputable source. Most respondents think that pig producers are trustworthy when it comes to providing information about food safety. A significant percentage of participants believe that word-of-mouth information on food safety is untrustworthy, with 33.5%. This implies that when looking for information on food safety, customers favour more official and reliable sources. In order to check the correlation between scale responses, we dichotomised the semantic differential scale responses into binary variables (0 = Not trustworthy (1-2), 1 = Trustworthy (3, 4)). Based on consumers' faith in different information sources during the ASF outbreak, the ANOVA results show statistically significant variations (**p < 0.05**) in their desire to purchase pork products in some variables. **Table 31** summarises statistically significant assumptions.

Table 31: Statistically significant assumptions on changing purchase habits towards pork after an ASF outbreak by information source trust (N=331)

Attitude	Information Source	Statistics				
I would be willing to buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	Newpaper	N	Mean	Standard deviation	F	p-value
	Not trustworthy	168	1.76	0.856	4.253	0.040
	Trustworthy	163	1.97	0.971		
	Total	331	1.86	0.919		
I would buy raw pork (minced meat, loin, thighs, etc.) the same way I did before the African swine fever outbreak.	Nébih	N	Mean	Standard deviation	F	p-value
	Not trustworthy	32	2.5	1.107	5.623	0.018
	Trustworthy	299	2.05	1.002		
	Total	331	2.1	1.019		
I would still buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak even if their prices had increased than before the African swine fever outbreak.	Producer	N	Mean	Standard deviation	F	p-value
	Not trustworthy	103	1.69	0.817	5.906	0.016
	Trustworthy	228	1.96	0.990		
	Total	331	1.88	0.947		
I would be willing to buy raw pork (minced meat, loin, thighs, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	Expert	N	Mean	Standard deviation	F	p-value
	Not trustworthy	70	2.24	0.999	5.926	0.015
	Trustworthy	261	2.21	1.044		
	Total	331	2.22	1.033		
I would be willing to buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	Expert	N	Mean	Standard deviation	F	p-value
	Not trustworthy	70	2.09	1.046	4.566	0.033
	Trustworthy	261	1.79	0.910		
	Total	331	1.84	0.947		
I would buy processed pork products (sausages, bacon, salami, etc.) in the same way as before the outbreak of African swine fever.	Word-of-mouth	N	Mean	Standard deviation	F	p-value
	Not trustworthy	256	2.15	1.003	5.113	0.024
	Trustworthy	75	2.45	1.106		
	Total	331	2.22	1.033		
I would be willing to buy raw pork (minced meat, loin, thighs, etc.) during the African swine fever outbreak if the price were lower than before the African swine fever outbreak.	Word of mouth	N	Mean	Standard deviation	F	p-value
	Not trustworthy	256	1.78	0.924	4.846	0.028
	Trustworthy	75	2.05	0.999		
	Total	331	1.84	0.947		
I would still buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak even if their prices had increased than before the African swine fever outbreak.	Word of mouth	N	Mean	Standard deviation	F	p-value
	Not trustworthy	256	1.81	0.907	5.831	0.016
	Trustworthy	75	2.11	1.047		
	Total	331	1.88	0.947		

Source: Own research, 2025

Price sensitivity is increased by trust in Official/Expert Sources Nébih; customers who were skeptical of Nébih were more likely to stick with their pre-outbreak raw pork purchases (M = 2.5 vs. 2.05, F = 5.623, *p* = 0.018), indicating that risk tolerance and skepticism about regulatory guarantees may be related. Producer trust presents that faith in producers reduces price resistance in times of crisis because those who distrust producers were less ready to purchase processed pork at higher costs (M = 1.69 vs. 1.96, F = 5.906, *p* = 0.016). Paradoxically, people who didn't trust specialists were more likely to purchase processed pork at a discount (M = 2.09 vs. 1.79, F = 4.566, *p* = 0.033). This might be an example of the "risk compensation" effect, in which a greater reliance on price signals results from mistrust in experts. Trust in word-of-mouth promotes consumption, according to the results. Customers who rely on unofficial word-of-mouth recommendations stated that processed pork baseline purchases were higher (M = 2.45 vs. 2.15, F = 5.113, *p* = 0.024). An increased ability to tolerate price increases (M = 2.11 vs. 1.81, F = 5.831, *p* = 0.016).

To sum up, while mistrust causes customers to rely more on price signals, faith in official sources lowers price sensitivity. Stabilising demand amid food safety emergencies requires bolstering confidence in authorities and regulators. Consumers' trust determines whether they value price incentives or safety guarantees, which is crucial information for crisis communication tactics.

4.3. The Summary and Relation of Qualitative and Quantitative Findings

The qualitative and quantitative primary research aims to provide a complex overview of the subject matter from both perspectives. As the agricultural market (i.e. pork market) is highly dependent on consumer trends, it is inevitable to have a glimpse from both sides of the supply chain. Each player shapes the chain, and in case of disruption, could reshape it. Managers and consumers have different perspectives with shared objectives (which is pork). **Table 32** provides an overview of the main objectives of the primary research.

Table 32: Overview of and relation to the primary research

Qualitative (managerial level)	Quantitative (end-user)
Focuses on strategic decisions and supply chain management	Focuses on consumer behaviour, demand shifts, and purchasing patterns
Explores prevention measures (biosecurity measures, culling regulations, entry matrices)	Measures consumption changes due to disruptions (decline in pork purchase, price sensitivity)
Identifies mitigation techniques	Quantifies how ASF fear alters buying habits (avoiding pork, switching to other substitutes)

Source: Own research, 2025

From the perspective of the managerial level, it could explain why certain policies and regulations may succeed or fail in mitigation. On the other hand, consumer data validates the real-world impact in the case of disruption. The results show that ASF could deeply impact managers and consumers, which puts the supply-demand in an imbalance. In a domestic market, due to the prevention and more severe impact of the possible ASF outbreak, mitigation techniques are involved. From the qualitative research, it is evident that export bans could make prices fluctuate due to a supply shock. Managers, after learning about demand-changing patterns, can adjust sales policies and mitigation techniques to aim for consumer trust over disruption shocks. The quantitative results present that after a possible ASF outbreak, consumers may change their eating patterns towards pork. Due to a fear of disease, there are some consumers would stop purchasing pork products. On the other hand, some would continue buying if there were price shifts. Our findings show that just 15% of regular consumers would continue to purchase and eat pork products in the same manner as they did before the ASF outbreak. In the case of seldom or infrequent pork consumers, 3% and 13%, respectively, would consume pork in the same manner. Pork consumption among regular consumers has decreased by 60% as a result of the interruption caused by an ASF outbreak. Many people would switch to substitutes, from which 87% of respondents would choose chicken meat source, 52% beef, and 44% fish and seafood. Understanding the present case from the managerial perspective, they can allocate and fill gaps to reduce market decline. Since 90% of the respondents find official government portals trustworthy information sources, managers could aim these sources to target awareness campaigns about the safety of continuing to purchase and buy pork meat. Moreover, actual information about policies and statuses could also gain trust. In addition, managers investing in local biosecure farms could also stabilise demand shocks. The immediate response of managers is to stop the transportation of live pigs, establish quarantine zones, and issue culling orders, while consumers become alarmed and abruptly avoid pork. The results also show that among respondents, producer mistrust had a direct effect on customer behaviour, most likely due to concerns about lack of information about biosecurity or transparency.

CONCLUSIONS AND DISCUSSIONS

5.1. The Acceptance or Rejection of the Hypotheses

Fourteen hypotheses were developed in the thesis, and we had to determine whether the study supported them. The findings confirmed that some of my assumptions were correct and accepted (10), and some were partially accepted (4). The summary can be observed in **Table 33.**

Table 33: The supportiveness of the hypotheses

	QUALITATIVE RESEARCH (managerial level)	**ACCEPT OR REJECT**
H1	The corporate business has set prevention methods and mitigation techniques for possible ASF outbreaks.	ACCEPT
H2	The Chinese pork market disruption impacted the domestic pork market in the chosen corporate business due to ASF.	ACCEPT
H3	Adopting supply chain diversification (e.g. multiple regional sources) and innovative technologies (e.g. Internet of Things) positively impacts consumer trust and mitigates disruption.	ACCEPT
	QUANTITATIVE RESEARCH (end-user level)	**ACCEPT OR REJECT**
H4	There are characteristic differences in meat consumption among age groups, specifically with the young generation consuming more chicken.	ACCEPT
H5	Segments formed based on pork consumption frequencies can be well-defined based on primary characteristics.	PARTIALLY ACCEPT
H6	Consumers' pork purchasing behaviour is segmented by income level, with lower-income groups prioritising cheap prices and bulk purchases, while higher-income groups focus on quality.	ACCEPT
H7	Age correlates with the importance placed on freshness and Hungarian pork origin, with the older generation putting more importance on them than the younger aged.	PARTIALLY ACCEPT
H8	The source of pork is determined by the type of place of living, specifically village areas, showing a stronger preference for home-breeding and direct-from-producer sourcing.	PARTIALLY ACCEPT
H9	Individuals who believe that ASF poses a health concern are more likely to stop or discontinue their pork purchases.	ACCEPT
H10	Attitudes towards pork consumption after an ASF outbreak can be segmented based on (1) health concerns, and continued purchase to (2) prior pork consumption frequency.	ACCEPT
H11	Consumers' continued pork purchase after an ASF outbreak can be segmented based on typical sourcing, with home-breeding and direct-from-producer sourcing tend to exhibit more resilient patterns, while retail purchasers are less resilient.	ACCEPT
H12	Price sensitivity during an ASF among consumers can be characterised and segmented, with consumers either ceasing purchases or adjusting demand in response to price fluctuations.	ACCEPT
H13	During an ASF outbreak, lower-income consumers (especially those struggling financially) are significantly more willing to purchase reduced-price pork—both raw and processed—than higher-income consumers, as price outweighs perceived health risks.	ACCEPT
H14	The source of information flow about the ASF outbreak has a significant impact on consumers' choice to stop or continue purchasing pork during the ASF outbreak.	PARTIALLY ACCEPT

Source: Own research, 2025

$\boxed{\text{H1:}}$ We accept the hypothesis since our qualitative primary research supports the assumption. Bonafarm has rigorous regulation and follows strict matrices to prevent and mitigate ASF outbreaks. It uses strong communication with organisations and uses AI technologies in pork count and feeding, by which the corporate business is able to filter possible infection behaviours. Bonafarm has set entry-exit policies for every kind of movement and divided the farm area into different zones. In terms of pork processing, pork coming from high-risk areas is also handled according to the regulations of the business and government.

$\boxed{\text{H2:}}$ The analysis reveals a consistent pattern that aligns with our hypothesis. According to the theoretical saturation in the topic, results present that Bonafarm experienced impacts originating from the Chinese pork market disruption due to ASF. Since China set export bans on Hungarian pork products due to the presence of ASF, Bonafarm experienced a huge decline in pork exports. As a consequence, supply in the domestic market increased, which pushed down pork prices.

$\boxed{\text{H3:}}$ The in-depth narratives indicate that the hypothesis is supported. Bonafarm has adopted supply chain diversification (option-contract and multiple regional sources). Specifically, from the appearance of ASF, the corporate business relies on multiple sources. Regarding procurement, Bonafarm uses three sources: Bonafarm Group provides 70–80% of the total, with the remaining portion coming from outside vendors and free market sources, which are always under supervision. There is no committed quantity for slaughter because Bonafarm has used option contracts (no committed quantities) since the ASF's appearance, which is an excellent coordination strategy in the event of a supply chain disruption. This is the main strategy used to address the decline in trade and consumption since the ASF. In addition, as it has been mentioned earlier, Bonafarm uses IoT and AI technologies, which can help mitigate risks. Bonafarm has strong communications with organisations about sampling and ASF-free pig traceability. Bonafarm also follows Nébih's official website, and refers to its actuality, which is ideal for connecting key players in the supply chain, and is gaining positive trust towards pork safety among consumers.

$\boxed{\text{H4:}}$ Since we find a significant correlation between meat choice and gender ($p < 0.001$), with special attention on the young generation choosing mostly chicken, we accept our assumption.

$\boxed{\text{H5:}}$ Partially accepted was the theory that segments based on pork consumption frequencies might be delineated using primary features. When it came to distinguishing between the segments, gender ($p = 0.001$) and education ($p = 0.007$) were shown to be significant, with the findings that more male respondents consume pork frequently, and lower education levels present frequent pork consumption. Nonetheless, there was no significant difference in the segments' levels of settlement type ($p = 0.099$), marital status ($p = 0.287$), or income ($p = 0.110$), for instance, indicating that these factors are not crucial in determining the frequency groups of pork intake in this study.

H6: The hypothesis is supported by the results. It was found that we can segment people's pork consumption based on price sensitivity. Lower income levels do have strong concerns about prices ($p <0.001$). Customers with lower incomes place a higher value on price than quality ($p < 0.001$), while higher-income respondents, on the other hand, prioritise quality over price. Moreover, buying in bulk is more common among struggling households ($p = 0.005$). Trials of new products are shaped according to people with lower incomes who are more willing to test less expensive options ($p < 0.001$) over the more expensive ones out of habit.

H7: The hypothesis is partially accepted, because we find significance in the case of raw pork Hungarian origin ($p <0.001$), processed pork freshness ($p = 0.006$) and Hungarian origin ($p <0.001$), however, raw pork freshness is insignificant ($p = 0.134$). The results show that younger customers are less concerned about freshness and Hungarian origin than the older generation. Young people are more receptive to imports or international brands, reflecting less cultural commitment to domestic goods. While the older generation places importance towards Hungarian-origin pork products.

H8: The hypothesis is partially supported by the results, as we find significance only in the case of raw pork ($p = 0.002$). People living in rural areas prefer stronger sourcing from home-breeding or producers, while people living in the capital purchase pork in big retail shops, such as hypermarkets and supermarkets.

H9: The findings support the hypothesis since we found a statistical significance ($p <0.001$) for raw pork, ($p = 0.006$) for processed pork avoidance. The study shows that those consumers who have a higher perception of ASF posing a risk to their health are more likely to stop purchasing pork, compared to those with a moderate perception of health risk.

H10: The assumption is confirmed by the findings. We found that consumption pattern change truly can be segmented based on (1) health concerns (all significant $p \leq 0.010$). Health risk-averse individuals are more likely to change their consumption habits towards pork by either reducing or stopping their purchase habits. In addition, (2) infrequent pork consumers would rather stop or reduce buying pork products; however, those who consume pork frequently tend to agree to continue buying it during ASF, regardless of price changes (all significant $p \leq 0.044$).

$\boxed{\text{H11:}}$ Hypothesis is supported. Customers' concerns regarding ASF and the channels they choose to buy from are statistically correlated ($p \leq 0.037$). Consumers sourcing from home-breeding and direct-from-producers tend to keep buying pork, regardless of the ASF and price shift impact, while those sourcing from retailers tend to be less resilient and are more likely to reduce pork purchases. This implies that supply chain transparency and trust may allay worries about food safety.

$\boxed{\text{H12:}}$ Hypothesis is supported. Customers were divided into two groups by the HCA: *price-sensitive* and *price-ignoring* clusters. Price sensitivity is confirmed to be a significant, quantifiable behavioural divide during ASF by the enormous end merger distance (253.500). This was further supported by the proximity matrix, which displayed the highest differences between clusters (e.g., 287) and minimal differences within clusters (e.g., 79). Given that the dendrogram and agglomeration schedule divided customers into two groups according to price sensitivity, the analysis amply supports this hypothesis. Customers in Cluster 1 (price-sensitive) only buy pork when it's on sale. Customers who keep purchasing even at increased costs are in Cluster 2 (price-ignoring). This result is consistent with price elasticity theory (e.g., Weyl & Fabinger, 2013), which postulates that demand for non-essential items (pork) will become more elastic in times of crisis. In addition, customers based on their purchasing habit changes can be segmented into two clusters: *avoidant-hesitant buyers* who completely stop buying pork products in the case of ASF, and *price-sensitive active buyers*, who would continue to purchase by reacting to price changes. All results all supported by significant testing.

$\boxed{\text{H13:}}$ In addition, we found statistically significant results between the association of income level and cheaper pork ($p = 0.014$; $p < 0.001$), meaning that those struggling with income level are more likely to buy discounted pork during ASF, since price overweights health risk concerns.

$\boxed{\text{H14:}}$ The hypothesis is partially supported by the fact that while the majority of evaluated sources did not demonstrate any discernible impact (insignificant), certain information sources—such as producers, word-of-mouth, and experts—significantly influence purchasing behaviour during ASF. This implies that in times of crisis, only specific trust channels influence customer choices. Rather than being causal correlations, the observed associations most likely reflect endogenous consumer biases. Results show this relationship is source-specific and non-uniform. Importantly, these correlations might not be due to causal trust effects, but rather to inherent consumer biases. Partial, context-dependent support is found for the notion that ASF-related pork purchasing behaviours are influenced by trust in information sources. Only 8 attitude variables were statistically significant ($p \leq 0.040$) out of the 56 tested relationships (7 sources × 8 habit variables), and they were concentrated in 3 sources: expert distrust increased discount-seeking ($F = 4.566$, $p = 0.033$), word-of-mouth trust increased baseline purchases ($F = 5.113$, $p = 0.024$), and producer trust decreased processed pork avoidance ($F = 5.906$, $p = 0.016$). These noteworthy instances, however, only account for 14% of experiments; 86% (48/56) had no effect, indicating that the majority of institutional sources (such as the government and media) were unable to affect behaviour. However, the overwhelming null rate (86%) suggests most institutional sources (e.g., government, media) fail to influence habits, and even significant effects explain minimal variance ($\eta^2 < 0.05$). Semantic differential scale dichotomisation may obscure granular trust-behaviour dynamics and may obscure nuanced relationships. Future studies should use: (1) experimental source-exposure trials with control groups; (2) multilevel modelling to account for regional/cultural confounders; and (3) longitudinal designs to monitor trust and habits before and after the crisis. Until then, trust’s function is still precarious and functions selectively rather than broadly as predicted. But remains neither universal nor deterministic.

Table 34 provides an overview and a summary of the thesis’s findings and key aspects regarding the objective, hypothesis, findings and novel scientific results which are referred to in Chapter 6.

Table 34: Summary of the thesis findings, methods and novel scientific results

Qualitative research							
OBJECTIVE	**HYPOTHESIS**	**SAMPLING METHOD**	**ANALYSIS METHOD**	**TOPIC**	**RESULT**	**INNOVATION**	**NOVEL SCIENTIFIC RESULTS**
O8	H1: The corporate business has set prevention methods and mitigation techniques for possible ASF outbreaks.	Qualitative, in-depth interview	Content analysis	Biosecurity measures	Bonafarm has strict regulations and preventive matrices	**I1** **I4**	**N1** **N3**
O4 **O7** **O8**	H2: The Chinese pork market disruption impacted the domestic pork market in the chosen corporate business due to ASF.	Qualitative, in-depth interview	Content analysis	Trade and consumption	Decline in Hungarian pork exports towards China	**I3**	**N1** **N3**
O8	H3: Adopting supply chain diversification (e.g. multiple region sources) and innovation technologies (e.g. Internet of Things) positively impacts consumer trust and mitigates disruption.	Qualitative, in-depth interview	Content analysis	Commerce activities	Bonafarm uses new tech. to mitigate the ASF impact	**I2** **I4** **I5**	**N1** **N3**

Quantitative research						
OBJECTIVE	**HYPOTHESIS**	**TOPIC**	**SURVEY QUESTION AND LEVEL OF MEASUREMENT**	**ANALYSIS METHOD**	**RESULT**	**NOVEL SCIENTIFIC RESULTS**
O3	H4: There are characteristic differences in meat consumption among age groups, specifically with the young generation consuming more chicken.	General meat consumption	III/1, nominal	chi-square test, Adj. Res.	The younger generation chose chicken ($p < 0.001$) in the biggest ratio as the priority.	**N2** **N4**
O3	H5: Segments formed based on pork consumption frequencies can be well-defined based on primary characteristics.	Consumer trends	III/3, nominal	chi-square test, Adj. Res.	Gender ($p = 0.001$), education ($p < 0.001$), show significance; others (marital status, settlement type, income, etc.) have no significance	**N2** **N4**
O3	H6: Consumers' pork purchasing behaviour is segmented by income level, with lower-income groups prioritising cheap prices and bulk purchases, while higher-income groups focus on quality.	Consumer trends	III/4, 5, 8, interval (1-4)	ANOVA, descriptive statistics	Lower-income individuals place higher concerns on price than quality ($p < 0.001$); rather choose new but cheaper products ($p < 0.001$); and buy in bulk ($p = 0.005$).	**N2** **N4**
O3	H7: Age correlates with the importance placed on freshness and Hungarian pork origin, with the older generation putting more importance on them than the younger aged.	Consumer trends	III/4, 5, 8, interval (1-4)	ANOVA, descriptive statistics	Older generation respondents, put a higher importance on freshness (only processed pork: $p = 0.006$), and on Hungarian-origin products ($p < 0.001$).	**N2** **N4**
O3	H8: The source of pork is determined by the type of place of living, specifically village areas,	Consumer pattern	III/6, 7, nominal	chi-square test, Adj. Res.	People in rural areas appear to source from home-breeding or directly from producers (only raw pork: $p = 0.002$)	**N2** **N4**

	showing a stronger preference for home-breeding and direct-from-producer sourcing.	changes due to disruption				
O4 **O6**	$\boxed{\text{H9:}}$ Individuals who believe that ASF poses a health concern are more likely to stop or discontinue their pork purchases.	Consumer pattern changes due to disruption	III/9, interval (1-4)	ANOVA, descriptive statistics	Higher risk perception reduces or stops continued pork purchase (p ≤0.006).	**N2** **N4**
O4 **O6**	$\boxed{\text{H10:}}$ Attitudes towards pork consumption after an ASF outbreak can be segmented based on (1) health concerns, and continued purchase to (2) prior pork consumption frequency.	Consumer pattern changes due to disruption	III/9, interval (1-4)	ANOVA, descriptive statistics	Higher risk perception reduces or stops continued pork purchase (p <0.001); frequent consumers are more about to continue their consumption habits, regardless of price changes (p ≤0.038).	**N2** **N4**
O4 **O6**	$\boxed{\text{H11:}}$ Consumers' continued pork purchase after an ASF outbreak can be segmented based on typical sourcing, with home-breeding and direct-from-producer sourcing tend to exhibit more resilient patterns, while retail purchasers are less resilient.	Consumer pattern changes due to disruption	III/9, interval (1-4)	ANOVA, descriptive statistics	Home-breeder and direct-from-producer tend to continue purchasing after ASF, regardless of price shifts (p ≤0.037)	**N2** **N4**
O4 **O5** **O6**	$\boxed{\text{H12:}}$ Price sensitivity during an ASF among consumers can be characterised and segmented, with consumers either ceasing purchases or adjusting demand in response to price fluctuations.	Consumer pattern changes due to disruption	III/9, interval (1-4)	ANOVA, descriptive statistics; Hierarchical Cluster, Factor and Cluster analysis	Clusters are characterised based on price sensitivity (price-sensitive group and price-ignoring group), and segmented based on consumer pattern changes (avoidant-hesitant buyers and price-sensitive active buyers) (all *p*≤0.001)	**N2** **N4** **N5** **N6**
O4 **O5** **O6**	$\boxed{\text{H13:}}$ During an ASF outbreak, lower-income consumers (especially those struggling financially) are significantly more willing to purchase reduced-price pork—both raw and processed—than higher-income consumers, as price outweighs perceived health risks.	Consumer pattern changes due to disruption	III/9, interval (1-4)	ANOVA, descriptive statistics	Struggling consumers are more willing to buy cheapened pork due to the ASF outbreak (p ≤0.014)	**N2** **N3** **N4**
O4 **O5** **O6** **O9**	$\boxed{\text{H14:}}$ The source of information flow about the ASF outbreak has a significant impact on consumers' choice to continue purchasing pork during the ASF outbreak.	Consumer pattern changes due to disruption	III/13, interval (1-4)	Dicotomisation, ANOVA, descriptive statistics	8 out of 56 testing show significance (p ≤0.040), however, rather than being causal correlations, the observed associations most likely reflect endogenous consumer biases.	**N2** **N4**

Source: Own research, 2025

5.2. Answering the Research Questions

Q1	Which factors can be impacted by a supply chain disruption?

Throughout the study, we focused on different types of supply chain disruptions by highlighting the case of the ASF influence. The conclusion can be derived that if there is a disruption in the chain, different factors can be impacted by the chain players. Numerous elements of an economy, company and consumer can be affected, and a supply chain interruption may impact their larger ecosystem. The results show that production lines may stop or slow down as a result of disruptions brought on by shortages. Stock-outs caused by an inability to restock inventory can have an impact on sales and customer satisfaction. Disruptions to the food business may jeopardise safety regulations. Because of hurried production or defective items, disruptions might result in increased financial waste due to safety-waste management strategies. Fresh food shortages brought on by disruptions may impact the population's access to vital nutrients. Our findings show that in the case of an ASF outbreak, 86% of respondents would switch to chicken sources, for instance, making pork businesses a highly competitive stage. Beef and fish consumption would also increase (by 55% and 44%, respectively). Due to spoiling, decreased demand, or higher expenses, farmers, growers, and other supply chain players may experience financial losses, too. Disruptions may lower export earnings and impact the trade balance if the nation exports a net amount of fresh product, just as experienced through China's export ban towards Hungarian pork products due to the ASF outbreak. Due to the export ban in China towards Hungary, Hungary lost its market share and position in the Chinese pork market. Our qualitative analysis also validates that Bonafarm experienced a huge decline in annual revenue. Public budgets may be strained if governments are forced to provide impacted industries with more subsidies or support. To lessen future disruptions, governments may enact new laws or rules that have an impact on business operations. Due to possible price fluctuations, the end-users of the chain and their consumption habits are also impacted, which is especially distributed among price-sensitive and moderately price-sensitive (price-ignoring) members.

Q2	How does the ASF outbreak impact the supply-demand balance in China and Hungary?

ASF first appeared in China in 2018. It drastically harmed the Chinese pork business. The production fell by more than 27% from 2018 to 2019. The findings show that a 0.78% drop in China's GDP is comparable to economic loss. Due to unforeseen temporary conditions, pork prices have increased significantly over time, particularly in 2019 and 2021. The situation led to a decline in pork consumption as a consequence. Therefore, both supply and demand have been harmed in China (Salling, 2025). Moreover, China imposed trade bans for imported pork products from the areas where ASF have been discovered. The export ban overlaps with Hungary as well. In Hungary, ASF also appeared in 2018, but only in wild boars. Our findings show that if we hypothesise an outbreak in domesticated pigs, consumers would change their eating patterns towards pork and would rather choose other substitutes. Pork businesses already face challenges due to the risk of ASF, which involves higher protection strategies and supply surpluses. Our results find that 60% of frequent pork consumers would reject purchasing raw pork and processed pork after a viral outbreak. However, some of the respondents would still stick to buying pork. But in overall aspects, consumers, due to health concerns, would stop or moderate pork purchasing and consumption. The Chinese pork export ban towards Hungary leads to an imbalance in the domestic market by increasing pork prices and then drastically decreasing them. Even if prices decrease, people tend to shift their consumption habits due to the health concerns of the case of ASF. A small number of people, especially loyal pork consumers or people with struggling incomes, would buy discounted pork. All in all, a supply-chain constant imbalance can be observed as a consequence of the ASF disruption.

Q3	How to mitigate and coordinate fresh produce supply chain disruption in the case of an ASF outbreak?

A multifaceted strategy is needed to mitigate and coordinate disturbances in the fresh produce supply chain, especially during an outbreak of ASF. Although ASF directly affects pigs, it also indirectly affects the supply chain. The findings present that establishing reliable monitoring programs for ASF outbreaks in swine populations in order to identify and stop the disease before it causes significant disruption is an essential mitigation technique. Monitoring outbreaks and their possible effects by connecting government organisations, farmers, and supply chain participants through an information flow platform could help mitigate risk and scepticism towards pork products and elevate transparency. According to our qualitative research results, determining high-risk zones, implementing safety strategies, and setting culling policies, could coordinate outbreak levels. Bonafarm follows a special matrix on how to handle pig slaughtering and carcass handling, among others. To lessen reliance on any one area impacted by ASF, sourcing fresh produce from a variety of providers in several regions is also an approach towards mitigation, especially by the option contract. Our findings reveal that the usage of option contracts can decrease disruptions. From the findings, we can understand that optimization of supply chain operations and anticipating possible disruptions by targeting government official portals to use campaigns and up-to-date information on the viral outbreak could mitigate disruption, increase consumer trust, and therefore decrease market impact. Managers should use official government portals to target awareness campaigns regarding safety.

Q4	What are the trends in meat consumption in Hungary, considering pork?

In Hungary, pork has long been the most popular meat and is ingrained in the nation's cuisine. Hungary has historically had one of the highest per capita pork consumption rates in Europe, demonstrating its importance in the national diet. No doubt it reached 10 million pork capital in the 70s. The findings show that among respondents, nowadays, pork is the second most consumed meat type after chicken. The majority of respondents consume pork several times per week, which is also distributed among genders. Our results show that more males are daily consumers of pork. When purchasing pork products (raw and processed), our findings show that the biggest determinants are freshness and quality (93% of importance), price (89% of importance), and food safety (88% of importance). People with struggling income levels are mostly focused on choosing cheaper prices over quality, buying in bulk or trying new and cheaper pork. Hypermarkets and supermarkets are the most popular sourcing locations among survey participants, depending on the type of place of living, in rural areas, home-breeding and sourcing from producers present an influential level. A towering ratio living in the capital buy pork in supermarkets. Among residents of smaller settlements, however, meat sources from their farms are appearing as well. Hungarian pork product is a priority among most of the respondents, especially among older generations. Referring to our qualitative results, Bonafarm is perceiving pork consumption decline due to trends and the ASF outbreak.

Q5	How do consumers change their consumption patterns due to disruption shocks, especially due to ASF?

When disruption shocks like an ASF outbreak impact the availability, cost, and perceived safety of pig products, consumer behaviour frequently changes dramatically. Depending on the extent and length of the disturbance, these shifts in consumption habits may be either temporary or permanent. Change to replace proteins, substitutional diets, in which people shift towards other meat proteins by not completely stopping eating meat, may become more popular as a result of the disruption (Salling, 2025). The findings present that because of worries about food safety or the health dangers linked with meat, some consumers may cut back on their overall meat consumption. 48% of respondents think ASF has some risk to personal health, leading to a drastic shift in pork consumption patterns.

Those people who consider the ASF outbreak risk-free would continue buying and consuming pork (less than 40 people out of 331), regardless of price shifts due to the ASF outbreak. While lower-income consumers might switch to less expensive options, higher-income consumers might be less impacted by price fluctuations and keep buying pork even if pricier. Consumer segmentation can be divided into two distinct groups. Those who actively buy and react to price shifts after an ASF outbreak (price-sensitive active buyers), and those who completely reject pork purchase (avoidant-hesitant buyers). Even if there is little risk to food safety, consumers may completely shun pork out of fear (avoidant-hesitant buyers). In addition, transparency could impact continued pork purchase, as our results reveal that those who source pork from home-breeding or direct-from-producers tend to be more resilient to pork purchase after ASF, compared to those who buy pork in retail. Demand learning is necessary for policymakers, producers, and retailers to adapt and meet the consumers' reactions and needs according to our quantitative results. Bonafarm constantly monitors consumer trends and changes its procurement strategy by relying on the realities of the market.

Q6	What kind of innovations can be derived from the topic?

The difficulties presented by supply chain interruptions, such as those brought on by ASF outbreaks, can spur and catalyse important advances and innovations. In the face of such changes, these solutions seek to increase sustainability, efficiency, and resilience. These innovations are referred to as I1, I2, I3, I4, and I5, respectively and are based on Etzkowitz (2008).

I1	**Diffusion of new biosecurity management.**

The technology, which is implemented to prevent ASF outbreaks, is a way of behavioural innovation. Findings present that dividing farms into risk zones, introducing new entry matrices, and slaughter plans fall into innovation and innovation management science, which is optional among entrepreneurs.

I2	**Implementation of modern monitoring technologies (AI, IoT, smart farming, etc.).**

Modern life brings opportunities and challenges to businesses. Innovativeness shapes a business and economy by using modern techniques, which can have a positive effect on labour, and finance, among others. Our findings show that using an AI pig-counting system can help and provide more reliable data and more traceability through IoT systems, even if we do not put a high focus on AI-related technical content. On the other hand, it can reduce labour costs and administration.

I3 Policy and regulatory innovations

New policies and regulations from the government, their diffusion is a type of innovation, which is collective, also known as group consensus. In terms of our topic, implementing risk zones and obligatory preventive measures to combat ASF are all types of policy innovations, and new advanced behavioural innovations.

I4 Public-Private Partnership (PPP) model

Promoting partnerships between academics, businesses, and governments to solve supply chain issues and spur innovation and establishing government incentive schemes to promote spending on supply chain technology and preventive measures against interruptions are examples of innovation management. Our results show that there have been several acts of collaboration of the triple helix model even before the appearance of ASF. Since the appearance of ASF, there has been a more elevated strategy followed by key players in the market to combat consumer trust and market share.

I5 Customer-centric innovations

In addition to addressing the difficulties brought on by supply chain interruptions like those brought on by ASF, an educational campaign can be an effective means of fostering sustainability, resilience, and knowledgeable consumer behaviour. Information flow and communication channels aimed at the public on how to prevent ASF, as well as its causes and effects, by which it is possible restore consumer trust in pork and other impacted items' quality and safety.

5.3. Model Specification Based on Primary and Secondary Research Conclusions

The objective of the study is to formulate a model, which concludes the possible response to supply chain disruption on the managerial level, both in perspectives from the public and private sector, and to understand how consumer eating patterns changes in case of distuption. Because, according to our knowledge, a similar model has not yet been formulated at the domestic level, we used several literature and our qualitative research from which we formulated our model. These references helped us by providing the model's pillars, which are summarised in **Table 35**.

Table 35: Systematic literature review for mitigation model formulation and sub-areas

Model factor	Description	Reference
Profitability	The literature describes that companies and states always try to gain profitability in the market.	Kim and Tomlin (2013) Bonafarm Group
Demand learning	As consumers are the driving factors at the end of the supply chain, learning and interacting with them is inevitable.	Wen et al. (2019); Li et al. (2021); Salling (2025)
Management and risk management	An ideal management strategy could help mitigate and coordinate disruption.	Xiao and Chen (2012);
Safety and investments	Safety and investments are inevitable in a growing business.	Yu et al. (2021);
Public support	Governmental responses are necessary to avoid big economic falls when disruption happens.	Yu et al. (2021);
New technology, AI and information flow	Innovation of modern lifestyles includes different high-tech solutions to coordinate the market.	Bottani et al. (2019); Wu et al. (2024); Hossain et al. (2017); Ivanov et al. (2019); Reynolds (2024); Etzkowitz (2008)

Source: Author's illustration

As is visible from the table, we utilised several pieces of literature to specify our own model that could help managers understand the key aspects which need to be referred to in the case of disruption. Therefore, **Figure 24** models the response and steps on the managerial level for supply chain resilience due to disruption.

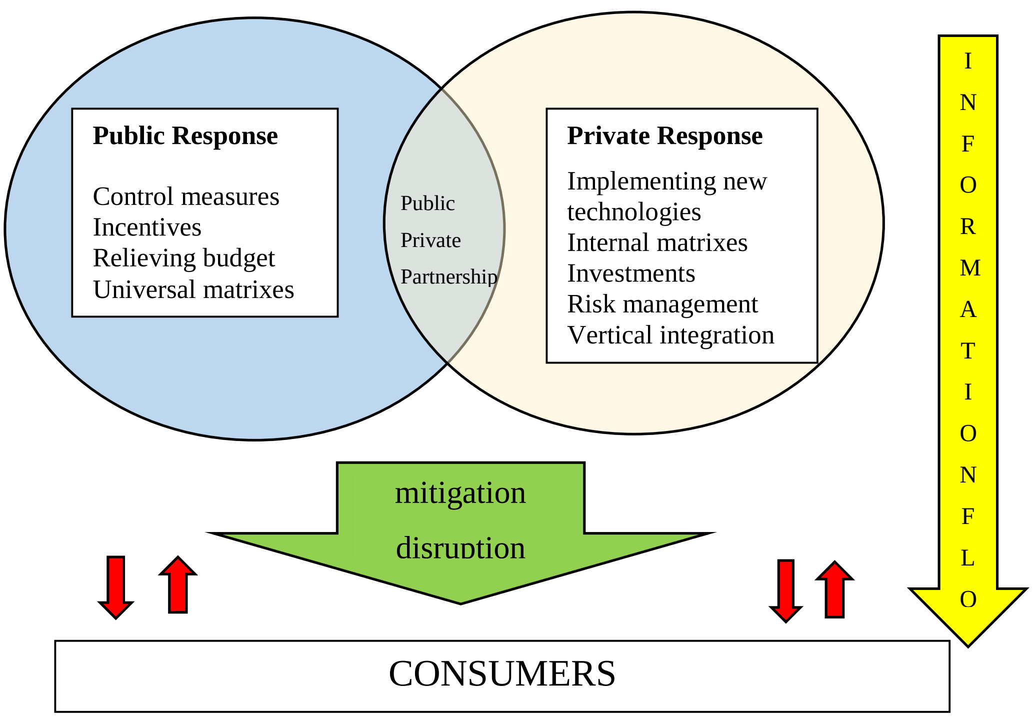

Figure 24: Modeling the managerial response due to disruption in supply chain resilience
Source: Own research (2025), based on qualitative results and Table 21

In terms of mitigation from the public sector, to decrease the negative effects on the economy or market, control measures need to be implemented. In the case of ASF, pig culling, protection zone application, and new behavioural techniques are all inevitable for the control of infected cases. By relieving the budget, the government can be prepared for such unexpected events. Moreover, which can elevate the partnership between the public and private sectors, is providing different incentives and projects for implementing modern technologies. That is how PPP is forming in case of disruption, which is an innovation initiative according to Etzkowitz (2008). Partnerships between the public and private sectors that combine resources and knowledge to spur innovation are frequently under the direction of policy objectives (Etzkowitz, 2008), especially when disruption affects the market (Yu et al., 2021). Government initiatives include tax breaks for research and development as well as direct public venture investments. Public venture programs fill up the gaps left by a lack of private investment, while policies like R&D tax credits assist businesses in high-risk industries (Etzkowitz, 2008). In the case of the private sector, it is inevitable to do internal matrices and risk management to mitigate disruption. Implementing new technologies and techniques, including AI initiatives and innovative behaviour models, are all types of mitigating and coordinating disruption. Which we could see from our qualitative research. Bonafarm Group implements mitigation techniques such as an internal matrix, preventive measures, investments in new approaches, and so on, while implementing governmental requirements based on zone distribution, control measures and information flow across players. The bottom of the stage is the consumer who is highly dependent on some factors; since the economy's production, consumption, and trade sectors are all significantly impacted by outbreaks (Çakır et al., 2018), according to some experts, people's life experiences—such as their values, character qualities, resources, and so on—have a major impact on their dietary decisions (Frost & Hartl, 1996). Food risk is also one of the other elements affecting people's purchasing decisions (Prati et al., 2012). Therefore, consumers and the entrepreneurial stage back and forth impact each other. By the flow of information and transparency by using new technologies, the disruption impact can be directly mitigated. Digital technology is one type of business asset that organisations may utilise to provide end-to-end transparency and further reduce demand uncertainty during high-impact events (Ivanov et al., 2019).

Another model was created based on the previous literature and our quantitative research. The model's objective is to have a broad overview of the psychological, social and economic influences on individuals, by which we can evaluate decisions when disruption happens. Because, according to our knowledge, a similar model has not yet been formulated at the domestic level, we used several international literature sources and our quantitative research results to formulate the model. These references helped us by providing the model's pillars, which are summarised in **Table 36**.

Table 36: Systematic literature review for consumer choice model formulation and sub-areas

	Model factor	Description	Reference
INTERNAL FACTOR	**General driving factors**	The literature describes the basic factors that drive individuals to choose a good, such as culture, habits, and family beliefs.	Fishbein (n.d.); Solomon (2024)
	Influencing factors	When choosing goods, besides the general factors, there are other influencing factors which impact choice (life experience, personal traits, personal values, psychological factors, herd mentality etc.).	Prati et al. (2012); Forbes (2017); Loxton et al. (2020); Yang et al. (2019)
	Fear of animal disease	The extent to which individual fear of animal disease poses a risk to personal health.	Çakır et al. (2018); Foster & Just (1989);
	Price sensitivity	Status and income influence the preferences of an individual.	Weyl & Fabinger (2013); Zamani et al. (2024)
	Psychological factors	Maslow's hierarchy of needs in consumer behaviours is categorised and which categories are thought to be most important for human existence. Psychological drivers.	Forbes (2017); Lester (2013); Samli (2012)
EXTERNAL FACTOR	**Socio-economic aspect**	Depends on the attributes of the country's socio-economic factors to a broader extent (religion, values, etc.).	Taha (2207); Solomon (2024)
	Government policies and information flow	How does the government react to the economy, and society influence consumer choices, and the way it is communicated?	Yang et al. (2019); Pieri (2018); Bessler et al. (2008)
	Disruption impact	Unexpected events could indirectly impact the consumer choice (stock-out, perishability, safety, etc.).	Yoon et al. (2017); Yuen et al. (2020)
	Substitutes and the price of goods	Price fluctuation can cause changes in consumption habits, and the availability of other substitutes could reshape consumer patterns.	Foster & Just (1989); Zamani et al. (2024); Weyl & Fabringer (2013); Salling (2025)

Source: Author's illustration

Figure 25 is a graphic representation of a hierarchy of requirements and decision-influencing elements, based on Maslow's Hierarchy of Needs and expanded to incorporate other decision-making-related factors. It models how consumer food choice patterns change due to disruptions throughout Maslow's hierarchy of needs.

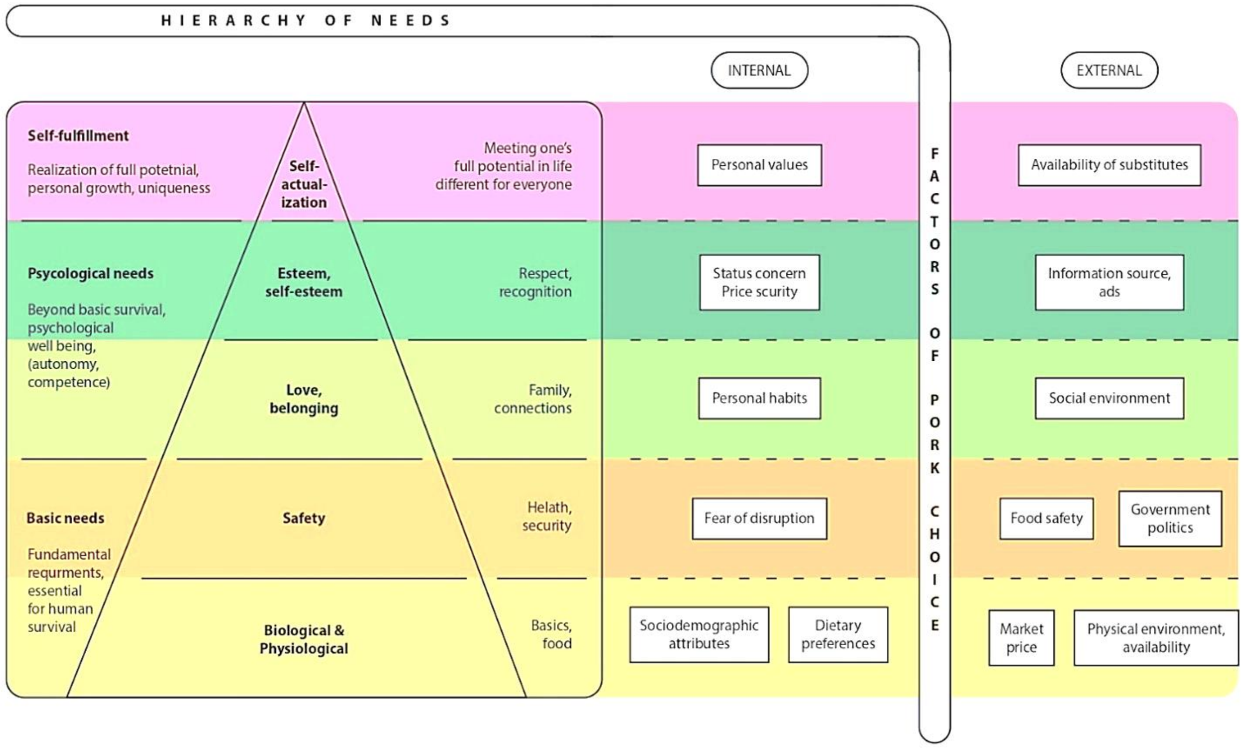

Figure 25: Modelling the pork choice of consumers after disruption
Source: Own research (2025), based on qualitative results and Table 22

A hierarchy of human wants, ranging from the most fundamental to the most advanced, is depicted on the left side of the diagram. The most necessary for survival are *biological and physiological needs*, which include things like food, water, and shelter. *Safety needs:* After basic survival is guaranteed, people look for stability, safety, and security (e.g., financial security, health). *Love & Belonging:* Humans seek relationships, social ties, and a sense of belonging (such as family and friendships) after safety. Respect & Recognition: As one moves up the hierarchy, people look to others and themselves for respect, acknowledgement, and *self-worth*. *Self-Fulfilment (Self-Actualisation):* At the summit of the hierarchy, people work to develop personally, reach their greatest potential, and accomplish their objectives.

The diagram's right side lists the internal and external elements that affect decision-making, especially when it comes to dietary preferences and other consumer behaviours. Going from top to bottom, internal factors are character traits and principles that influence a person's decisions. Personal values are the fundamental ideas and standards that direct one's actions. The status concern is a want for acknowledgement or social standing. Personal habits shape preferences and routines that affect choices. Fear of disruption is the opposition to change or disturbance of daily patterns. Features such as age, gender, income, and educational attainment are examples of sociodemographic attributes which could also impact choices. Dietary preferences or personal preferences, dietary limitations, or decisions pertaining to health. External factors are outside forces that affect how decisions are made. Substitute availability is the existence of substitutes in the market. Advertising, marketing, and other information channels are examples of information sources which could impact choices. The social environment highlights the impact of friends, family, and social conventions. Food safety issues pertaining to the quality and safety of food and nations' concern about it. Government policies, rules and guidelines that influence decisions, especially in the case of disruption. The price of products and services is known as the market price. Physical environment and availability shape the availability and accessibility.

From the model, it is observable that pork choice will be affected by different factors, including some internal factors and some external factors. All these aspects are derived from Maslow's hierarchy of needs. The hierarchy's first pillar includes basic needs and fundamental requirements essential for human survival. In the case of our model, pork is a fundamental and essential meat for human survival. In terms of our research topic, the first stage stands for individual socio-demographic attributes and dietary preferences. From the results, we could see how income, place of living or age differences, among others, have significance on pork consumption in general. On a broader extent, the nation's psychological environment and availability of protein determine the pork choice, besides their prices. It means that the supply of pork shapes the stock, availability and prices. Stepping forward, the safety and well-being stages formulate health and security requirements (i.e. fear of ASF from an individual viewpoint; and food safety and government policy from an external aspect). From our results, we could understand that individuals' opinions of ASF posing a risk to their health could impact pork choice. Government measures could help mitigate scepticism. Psychological needs are the second pillar of the triangle, which includes love and belonging. From the individuals' perspectives, it can be derived as personal or family habits, while from a national perspective, the social environment of a nation. Self-esteem includes respect and recognition, which, from our findings, result in price sensitivity and status. Respect and recognition from external factors are the information sources, such as official websites, radio and ads, which could also shape and impact pork choice during disruption. The third pillar is self-actualisation and self-fulfilment of uniqueness. From an internal aspect, the third pillar includes personal opinions and values. An individual by its uniqueness could decide on pork consumption choices before, during or after a disruption. From an external perspective, the availability of substitutes shapes self-actualization, which indirectly impacts pork choice.

5.4. The Significance of Research Results for the Economy, Their Practical Applicability and the Possibilities for Further Development of the Topic

The fresh produce industry, especially the swine sector, requires far more unique strategies due to its sensitivity towards disruptions. Although generic suggestions cannot be provided, each pork business requires a unique plan to mitigate, especially when interruptions happen in the chain. Developing a devoted clientele, better segmentation, learning the demand, and understanding how they would react to disruptions is essential, and in our opinion, far more crucial. The results have shown that chicken is the most consumed meat type among Hungarians, which means that the focus on elevating pork products, highlighting its nutritional and health benefits, could help popularise it. Furthermore, because of trade restrictions and a possible pig culling of affected swine, ASF outbreaks could result in a considerable decrease in pork production. Policymakers and industry stakeholders can evaluate economic losses and create plans for alternate solutions to prevent or stop an outbreak. Price shifts brought on by reductions in the supply of pork may have an impact on consumer spending trends. Since food safety is an important factor when purchasing pork products among respondents, it could be an ideal approach to put more attention on emphasising the safety levels of consuming pork during ASF. The information flow between the chain players is necessary in terms of different aspects, from sharing information to the use of campaigns on prevention, especially through institutional portals. If there is a closer attachment between the government and the private sector, it could help dispel doubts. By using the model, companies can understand some external and internal factors which could impact pork choice during disruptions.

The applicability of research findings of shifting pork consumption patterns brought on by ASF is broad in a variety of fields, such as economics, policymaking, business practices, and consumer behaviour. To reduce financial losses, research can direct the creation of more efficient surveillance systems, biosecurity protocols, and outbreak response plans. Governments can create equitable compensation plans to assist impacted producers and preserve pork sector stability with the use of quantitative data on farmer losses. Knowledge of the effects of import and export restrictions can guide trade discussions and assist nations in creating backup plans to lessen economic disruptions. Businesses can create focused marketing initiatives to restore customer confidence in pork products or promote alternatives with the use of qualitative insights into consumer preferences and anxieties. In order to guard against future epidemics, businesses can use research to create risk management plans or insurance products. Retailers and food service businesses can use research to predict shifts in customer demand and modify their stock and menus appropriately. Results on consumer worries regarding ASF might direct public awareness initiatives to reassure customers and enlighten them about the safety of pork products. Research findings can spur innovation in sustainable farming methods, biosecurity technologies, and disease-resistant cattle breeding. Particularly in areas where pork is a main meal, the results can help guide initiatives to address any food security issues brought on by decreased pork availability. In summary, research on shifting pig consumption patterns brought on by ASF has a wide range of applications, addressing both short-term economic issues and long-term plans for sustainability, innovation, and resilience in the world food system.

Future studies on the social and economic effects of shifting pig consumption habits brought on by ASF can look at a variety of subjects to fill in knowledge gaps, tackle new issues, and spur innovation. For instance, examine how ASF affects GDP, employment, and trade balances over the long run in both the domestic and international economies. Assess whether the intake of pork has changed temporarily or if this is a sign of a long-term change in dietary choices. Examine the growing potential of alternative proteins as pork alternatives. Examine how the pig sector may enhance supply chain management, biosecurity, and traceability through the use of digital technologies (such as blockchain, IoT, and AI). Examine how precision agricultural technologies might improve pig farming’s disease monitoring and control. By using our model, businesses could consider mitigating similar animal disease disruptions, such as the actual issue of foot-and-mouth disease in the Hungarian beef market (Nébih, 2025).

5.4.1. Contribution of the Thesis

The main contribution of the study is that businesses in the fresh produce, swine and meat industries can create more robust supply chains by using the study’s identification of efficient mitigation and coordination techniques. This guarantees steady production and delivery while lowering financial losses brought on by interruptions like ASF, natural calamities, or pandemics. The study contributes to theoretical knowledge of supply chain disruptions, especially as they relate to pork livestock. By adding disease-related disruptions like ASF, which have received little attention in conventional domestic supply chain literature, it broadens the scope of current frameworks. The study fills a significant void in innovation management science by investigating the relationship between shifting consumer behaviour and managerial tactics. It emphasises how supply chain decisions can be influenced by consumer-driven demands and vice versa. To address supply chain issues, the study makes use of case study analyses, simulation methods, qualitative and quantitative models. This enhances the discipline's methodological arsenal by illustrating how management science concepts can be used practically to solve real-world issues. The study promotes supply chain management innovation and marketing, which aids companies in maintaining their competitiveness, specifically in times of disruption.

5.4.2. Limitations

In order to enrol Hungarian pork consumers, this study used a quantitative online survey with heterogeneous snowball sampling, which was started with peers and students at Óbuda University. Although this method allowed for quick data collection, self-selection and network homophily may have caused it to overrepresent younger, more educated demographics. Although social desirability bias (e.g., underreporting price sensitivity) and hypothetical bias (difference from real-world behaviour) are still limitations. Notwithstanding its limitations, this approach laid the foundation for future probabilistic sampling by offering crucial early insights into behavioural changes brought on by crises. For specialised targeting (pork consumers during crises), snowball sampling was practical; however, for robustness, future research should include a random sample as well.

Although the study's conclusions offer insightful information about how consumers behave during an ASF outbreak, there are drawbacks due to the sample size (N = 331). The statistical power for in-depth segment comparisons is diminished by small subgroup sizes (such as older adults and rural customers, etc.). Self-reported intentions may also be exaggerated beyond real-world cases due to the survey's hypothetical character. These limitations require caution when extrapolating data. To improve representativeness and validity, future studies should use stratified random sampling and real-time data collection during real outbreaks.

The results, particularly the cluster findings are best understood in light of crisis communication around pork and ASF. The extent of another crisis and the product's cultural and consumer relevance determine whether it can be generalised. For instance, hesitant-avoidant behavior may be similar in the case of zoonotic epidemics, but priorities may differ in segments based on price sensitivity. The results might not be applicable to nations with differing regulatory systems or pork consumption patterns (such as Asia versus Europe). Long-term behavioral changes following a crisis, such as whether avoidance continues after outbreaks have subsided, cannot be captured by cross-sectional data. It would be beneficial to test the clusters' stability in different product categories in future studies.

6. NOVEL SCIENTIFIC RESULTS

1. I determined the mitigation options in case of disruption in the supply chain based on the synopsis of the theoretical background on a managerial level. **N1**

I compiled the findings of national and international research and models that looked at the variables of mitigating, especially animal disease outbreaks, after a disruption happens in the market.

2. I determined the consumer pattern changes towards pork in the case of disruption in the supply chain based on the synopsis of the theoretical background. **N2**

I compiled the findings of national and international research and models that looked at the variables influencing the fresh food choice of pork after disruption happens in the market.

3. I developed my own study model on the mechanism of action at the managerial level when disruption happens in the supply chain **N3**

Developing a theoretical model for the mitigation and coordination of disruption was one of my thesis's primary goals. I developed my elemental mitigation model by describing the private and public sectors' reaction steps to disruption by the combination of collaboration. After the qualitative phase of the empirical research and the conclusions, it took the shape of a final research model. With the help of my quantitative study, I could demonstrate the connections between the variables in the research model and understand the market's driving factors.

4. I developed my own study model on the mechanism of consumers' changing pork choice patterns due to disruption in the supply chain. **N4**

Developing a theoretical model of influencing factors on consumers' pork choice during disruption was one of my thesis's primary goals. I developed my own elemental model by describing how consumers would react to disruptions in their eating patterns, and also by interpreting the influencing internal and external factors based on the hierarchy of needs. After the qualitative and quantitative phases of the empirical research and the conclusions, it took the shape of a final research model. With the help of my quantitative study, I could demonstrate the connections between the variables in the research model and understand it more deeply.

5. I classified the sample according to individual price sensitivity and determined the factors that influence the choice of pork in the case of a hypothetical ASF outbreak. **N5**

In light of other findings from my empirical research, I was able to create consumer target groups that are distinct from one another in terms of price sensitivity during a disruption.

6. I classified the sample according to individual demand shifts on either ceasing or adjusting demand based on price shifts due to the ASF outbreak. **N6**

In light of other findings from my empirical research, I was able to create consumer target groups that are distinct from one another in terms of completely rejecting and avoiding continued pork purchase or adjusting demand on the basis of price fluctuations due to the ASF outbreak.

SUMMARY

In the doctoral thesis, I analysed and researched the fresh produce supply chain disruptions, with a special focus on the fresh produce swine industry. Throughout the thesis, I highlighted the African swine fever outbreak as an example, and I measured its consequences on the market and consumer eating and purchasing patterns towards pork. Moreover, I emphasised the mitigation and coordination options through managerial perspectives. In my opinion, the swine industry is essential in many countries' market share. Due to its attribute of importance, it is inevitable to constantly analyse, study and research. From my viewpoint, people are gradually changing their eating habits, which can be impacted by many factors, including personal values, national ethics, pricing, food safety measures, and last but not least, unexpected events, such as animal disease outbreaks and natural disasters, among others.

My topic's relevance stems from the fact that our nation's consumption patterns towards pork have changed significantly in recent decades. Since pork is one of the most consumed meat types globally, and is important in Chinese and Hungarian markets too, I found it necessary to research the actual trends and emphasise how Hungarian consumers would react to a true African swine fever outbreak in the domestic pig supply. Studying this problem is important because the global food and meat supply chain, particularly the fresh produce swine industries, has a significant impact on food security, economic stability, and public health. Disruptions could affect both producers and consumers, leading to significant financial losses, food shortages, and price adjustments.

An important part of the dissertation was to conduct a complex overview of the literature review to be able to look at the facts in the most open perspectives. I analysed more than 200 international and domestic studies, as well as collected datasets from official websites. I presented the supply chain of fresh produce and supply chain disruptions in general. I could understand how complex the chain is, and how important is to have constant information flow between the chain players. I also demonstrated the Chinese and Hungarian pig market, and how ASF impacts are. Different supply chain mitigation and coordination effects was also presented in the doctoral thesis. Lastly, since one of the aims of the thesis is to deeply analyse the impact on consumer eating habit changes, I analysed some historical situations of different animal disease outbreaks, which could provide a guide in the subsequent research formulations.

In the empirical phase, I chose to use qualitative and quantitative research as well. In terms of qualitative primary research, a structured in-depth interview was conducted with Bonafarm, focusing on managerial techniques in mitigating ASF outbreaks in their supply chain. One of the sample methods we used for the primary quantitative investigation was the heterogeneous snowball seed sampling methodology. The primary population and the seeds for the snowball sampling were friends and students at Óbuda University; thanks to their involvement, we were able to expand the sample size. We used heterogeneous snowball seed sampling without filtering criteria for inclusion in the sample. A quantitative sample data collection method and a pre-tested, standardised online questionnaire were created to carry out the survey. Different statistical methods were used to analyse the data, including ANOVA, chi-square, cluster analysis, among others.

Our results show that in the case of ASF, the corporate business has been impacted severely. Chinese export bans, implementation of new biosecurity measures, behavioural matrices, and other technologies are among the impacts and mitigation techniques Bonafarm faced and introduced since ASF’s first appearance in wild boar populations in the domestic market. The quantitative results presented that the consumption pattern towards pork could truly indirectly change in the case of a direct ASF outbreak among domestic pigs. Specifically, health concerns are strongly correlated with the changing pork purchase habits, meaning that those people who have high concerns about ASF posing a risk to their health are more likely to stop or reduce pork consumption. Consumers can be segmented into two distinct groups based on pork purchase pattern changes due to ASF. Some avoidant-hesitant buyers completely stop or reduce pork purchase, and price-sensitive active buyers who react to price shifts due to disruption, but still stick to pork purchase.

This study enhances theoretical rigour by integrating consumer resilience theory (Prati et al., 2012; Foster & Just, 1989) and innovation diffusion models (Etzkowitz, 2008; Yu et al., 2021) to analyse crisis-driven behaviour. While Hungary lacks historical ASF market data (as outbreaks have been confined to wild boars only), this study adapts consumer crisis response theory (Kashyap et al., 2024, Zamani et al., 2024) and food safety trust models (Hinde et al., 2001) to hypothesize behavioural patterns. These frameworks, validated in analogous zoonotic outbreaks (e.g., avian influenza in poultry markets), guided survey design to capture risk perceptions (H9, H10), price sensitivity (H12, H13) and trust dynamics (H14). To compensate for the data gap, we benchmarked results against general pork consumption trends (KSH, 2023), and used general consumption patterns and hypothetical scenarios to isolate crisis-specific decision-making. The findings offer preliminary insights for policymakers anticipating domestic ASF scenarios.

ÖSSZEFOGLALÓ

A doktori értekezésben a frisstermék-ellátási lánc zavarait elemeztem és kutattam, különös tekintettel a sertésiparra vonatkozóan. A dolgozat során példaként emeltem ki az afrikai sertéspestis-járványt, továbbá mértem a piaci és a fogyasztói étkezési szokások sertéshússal kapcsolatos következményeit. Ezen túlmenően a menedzseri szempontok révén hangsúlyoztam a mérséklési és koordinációs lehetőségeket. Véleményem szerint a sertésipar számos ország piaci részesedésében elengedhetetlen. Fontossága miatt elkerülhetetlen a folyamatos elemzése, tanulmányozása, kutatása. Meglátásom szerint az emberek fokozatosan változtatják étkezési szokásaikat, amit számos tényező befolyásolhat, többek között személyes értékek, nemzeti etika, árképzés, élelmiszer-biztonsági intézkedések, és nem utolsósorban váratlan törések a láncban, mint például az állati eredetű fertőzéskitörések, természeti katasztrófák.

Témám aktualitása abból adódik, hogy nemzetünk sertéshúsfogyasztási szokásai az elmúlt évtizedekben jelentősen megváltoztak. Mivel a sertéshús világviszonylatban is az egyik leginkább fogyasztott húsféleség, a kínai és a magyar piacon is kimondottan fontos szerepet tölt be van. Éppen ezért is láttam szükségesnek a jelenlegi trendek felkutatását és annak hangsúlyozását, továbbá, értékelni a hazai fogyasztók reakcióját egy valós afrikai sertéspestis-járványkitörésre a házisertésekben. E probléma a tanulmányozása azért is nagyon fontos, mert a globális élelmiszer- és húsellátási lánc, különösen a friss sertéstermékek ágazata jelentős hatással van az élelmezésbiztonságra, a gazdasági stabilitásra és a közegészségügyre. Az efféle törések mind a termelőket, mind a fogyasztókat érinthetik, ami jelentős pénzügyi veszteségekhez, élelmiszerhiányhoz és árkiigazításokhoz vezethet.

A disszertáció fontos része volt a szakirodalmi áttekintés komplex áttekintése, hogy a tényeket a legnyitottabb perspektívákból szemlélhessük. Több mint 200 nemzetközi és hazai tanulmányt elemeztem, valamint hivatalos weboldalakról gyűjtöttem adatsorokat. Bemutattam a frisstermékek ellátási láncát, a fellépő zavarokat és töréseket. Bemutattam, milyen összetett ez a lánc, és mennyire fontos az állandó információáramlás a lánc szereplői között. Kutattam a kínai és a magyar sertéspiacot egyaránt, és az ASP hatásait is. A doktori értekezésben bemutatásra kerültek a különböző ellátás-lánci törések mérséklési és koordinálási lehetőségei is. Végezetül, mivel a disszertáció egyik főbb célja a fogyasztói étkezési szokások változásaira gyakorolt hatás mélyreható elemzése volt, szintén elemeztem a különböző állatbetegség-kitörések helyzetét, amelyek támpontot adhattak a további kutatási hipotézisek és célok megfogalmazásokhoz.

Az empirikus fázisban a kvalitatív és kvantitatív kutatások alkalmazását választottam. A kvalitatív primer kutatás tekintetében strukturált mélyinterjút készítettem a Bonafarmmal. A kutatás az ASP-járványok mérséklését szolgáló menedzseri technikákra összpontosított. A primer kvantitatív vizsgálathoz módszerünk, a heterogén hólabda magvakkal mintavételi módszer volt. Az elsődleges populáció és a hólabda-mintavétel magvai az ismerősök és az Óbudai Egyetem hallgatói voltak; közreműködésüknek köszönhetően a mintanagyságot bővíteni tudtam. A mintába kerüléshez heterogén hólabda-magvakkal mintavételt alkalmaztunk szűrési kritériumok nélkül. A felmérés lebonyolításához kvantitatív mintavételi adatgyűjtési módszert és előre tesztelt, sztenderdizált online kérdőívet készítettem. Az adatok elemzéséhez különböző statisztikai módszereket alkalmaztunk, többek között ANOVA-t, khi-négyzetet, klaszteranalízist.

Eredményeim azt mutatják, hogy az ASP esetében a vállalati üzletág súlyosan érintett. A kínai exporttilalmak, új biztonsági intézkedések bevezetése, viselkedési mátrixok, mérséklő technikák, mind részét képezik a Bonafarm járványmérséklési intézkedéseinek. A kvantitatív eredmények azt mutatták, hogy a sertéshús fogyasztási szokások valóban megváltozhatnak az ASP-járvány közvetlen kitörése következtésben. Kimondott kapcsolat vélhető fel, az egészségügyi aggodalmak és sertéshús-vásárlási szokások változása között, ami azt jelenti, hogy azok a fogyasztók, akik inkább kockázatkerülők, ugyanis úgy vélik, hogy az ASP veszélyt jelent az egészségükre, nagyobb valószínűséggel kerülik vagy csökkentik a sertéshús fogyasztását, vásárlását. A fogyasztók két külön csoportra oszthatóak, az ASP miatti sertéshús-vásárlási szokások megváltozása következtében. Az ún. *kerülő-habozó vásárlók* egy része teljesen ellál vagy csökkenti a sertéshús vásárlását. A másik csoport az *árérzékeny de aktív vásárlók*, akik reagálnak a zavarok miatti áreltolódásokra, de továbbra is ragaszkodnak a sertéshús vásárlásához.

Jelen tanulmány fokozza az elméleti alaposságot a fogyasztói reziliencia elméletének (Prati et al., 2012; Foster & Just, 1989) és az innovációdiffúziós modellek (Etzkowitz, 2008; Yu et al., 2021) integrálásával a válságvezérelt viselkedési kutatásokat. Mivel Magyarországon csak a vaddisznóállományban van jelen az ASP járvány, hiányoznak a historikus ASP piaci adatok, így a tanulmány a fogyasztói válságelméletet (Kashyap et al., 2024, Zamani et al., 2024) és az élelmiszerbiztonsági bizalmi modelleket (Hinde et al., 2001) adaptálja a viselkedési minták hipotéziseinek felállításához. Ezek a keretrendszerek, amelyeket analóg zoonózisos járványokban (pl.

madárinfluenza) validáltak, irányított kérdőíves tervezést alkalmaztak a kockázatészlelés (H9, H10), az árérzékenység (H12, H13) és a bizalom dinamikájának (H14) rögzítésére. Az adathiány kompenzálására az eredményeket az általános sertéshúsfogyasztási trendekhez viszonyítottuk (KSH, 2024), és általános fogyasztási mintákat, valamint hipotetikus forgatókönyveket használtunk a válságspecifikus döntéshozatal elkülönítésére. Az eredmények előzetes betekintést nyújtanak a hazai ASP előrejelző politikai döntéshozók számára.

OWN PUBLICATIONS

Publications list of Salling, Melissza
MTMT publications and citation summary table

Data of Salling, Melissza (07.07.2025)		
	Scientific publications	Independent references
All scientific publications and independent references	11	29

Source: MTMT, 07.07.2025.

Regarding the topic

1. Yu, Y., He, Y., & Salling, M. (2021). Pricing and Safety Investment Decisions in Food Supply Chains with Government Subsidy. Journal of Food Quality, 1-28.

2. Tang, X., Yong, H., & Salling, M. (2021). Optimal pricing and production strategies for two manufacturers with industrial symbiosis. *International Journal of Production Economics*, 235, 108084.
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4. Salling, M. (2024). Analysis of the Impact on Prices of African Swine Fever in China. In: EBES, Publications (Eds.) 48th EBES Conference: Program and Abstract Book. Istanbul, Törökország: *EBES Istanbul*, pp. 61-62., 2 p.

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NYILATKOZAT

A MUNKA ÖNÁLLÓSÁGÁRÓL, IRODALMI FORRÁSOK MEGFELELŐ MÓDON TÖRTÉNT IDÉZÉSÉRŐL

Alulírott Salling Melissza kijelentem, hogy a "*Supply chain disruption in fresh produce swine industry: impact and mitigation of disruption*" című benyújtott doktori értekezést magam készítettem, és abban csak az irodalmi hivatkozások listáján megadott forrásokat használtam fel. Minden olyan részt, amelyet szó szerint, vagy azonos tartalomban, de átfogalmazva más forrásból átvettem, a forrás megadásával egyértelműen megjelöltem.

Budapest, 2025.08.27.

Salling Melissza
aláírás

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ANNEXE

Annex I – Guide to the Interview

Interjú forgatókönyv/*Interview guide*

Köszönd meg a részvételt és az időt, amit az interjúra szántak. Mutatkozz be röviden. Ismertesd az interjúalanyokkal, hogy mi az interjú célja, hogyan és mi fog történni. Emeld ki, hogy az interjú teljesen anonym módon fog zajlani, tehát a jelenlévők semmilyen adata nem less felfedve az interjú kiértékelésekor, sem a későbbiekben. Emeld ki az őszinte válaszok fontosságát, továbbá egyezzetek meg abban, hogy az elhangzottak milyen folyamaton kell, hogy átessenek a cégen belül, hogy publikálható legyen.

Thank them for their participation and the time they have given to the interview. Briefly introduce yourself. Explain to the interviewees the purpose of the interview, how it will be conducted, and what will happen. Emphasise that the interview will be completely anonymous, so no information about those present will be revealed during the interview evaluation or later. Emphasise the importance of honest answers, and agree on the process that what is said must go through the company's approval before it can be published.

1. Bemutatkozás *Introducing ourselves*

Először kérem mutatkozzunk be egymásnak. Én pedig ismertetem a kutatás témáját, célját és miért a Bonafarmra esett a választás.

First, please introduce yourself. I will explain the topic of the research, its purpose, and why Bonafarm was chosen.

2. Interjú *Interview*

Kérdéseket az interjú előtt email-en keresztül megkapták, ezért az alapján haladj és ha útközben felmerül még kérdés, akkor azokat tisztázzátok.

Questions via email have been sent before the interview, so proceed based on that and if any questions arise along the way, clarify them.

A fő kérdések:	***Main questions:***
1. Hogyan épül fel az Önök vállalatánál a teljes ellátási lánc (gondolok itt a sertéstenyésztés, vágóhíd, feldolgozás, végtermék eljuttatása a kis és nagyvállalatoknak, stb.)	*1. How is the entire supply chain structured at your company (I mean pig farming, slaughterhouse, processing, delivery of the final product to small and large companies, etc.)*
2. Esetleg tudnak-e nekem számadatokat mondani, hogy mekkora per/koponya a sertéstelep, mennyi disznót vágnak le naponta/havonta vagy évente, mennyi kerül feldolgozásra a kereslet-kínálat függvényében?	*2. Can you give me some data on how big the pig farm is, how many pigs are slaughtered per day/month or per year, and how much is processed depending on supply and demand?*

3. Hogyan védekeznek a telepeken egy esetleges vírusfertőzéssel szemben (különösképp az afrikai sertéspestis tekintetében, mivel arra teszem a hangsúlyt a disszertációban)	*3. How do farms protect themselves against a possible viral infection (especially concerning African swine fever, as that is what I am focusing on in my dissertation)*
4. Vannak-e kialakított zónák, védőfelszerelés, fertőtlenítés, stb. Ilyen kialakítások hogyan befolyásolják a költséghatékonyságot, ROI-t?	*4. Are there designated zones, protective equipment, disinfection, etc? How do such designs affect cost-effectiveness and ROI?*
5. Használnak-e bármiféle mesterséges intelligencia rendszert a sertések monitorozására, sertés nyilvántartásra (RFID, hőkamera, chip, stb.)? Ha igen, az milyen adatokat mutatnak meg? Ezzel hogyan lehet mérsékelni a fertőzés felütését?	*5. Are any artificial intelligence systems used to monitor pigs and register pigs (RFID, thermal imaging, chip, etc.)? If so, what data does it show? How can this help mitigate the spread of infection?*
6. Hogyan készülnek fel a kereslet csökkenésre a sertéspiacon? Hogyan tudják kezelni az igény visszaesést? Erre van-e bármi módszer?	*6. How are they preparing for the decline in demand in the pork market? How can they handle the decline in demand? Is there any method for this?*
7. Távol-Kelet? Kínába exportál a Bonafarm? ASP korlátozások hogyan befolyásolták a kiszállítást?Az interjú során több kérdés is felmerült, melyekre az interjúalanyok hasznos információkkal láttak el.	*7. Far East? Does Bonafarm export to China? How did ASP restrictions affect shipments? Several questions arose during the interview, to which the interviewees provided useful information.*

Egyéb felmerülő kérdések: ***Other questions:***

(a) Hogyan működik a sertések testhőmérése? Mi az ideális testhő?	*(a) How does body temperature measurement work in pigs? What is the ideal body temperature?*
(b)Hogyan működött egy próba tesztelés, mi a véleménye egy hőkamerás rendszer kialakításáról?	*(b) How did a trial test work, what is your opinion on the design of a body thermal system?*
(c) Kereskedelmi visszaesés tapasztalható-e az ASP óta?	*(c) Has there been a decline in trade since ASF?*
(d) Zóna szerinti sertésvágás hogyan működik az MCS Vágóhídnál?	*(d) How does zone-based pig slaughtering work at MCS Slaughterhouse?*
(e) ASP befolyása az exportra?	*(e) What is the ASF's impact on exports?*
(f)Hazai fogyasztói kereslet miben nyilvánul meg az elmúlt években?	*(f) What has domestic consumer demand been manifested in recent years?*

3. Interjú vége

Finish the interview

Köszönd meg a részvételt és ismertesd, hogy a felmérés kiértékelését követően a jegyzetet meg fogod küldeni a kommunikációs irodának felülvizsgálatra és csak az általuk elfogadott verziót fogod felhasználni a dolgozatban és publikációkban.

Thank them for their participation and explain that after evaluating the survey, you will send the notes to the communications office for review and that you will only use the version they accept in the paper and publications.

Annex II – Approval from Bonafarm

febr. 18., K 2:15

címzett: én

Kedves Melissza!

Csatolva küldöm a véleményezett anyagot. Kérem, hogy kihúzott részeket semmilyen formában ne használja a jövőben, azok publikálásához nem tudunk hozzájárulni.

Egy melléklet • Megvizsgálta a Gmail

Bonafarm Csopor...

Annex III – Survey

Bevezetés/*Introduction*

Beleegyező nyilatkozat

Kedves Kitöltő!

Salling Melissza vagyok, az Óbudai Egyetem, Innováció Menedzsment Doktori Iskola PhD hallgatója. Disszertációmban a sertéshús fogyasztás szokásait és az afrikai sertéspestis következtében megváltozott vásárlási szokásokat kutatom. 18 év feletti kitöltőket keresek, nőket és férfiakat egyaránt, akik fogyasztanak húst, sertéshúst.

A kérdőív kitöltése körülbelül 5-6 percet vesz igénybe. A kutatásban való részvétel önkéntes és anonym jellegű. Az adatokat PhD diplomamunkámhoz fogom felhasználni, tehát a kitöltéssel Ön elsősorban diplomám megszerzéséhez járul hozzá, amit előre is nagyon köszönök.

Köszönöm, hogy elolvasta a feltételeket, ha elfogadja őket, elkezdheti a kérdőív kitöltését.

Informed Consent

Dear Respondent!

I am Melissza Salling, a PhD student at the Óbuda University, Innovation Management Doctoral School. In my dissertation, I am researching pork consumption habits and the changes in purchasing habits due to African swine fever. I am looking for respondents over 18, women and men, who consume meat, pork meat.

Filling out the questionnaire will take approximately 5-6 minutes. Participation in the research is voluntary and anonymous. I will use the data for my PhD thesis, so by filling it out you are primarily contributing to my degree, for which I thank you very much in advance.

Thank you for reading the terms and conditions, if you accept them, you can start filling out the questionnaire.

1. Ön melyik hústípust fogyasztja a leggyakrabban? / *Which meat type do you consume the most?*

Csirke / *Chicken*
Sertés / *Pork*
Marha / *Beef*
Pulyka / *Turkey*
Kacsa */ Duck*
Liba */ Goose*
Hal és tengergyümölcsei / *Fish and seafood*
Nyúl és egyéb */ Rabbit and others*

2. A leggyakrabban fogyasztott hústípuson felül, milyen egyéb hústerméket fogyaszt gyakran? Több opció is választható. / Besided the most consuned meat type, what other meat do you consume on regular basis? More options can be selected.

Csirke / *Chicken*

Sertés / *Pork*

Marha / *Beef*

Pulyka / *Turkey*

Kacsa */ Duck*

Liba */ Goose*

Hal és tengergyümölcsei / *Fish and seafood*

Nyúl és egyéb */ Rabbit and others*

3. Milyen gyakran fogyaszt sertéshúst, ill. abból készült feldolgozott termékeket? / *How often do you consume pork or pork processed products?*

Naponta / *Daily*

Hetente többször / *Couple of times a week*

Hetente / *Weekly*

Havonta többször / *Couple of times a month*

Havonta / *Monthly*

Ritkábban, mint havonta / *Less than on monthly basis*

4. Nyers sertéshús (pl. darált hús, comb, karaj stb.) vásárlása során Önnek mennyire fontosak az alábbi szempontok? Kérem, osztályozza 1-4-ig! (**4– nagyon fontos, 1- egyáltalán nem fontos**) / *How important are the following aspects to you when buying raw pork (raw meat, such as minced meat, loin, chop, etc.)? Please rate them from 1 to 4. (4 – very important, 1 – not important at all)*

Megnevezés / *Description*	**Fontosság /** *Importancy*			
Kiszerelés, csomagolás */ Packaging*	4	3	2	1
Ár (Ft/kg) */ Price (HUF/kg)*	4	3	2	1
Tartási körülmények */ Breeding conditions*	4	3	2	1
Élelmiszerbiztonság* */ Food safety*	4	3	2	1
Magyar termék* */ Hungarian product*	4	3	2	1
Frissesség */ Fresshness*	4	3	2	1
Reklám, média üzenetek	4	3	2	1

/Ads, mass media messages				
Barátok, ismerősök véleménye, javaslata / Opinion, suggestions of frineds	4	3	2	1

*élelmiszerbiztonság jelentése: az élelmiszerek kezelése, elkészítése és tárolása oly módon, hogy az a lehető legjobban csökkentse az élelmiszer-fogyasztásból származó megbetegedés kockázatát */*food safety means: handling, preparing and storing food in a way that minimizes the risk of individuals becoming ill from foodborne diseases*

*magyar termék: hazánkban született, nevelt, feldolgozott állat/*hungarian product: produced, manufactured in our country*

5. Feldolgozott sertéshústermékek (sonka, szalámi, szalonna, kolbász stb.) vásárlása során Önnek mennyire fontosak az alábbi szempontok? Kérem, osztályozza 1-4-ig! (<u>4– nagyon fontos, 1-egyáltalán nem fontos</u>) / *How important are the following aspects to you when buying processed pork (ham, salami, bacon, sausage, etc.)? Please rate them from 1 to 4. (<u>4 – very important, 1 – not important at all</u>)*

Megnevezés / *Description*	**Fontosság /** *Importancy*			
Kiszerelés, csomagolás */ Packaging*	4	3	2	1
Ár (Ft/kg) */ Price (HUF/kg)*	4	3	2	1
Tartási körülmények */ Breeding conditions*	4	3	2	1
Élelmiszerbiztonság* */ Food safety*	4	3	2	1
Magyar termék* */ Hungarian product*	4	3	2	1
Frissesség */ Fresshness*	4	3	2	1
Reklám, média üzenetek */Ads, mass media messages*	4	3	2	1
Barátok, ismerősök véleménye, javaslata / Opinion, suggestions of frineds	4	3	2	1
Márka / Brand	4	3	2	1

*élelmiszerbiztonság jelentése: az élelmiszerek kezelése, elkészítése és tárolása oly módon, hogy az a lehető legjobban csökkentse az élelmiszer-fogyasztásból származó megbetegedés kockázatát */*food safety means: handling, preparing and storing food in a way that minimizes the risk of individuals becoming ill from foodborne diseases*

*magyar termék: a termék előállításához felhasznált valamennyi összetevő Magyarországról származik/*Hungarian product: most of the ingredients used to produce the product come from Hungary*

6. Honnan származik leginkább a nyers sertéshús, amit elfogyaszt (pl. darálthús, comb, karaj stb.)? */ Where* *does most of the raw pork you eat come from? (e.g. miced meat, loin, chops, etc.)?*

Saját nevelés / *Home-breeding*

Termelőtől / *Pork breeder*

Húsbolt, hentes / *Butcher*

Hipermarket, szupermarket, egyéb kiskereskedelmi egység / *Hypermarket, supermarket, other retail unit*

7. **Honnan származik leginkább a feldolgozott sertéshús, amit elfogyaszt (pl. kolbász, szalámi, szalonna stb.)?** / *Where does most of the processed pork you eat come from?(e.g. sausage, salami, bacon, etc.)?*

Saját nevelés / *Home-breeding*

Termelőtől / *Pork breeder*

Húsbolt, hentes / *butcher*

Hipermarket, szupermarket, egyéb kiskereskedelmi egység / *Hypermarket, supermarket, other retal unit*

8. **Milyen mértékben ért egyet az alábbi állításokkal?** (**4– teljes mértékben egyetért, 1- egyáltalán nem ért egyet**). / *To what extent you agree with below statements? (4 – strongly agree, 1 – not agree at all)*

Megnevezés / *Description*	**Egyetértés mértéke /** *Degree of agreement*			
A sertéstermékek vásárlása során mindig az alacsonyabb árú terméket választom, nem foglalkozva annak minőségi besorolásával. / *When buying pork products, I always choose the lower priced product, regardless of its quality rating.*	4	3	2	1
Akció során többet is hajlandó vagyok vásárolni, mint amennyire valójában szükségem lenne. / *During a sale, I am willing to buy more than I actually need.*				
Hajlandó vagyok új termékeket vásárolni a már bevált termékek helyett, ha azok ára kedvezőbb. / *I am willing to buy new products over tried and tested products if they are more affordable.*	4	3	2	1
Mindig figyelek arra, hogy a legfrissebb terméket válasszam. / *I always make sure to choose the freshest product.*	4	3	2	1
Étteremben általában a sertéshúsból készült ételeket választom. / *In restaurants, I usually choose dishes made with pork.*	4	3	2	1
Ünnepekkor és nagyobb családi eseményekkor is ragaszkodom a sertéshúsból készült ételek elkészítéséhez. / *I also insist on preparing pork dishes during holidays and larger family events.*	4	3	2	1
Előnyben részesítem a magyar eredetű sertéstermékeket a külföldiével szemben. / *I prefer pork of Hungarian origin over foreign origin pork.*	4	3	2	1
Félek attól, hogy a sertéshús esetében Magyarországon is kitör valamilyen élelmiszerbotrány. / *I'm afraid there will be a food scandal with pork too in Hungary.*	4	3	2	1

Háttérinformáció: Az afrikai sertéspestis (ASP) egy rendkívül fertőző és halálos sertésbetegség, amely mind a gazdaságban nevelt, mind a vaddisznót érintheti. Az afrikai sertéspestis nem fertőzi meg az embereket, de könnyen átkerül egyik sertésről a másikra a fertőzött sertés testnedveivel való közvetlen érintkezés útján. */ Background: Both farm-raised and wild pigs are susceptible to the lethal and extremely contagious swine disease known as African Swine Fever (ASF). Although African swine fever cannot infect humans, it can easily spread from pig to pig through direct contact with an infected pig's bodily fluids.*

A következő a hipotetikus helyzet / *Consider the following hypothetical situation*

Tételezzük fel, hogy Magyarországon az afrikai sertéspestis (ASP) nagymértékű kitörése a házisertések körében is tapasztalható. A járvány kitörését megerősítik, a sertéstelepek pedig sertéspusztulásokról számolnak be. Ebből az következik, hogy a vírussal fertőzött disznók húsa valószínűleg bekerül a sertéshús ellátási láncba.

Kérjük, válaszoljon az alábbi, sertéshús fogyasztási és vásárlási szokásokkal kapcsolatos kérdésekre. Kérjük, az alapján válaszoljon a kérdésekre, ahogyan egy tényleges nagymértékű afrikai sertéspestis-járvány kitörése esetén cselekedne.

Assume that Hungary is experiencing a large outbreak of African Swine Fever (ASF) in hogs. The outbreak is confirmed and hog farms report pig deaths. Meat from hogs infected with the virus is likely to be part of the pork supply chain.

Please respond to the following inquiries about the pork you purchase. Please make an effort to respond as closely as feasible to the real response you expect in the event of an African swine fever outbreak. Your answers are still anonymous.

9. **Milyen mértékben ért egyet az alábbi állításokkal a nyers sertéshús és feldolgozott sertéstermékek vásárlását illetően, amikor afrikai sertéspestis tombol a házisertések körében? (4– teljes mértékben egyetért, 1- egyáltalán nem ért egyet)** / *To what extent do you agree with the following statements regarding the purchase of raw pork and processed pork products during an outbreak of African swine fever in domestic pigs? (4 – totally agree, 1 – do not agree at all)*

Megnevezés / *Description*	**Vásárlási mérték /** *Buying extent*			
Ugyanúgy vásárolnám a nyers sertéshúst (darálthús, karaj, comb stb.), mint az afrikai sertéspestis kitörése előtt. / *I would buy raw pork (minced meat, loin, thighs, etc.) the same way I did before the African swine fever outbreak.*	4	3	2	1
Ugyanúgy vásárolnám a feldolgozott sertéstermékeket (kolbász, szalonna, szalámi stb.), mint az afrikai sertéspestis kitörése előtt. / *I would buy processed pork products (sausages, bacon, salami, etc.) in the same way as before the outbreak of African swine fever.*	4	3	2	1
Hajlandó lennék nyers sertéshúst (darálthús, karaj, comb stb.), vásárolni az afrikai sertéspestis kitörése idején, ha annak ára alacsonyabb, mint az afrikai sertéspestis kitörése előtt. / *I would be willing to buy raw pork (minced meat, loin, thighs, etc.) during the African swine fever outbreak if the price was lower than before the African swine fever outbreak.*	4	3	2	1

Hajlandó lennék feldolgozott sertéstermékeket (kolbász, szalonna, szalámi stb.) vásárolni az afrikai sertéspestis kitörése idején, ha annak ára alacsonyabb, mint az afrikai sertéspestis kitörése előtt. / *I would be willing to buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak if the price was lower than before the African swine fever outbreak.*	4	3	2	1
Akkor is vásárolnám a nyers sertéshúst (darálthús, karaj, comb stb.) afrikai sertéspestis kitörése idején, ha annak ára emelkedett az afrikai sertéspestis kitörése előtti árhoz képest. / *I would buy raw pork (minced meat, loin, thighs, etc.) even if its price had increased during the African swine fever outbreak than before the African swine fever outbreak.*	4	3	2	1
Akkor is vásárolnám a feldolgozott sertéstermékeket (kolbász, szalonna, szalámi stb.) az afrikai sertéspestis kitörése idején, ha annak ára emelkedett az afrikai sertéspestis kitörése előtti árhoz képest. / *I would still buy processed pork products (sausages, bacon, salami, etc.) during the African swine fever outbreak even if their prices had increased than before the African swine fever outbreak.*	4	3	2	1
Semmi esetben nem vennék nyers sertéshúst (darálthús, karaj, comb stb.) a járvány kitörése idején. / *Under no circumstances would I buy raw pork (minced meat, chops, thighs, etc.) during the outbreak.*	4	3	2	1
Semmi esetben nem vennék feldolgozott sertéstermékeket (kolbász, szalonna, szalámi stb.) a járvány kitörése idején. / *Under no circumstances would I buy processed pork products (sausages, bacon, salami, etc.) during the outbreak.*	4	3	2	1

10. **Hogy érzi, milyen mértékben jelent kockázatot az afrikai sertéspestis a személyes egészségére- Jelent-e veszélyt az Ön egészségére élelmiszerbiztonsági* szempontból?** / *To what extent do you feel African swine fever poses a risk to your personal health, does it pose a threat to your health from a food safety* perspective?*

Nagy kockázat / *High risk*

Némi kockázat / *Some risk*

Nincs kockázat / *No risk*

Bizonytalan, nem tudom / *Uncertain, I do not know*

*élelmiszerbiztonság jelentése: az élelmiszerek kezelése, elkészítése és tárolása oly módon, hogy az alehető legjobban csökkentse az élelmiszer-fogyasztásból származó megbetegedés kockázatát */*food safety means:*

handling, preparing and storing food in a way that minimizes the risk of individuals becoming ill from foodborne diseases

11. **Az afrikai sertéspestis kitörése esetén, ha más termékkel helyettesítené a sertéshúst, mit gondol, mi lenne az? Több lehetőséget is választhat.** / *In the event of an outbreak of African swine fever, if you could replace pork with another product, what do you think it would be? You can choose several options.*

Csirkehús / *Chicken*

Marhahús / *Beef*

Bárányhús / *Lamb*

Egyéb baromfihús (kacsa, liba, pulyka) / *Other poultry (duck, goose, turkey)*

Hal és tengergyümölcsei / *Fish and seafood*

Húsmentes termékek / *Non-meat food product*

Más / *Other*: ______________

12. **Tapasztalt-e már hasonló élelmiszerből származószennyezettséget (fertőzés, vegyi- vagy nehézfémszennyezés stb.) Magyarországon az elmúlt években, amely bizonyos termékek esetében változtatott fogyasztási szokásain (pl. madárinfluenza, szalmonella, szennyezett zöldség és gyümölcs stb.)? /** *Have you experienced similar food-borne contamination in Hungary in the past years that has changed your consumption habits towards a product (e.g. avian influenza, salmonella, contaminated vegetables and fruits, etc.)?*

Igen/ *Yes*

Nem/ *No*

Nem tudom/ *Do not know*

13. **Kérjük, jellemezze az élelmiszerbiztonsággal, élelmiszer-betegséggel kapcsolatos különféle hír- és információforrások megbízhatóságát / (4– teljes mértékben megbízható, 1- egyáltalán nem megbízható) /** *Please indicate the trustworthiness of various sources of news and information about food safety, food disease (4 – completely reliable, 1 – not reliable at all)*

Megnevezés / *Description*	**Megbizhatóság mértéke /** *trustwothiness*			
TV és rádiós hírek / *TV and radio news*	4	3	2	1
Social media	4	3	2	1
Újságok, napilapok / *newpaper, magazine*	4	3	2	1
Nemzeti Élelmiszerlánc-biztonsági Hivatal (Nébih)/ *National Food Chain Safety Office (Nébih)*	4	3	2	1
Sertéstermelő, gyártó, kereskedő vállalatok / *Pork breeders, producers, sales entrepreneurs*	4	3	2	1
Szakértő (dietetikus, gasztroenterológus) / *Expert (dietitian, gastroenterologist)*	4	3	2	1

Szájról szájra terjedő hírek (barátok, család, stb.) / *Word of mouth (family, friends, etc.)*	4	3	2	1

----

14. Ön milyen nemű? */ What is your gender?*

Nő */ Female*

Férfi */ Male*

15. Ön melyik korcsoportba tartozik? */ What is your age?*

18-29

30-39

40-49

50-59

60+

16. Mi az Ön legmagasabb iskolai végzettsége? / What is your *highest education level*?

Maximum 8 általános / Maximum *elementary school*

Szakmunkásképző, szakiskola */ Vocational training, vocational school*

Érettségi/ *Highschool*

Felsőfokú diploma / Higher education diploma

17. Milyen gazdasági aktivitást tölt be? /*What is yout economic activity*?

Aktív szellemi / *Active intellecual*

Aktív fizikai / *Active phisical*

GYES, GYED / Maternal leave

Nyugdíjas / *Retired*

Háztartásbeli / *Household*

Tanuló **/** *Student*

Munkanélküli / *Unemployed*

Egyéb inaktív kereső / *Other inactive earner*

Egyéb eltartott / *Other dependant*

18. Milyen településtípusba tartozik lakhelye, ahol életvitelszerűen lakik? / *What is the type of place of* *settlement where you live?*

Főváros / *Capital city*

Vármegye jogú város, vármegyeszékhely / *County town, capital of county*

Egyéb város / Other *city*

Egyéb település (falu, község, tanya, stb.) / *Other settlement (village, municipality, farm, etc.)*

19. Melyik megyében lakik életvitelszerűen? / What county do you live in?

Budapest (főváros)

Bács-Kiskun

Baranya

Békés

Borsod-Abaúj Zeplén

Csongrád-Csanád

Fejér

Győr-Moson-Sopron

Hajdú-Bihar

Heves

Jász-Nagykun-Szolnok

Komárom-Esztergom

Nógrád

Pest

Somogy

Szabolcs-Szatmár-Bereg

Tolna

Vas

Veszprém

Zala

20. Mi az Ön családi állapota? / *What is your marital status?*

Egyedülálló / *Single*

Élettárssal él */ Lives with a partner*

Házas / *Married*

Elvált / *Divorced*

Külön él házastársától */ lives separately from his/her spouse*

Özvegy / *Widow*

21. Ön hova sorolná háztartása havi jövedelmét? / *How would you classify your household's monthly income?*

Rendszeresen megélhetési gondjaink vannak / *Contantly have livelihood problems*

Néha arra sem elég, hogy megéljünk belőle / *Sometimes it is not even enough for living*

Éppen elegendő, hogy megéljünk belőle, de félretenni már nem tudunk / *It is just enough for living, but can not save*

Megélünk belőle, de keveset tudunk félretenni / *It is enough for living, but can only save a little*

Nagyon jól megélünk belőle és félre is tudunk tenni / *Can make a very good living from it and can even save*

NT/NV (Nem tudja/nem válaszol) / *Do not know, do not want to answer*

Annex IV- Analysis Results

Table 37: Summary statistics of respondents, socio-demographic variables (N=331)

Variable	Category	Merged-category	Statistics	Percentage
Gender	Female	/	211	63.75%
	Male	/	120	36.25%
Age	18-29	Young (18-29)	209	63.14%
	30-39 40-49	Middle-Aged (30-49)	95	28.7%
	50-59 60+	Older (50+)	27	8.16%
Education	Maximum elementary school Vocational training, vocational school	Low Education	18	5.44%
	High school	High School	151	45.62%
	Higher education diploma	Higher Education	162	48.94%
Economic activity	Active intellectual Active physical	Employed	179	54.08%
	Maternal leave Retired Household Other dependent Unemployed Other inactive earner	Not working	28	8.45%
	Student	Student	124	37.46%
Type of place of living	Capital city	/	141	42.60%
	County town, capital of county	/	69	20.85%
	Other city	/	69	20.85%
	Other settlement (village, municipality, farm, etc.)	/	52	15.71%
County	Budapest (főváros) Pest	Pest	216	65.26%
	Bács-Kiskun Békés Csongrád-Csanád	Southern Great Plain	43	13%
	Hajdú-Bihar Jász-Nagykun-Szolnok Szabolcs-Szatmár-Bereg	Northern Great Plain	16	4.83%
	Borsod-Abaúj Zeplén Nógrád Heves	Northern Hungary	14	4.23%
	Baranya Somogy Tolna	Southern Transdanubia	16	4.83%
	Komárom-Esztergom Fejér Veszprém	Central Transdanubia	21	6.34%
	Győr-Moson-Sopron Vas Zala	Western Transdanubia	5	1.5%
Marital Status	Married Lives with a partner	Committed relationship	181	54.68%
	Single Divorced Lives separately from spouse Widow	Not currently married Struggling	150	45.3%
Subjective income	Constantly have livelihood problems Sometimes it is not even enough for living It is just enough for living, but cannot save	Struggling	47	14.2%
	It is enough for living, but can only save a little	Stable	147	44.41%
	Can make a very good living from it and can even save	Comfortable	94	28.40%
	Do not know, do not want to answer	Unknown/prefer not to say	43	13%

Source: Own research, 2025

Table 38: Corporate structure and vertical integration of Bonafarm Group

	Vertical integration	Main Activity	Group	Other	Location
Bonafarm Group	***Crop production***	• 34 thousand hectares of arable land • Feed Raw Material Base • Trade and external sales • cereals, maize, rapeseed and many others • Seed Production	Agroprodukt Zrt., Bóly Zrt., Bonafarm-Bábolna Feed Zrt., Dalmand Zrt.	• Crop and feed industry raw material trading division • Input Trading and Production Business • logistics business unit (**Danai Kikötő**, **Vémend Mill Plant – for** the storage of grain palletized goods – nearly 200,000 tons of storage capacity • The **Vémend corn mill** – flour and meal production • products mainly in Hungary, but also in Scandinavian countries, South Africa	Nagyigmánd, Zalacséb, Újszász, Mohács, Dalmand
	Animal nutrition	• Feed products made from quality raw materials • Premixes and ready-to-eat feed production • The product range (pig, cattle, poultry, horse, lamb, goat, rabbit, fur animal, fish, pheasant, quail, ostrich, giraffe and bear feeds)			
	Pig breeding	• Breeding and sales of own and integration pig farms • 16 own livestock farms (1 central boar farm, 2 nucleus and 7 commodity sow farms, 2 gilt rearing farms, 4 fattening farms), • and 6 integrated sow farms and 100-120 integrated fattening farms	Dalmand Zrt., Bóly Zrt., Fiorács Zrt.	• In 2019, more than 680 thousand pigs for fattening were • 750 thousand units by 2022 • 2023 599,150 pcs • 2024 annual plan: sale of 659 thousand fattening pigs • Average annual lean meat yield of 61% – including 96% ‘‘S’’ and ‘‘E’’ quality • The supply of reproductive material for 40,000 sows can be ensured • F1 breeding animal with DanAvl genetics produced on a nucleus colony	
	Production of meat products	• Provision of product raw materials • compliance with animal health and food safety requirements • Covering the entire meat product chain from the slaughter of live animals to the wholesale and retail trade of meat and meat products	MCS Slaughterhouse Zrt., Pick Szeged Zrt.	• a significant part of the pigs slaughtered at slaughterhouses are provided by the Bonafarm Group and the pig farms belonging to its integration • Pick Szeged Zrt. is supplied with raw materials by MCS Slaughter Zrt., • sales to domestic and export, retail and processing partners • packaging	
	Meat sector				

Reference: Own research (2025) based on the qualitative interview and Bonafarm website

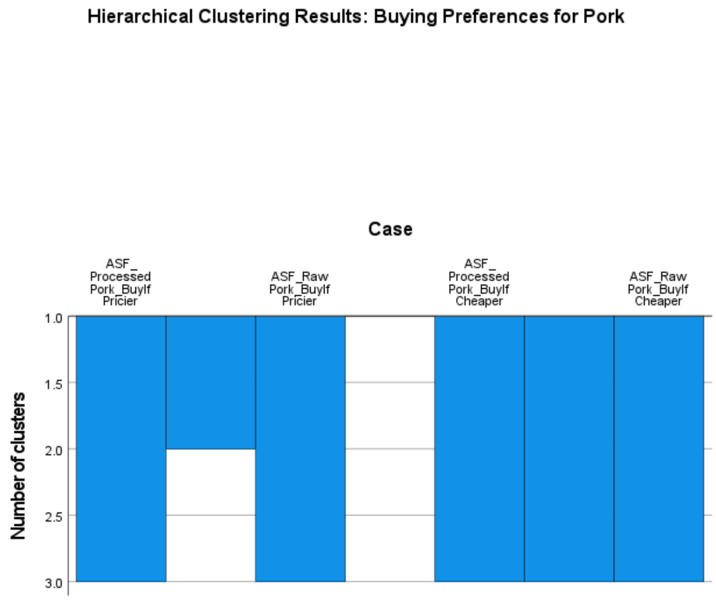

Figure 26: Dendrogram of purchasing behaviours
***Note*: The y-axis represents merger distances; the dashed line marks the optimal two-cluster solution**
Source: Own research, 2025

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