Feature Article

How two concurrent pandemics put a spoke in the wheel of intensive pig production

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Implications

- Intensive pig production is an example of a cost-efficient production system: an optimized meat chain with highly specialized links.
- External factors, such as the COVID-19 and African swine fever pandemics, are having an immense impact on the chain and farmers' income.
- These crises may exacerbate societal concerns about industrialized production, especially when linked with poor animal welfare and the risk for future pandemics.
- Transition from a supply-driven to a demand-driven market may result in more sustainable business models.

Key words: African swine fever, COVID-19, pigs

Introduction: The Pig Chain as an Example of Efficiency Optimization

At the time of writing, the global COVID-19 pandemic is happening in conjunction with the African swine fever (ASF) pandemic (Blome et al., 2020). Both pandemics have proven to be a challenge for pig production. Intensive pig production is an example of a cost-efficient production system, namely an optimized meat chain with highly specialized links. It includes genetic, pharmaceutical, and feed companies, pig producers, transportation companies, slaughterhouses, processers, and retailers (Rodríguez et al., 2013). Over the years, genetic selection, optimized feeding, and improved farm management practices have decreased the inputs per kilogram of pork (Patience et al., 2015). Industrial slaughterhouses and processers have also optimized their processes. Characterized by high efficiency, the European pork production chain has maintained its position as the largest exporter of pork and pork products at competitive prices in spite of high labor costs (Popescu, 2020). However, industrial pig production as a concept has been challenged (Sørensen et al., 2006). The current double pandemic has revealed not only that the industrialization of pig production is an issue of consumer perception but also that risk factors are inherent to the system. These recent pandemics, like other unexpected events in the past, have revealed the vulnerabilities inherent to the system that we highlight here.

Vulnerability of the Pig to Pork Chain in Times of Pandemics

Prices on the world market are volatile and subject to external factors although local calamities may be balanced out by global supply and demand. The ASF crisis has had a clear impact on pork prices: in European countries with positive cases, prices dropped quickly because of an export ban to countries outside Europe, such as China. In contrast, the massive outbreak of ASF in China led to a shortage of pork on the world market, with price increases in other parts of the world (Mason-D'Croz et al., 2020). This may have stimulated farmers to inseminate more sows or invest in larger farms as expected according to the cobweb theorem (Ezekiel, 1938). With a 9- to 10-month period between insemination and slaughter, the pig chain cannot adapt quickly to an increasing or decreasing demand. This became painfully clear during the COVID-19 pandemic:

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Figure 1. In 6 months' time, this newborn piglet will be a slaughter pig.

with the closure of restaurants and the ban on group events, the demand for pork decreased (European Commission, 2020). Additionally, large slaughter and processing plants (mainly in the United States) had to close due to COVID-19 outbreaks and labor shortages because of quarantine measures, leading to a shortage in slaughter capacity (McEwan et al., 2020). As a result, not all pigs could be brought to the slaughterhouse as planned. This has led to overstocking, reduced production efficiency, and eventually even euthanasia of pigs on farm. Outbreaks of COVID-19 in slaughterhouses and meat processing companies also occurred in a number of European countries, particularly in Germany. This raised awareness of the poor working conditions of meat workers across Europe, especially because the sector depends to a large extent on migrant and cross-border workers. Closed borders also caused labor shortages during the COVID-19 pandemic (European Federation of Food, Agriculture and Tourism Trade Unions, 2020). Most outbreaks in European slaughterhouses have been small in comparison to those in the United States. Prices did rise again after confinement measures against COVID-19 were progressively lifted (European Commission, 2020). Nevertheless, the events raised awareness of the sector's dependency on sufficient slaughter capacity.

Biosecurity in Intensive Pig Production

The high stocking density in intensive animal farming makes biosecurity a key factor. Biosecurity measures can be more easily implemented in intensive compared to extensive systems (Maes et al., 2019). As such, the risk of contracting diseases such as ASF is probably lower in intensive systems, as indicated by the higher prevalence of ASF outbreaks in backyard and small-scale herds (Costard et al., 2015). While modern intensive pig farms focus on strict biosecurity, high population density dramatically increases the risk of the rapid spread of disease if biosecurity measures fail. Biosecurity measures can reduce the impact of diseases such as ASF but some endemic diseases cannot be prevented in areas of high pig density and can only be controlled by vaccination programs or destocking and repopulation (Sørensen et al., 2006). Pig production is also considered a potential risk factor for future human pandemics, in particular those caused by influenza viruses. Pigs are susceptible to both avian and mammalian influenza viruses, and pig farms are, therefore, considered as potential "mixing vessels" for new viruses with the potential to cause human pandemics (Kahn et al., 2014; FAO, 2020). Still, with high biosecurity measures, the risk of contact between pigs and (wild) birds is probably either absent or low in intensive pig production and risks occur most from pig/human contact. Pigs have experienced influenza outbreaks from human origin, but so far only one case of influenza transmitted from swine to humans has been reported to cause an influenza pandemic in humans (Trovão and Nelson, 2020).

To date, strict biosecurity has resulted in increased control of several pathogens but full control of pathogens is impossible. Intensive pig production may especially be vulnerable to airborne viruses with potential risk for causing human pandemics (Davies, 2011; VanderWaal and Deen, 2018).

Farmer Income in a Supply-Driven Market

Specialization in the pig to pork production chain can be considered as an example of the treadmill theory (Levins and Cochrane, 1996). According to this theory, technological innovations are a driving force behind the growing scale of operations: with the introduction of new technologies (e.g., better management and better genetics), early adopters benefit from the reduced costs of production for an initial period. However, this temporary benefit declines as increasing numbers of farmers adopt the technology, leading to increased production and outputs, followed by a decrease in output prices. As a result, profitability declines and farmers are urged to adopt the technology to reduce their production costs under the current market conditions in order to stay in business (Levins and Cochrane, 1996). Indeed, intensive pig production is characterized by efficiency improvements, large numbers of pigs, and relatively small and volatile margins. Thus, small differences in pig prices and market disruptions have large effects on farmer income. As the number of slaughter pigs is determined almost a year ahead, and the pig production chain can be considered to be a supply-driven market, a sudden disruption, such as slaughterhouse closures, caused by the COVID-19 pandemic may have a major impact not only on the received price per pig but also on the cost of production because of decreased feed efficiency with higher slaughter weights (Van den Broeke et al., 2020). In particular, for "Protected Designation of Origin" products, a specific weight range is requested and deviations may lead to price penalties and inefficiencies along the chain (Parma Ham Specifications, 1992). Farmers have little room for short-term adjustments. One possible measure is to slow down growth rates, thus extending the time required to reach slaughter weight. Despite the higher feeding cost because of decreased feed efficiency, with possibly also a negative effect on the nutrient excretion to the environment, this option may be the only viable alternative. It may also be the best option for animal welfare if slower growth is obtained by adapting the diet rather than through management measures, such as water restriction (for more information on this strategy, see Tokach et al., 2021). Optimal space allocation is traditionally one of the key factors in efficiency optimization. More pigs occupying the same space decreases the fixed cost per pig (Powell et al., 1993). Only in small segments—in niches that can be considered demand driven—are farmers paid extra for giving their pigs more space, mostly in light of improved welfare.

Animal Welfare

Good animal welfare is a prerequisite for society and animal welfare concerns have been increased since the 1960s (Maes et al., 2019). This concern has become even more apparent during a pandemic. In the case of ASF or other infectious diseases that need to be eradicated, a major focus is to eliminate the pigs on infected farms to prevent the disease from spreading to other farms. Consumers were particularly outraged about the practice of burning and burying live pigs in China during the ASF crisis (Loeb, 2019). Many risk factors are associated with on-farm killing of animals, both during the handling and moving of pigs before slaughter and during the slaughter process itself (EFSA Panel on Animal Health and Welfare et al., 2020). Societal acceptance of pig production clearly depends on the perception of extreme care for humane handling of animals during rearing and slaughtering and the transparency regarding these procedures. If a drop in slaughter capacity prohibits pigs from reaching the slaughterhouse in a timely way, there is an evident risk of overstocking, with concomitant welfare problems and disease risks. On-farm killing of healthy animals is a last resort that has serious implications for all three pillars of sustainability but keeping pigs on farm may not always be possible. The pig chain is, therefore, obliged to find strategies to avoid these bottlenecks in the future.

Conclusion

The pig to pork chain—with its highly specialized and optimized links—is an example of a cost-efficient production system. Maximizing stocking density within legal limits and process optimization lead to minimal costs per animal in the farm or per carcass in the slaughterhouse. Recent pandemics show the vulnerability of this pig chain as a whole and, especially, the potential risk exposure of the farmers and their animals. External factors, such as disease outbreaks or reduced slaughter capacity have an immense impact on the farmers' income. At the same time, these crises may augment societal concerns about industrialized production, especially when a crisis is linked to poor animal welfare and the risk for future pandemics. The awareness of these risks should be a driver toward a transition in the pig chain from a supply-driven to a demand-driven market with a built-in flexibility to anticipate market requirements. To allow flexibility, more housing space and higher slaughter capacity will be necessary. This will imply higher costs per unit of production and will require cooperation throughout the chain with clear arrangements between all partners in the chain. This must finally result in sustainable business models and a fair income for each partner in the value chain. A high level of optimization and specialization can still be useful in the future, but the focus should shift to optimal instead of maximal production.

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