

FINANCIAL LOSSES IN PORK SUPPLY CHAIN: A STUDY OF THE PRE-SLAUGHTER HANDLING IMPACTS

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ABSTRACT: Brazil is amongst the world's largest swine producers. However, its competitiveness has been vulnerable due to a lack of cooperation between the supply chain players. This condition makes the financial losses to be evaluated taking into account only an individual node, and most of the time, these damages are imputed by swine breeders. Living weight losses occur between the farm to slaughterhouses, and the main cause of these losses is the pre-slaughter handling, especially during animal transportation. In this research, we analyzed the pre-slaughter handling in a swine farm in Brasilândia, MS, Brazil. Analyzed data were provided by five slaughterhouses (farm clients) from the studied region, in which it was considered living weight losses, carcass bruising, animal injury, and death rate. The results indicated that total financial losses represent 160 thousand dollars per year, when taking into account the supply chain management.

KEYWORDS: supply chain management; pork production; economic impact.

PERDAS FINANCEIRAS NA CADEIA DE SUPRIMENTOS DE SUÍNOS: UM ESTUDO DOS IMPACTOS DO MANEJO PRÉ-ABATE

RESUMO: O Brasil encontra-se entre os maiores produtores de carne suína do mundo; entretanto, sua competitividade tem sido prejudicada pela falta de cooperação entre os atores da cadeia de suprimentos. Isso faz com que as perdas financeiras sejam avaliadas em cada nó, individualmente. Na maioria dos casos, as perdas são computadas pelos produtores de suínos que absorvem os prejuízos. As perdas de peso vivo ocorrem geralmente durante o manejo pré-abate, principalmente durante o processo de transporte. A pesquisa foi realizada na cidade de Brasilândia, Estado de Mato Grosso do Sul, Brasil. Foram analisadas as operações de manejo pré-abate na granja e os dados fornecidos por cinco frigoríficos, considerando as perdas de peso vivo, as escoriações de carcaça, animais lesionados e a mortalidade. Os dados foram relacionados com o volume comercial de vendas do ano de 2012. Os resultados indicaram que as perdas financeiras corresponderam, neste caso, a 160 mil dólares, levando-se em conta os valores que deixaram de ser obtidos pela cadeia de suprimentos suinícola.

PALAVRAS-CHAVE: cadeia de suprimentos; produção de suínos; impacto econômico.

INTRODUCTION

The world pork production has increased every year and current production is around 100 million metric tons. Brazil is one of the most import players in this scenario and its production corresponded to three million metric tons in 2010. This figure represents 10% of all the exports

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around the globe. Pork production brings to the country one billion dollars per year (MIELE & MACHADO, 2010; ABIPECS, 2012).

Pork meat production organization and distribution processes involve the supply chain sector. Therefore, the idea consists in following the processes and all chain agents, starting with raw material such as grains for ration production up to the retail market or final consumer. The chain is characterized by its complexity and can be analyzed through contracts and vertical integration. In the first case, swine farmers are partners with different cooperatives, which are responsible for animal stunning and slaughter, as well as meat processing and delivery to the market. In the second case, the pork industry has its production and contract; such relationship can be made either in independent or integrated way (CHRISTOPHER, 2011; MIELE & WAQUIL, 2007).

Swine production efficiency is typically evaluated by both pre-slaughter handling and slaughter process. Moreover, it is essential to maintain a strict control of the operations, once they are associated with living weight losses and consequent profitability reduction (SILVEIRA, 2010; ARAÚJO et al., 2011).

According to LUDTKE et al. (2012), animal transportation is a stressful process because of the excessive handling during loading, traveling and unloading operations. Pre-slaughter activities are then a critical stage for the farming. A typical pork supply chain includes suppliers, industries and retailers. These players are responsible for delivering meat to final costumers. PEREZ et al. (2009) suggested that this chain framework could be adjusted for each different stage, associating it with responses to customer requirements. First stage actions can affect all chain until the last phase; therefore, it is needed to overview the pork supply chains in an integrated way.

Thus, the aim of this paper was to analyze financial losses in the pork supply chain due to the impact of an inadequate pre-slaughter handling.

MATERIAL AND METHODS

This study was conducted in a commercial swine farm located in Brasilândia County, Mato Grosso do Sul State, Brazil. The farm has 8,000 pigs in intensive production system in full cycle.

Procedure

With the purpose of understanding the pork supply chain, we analyzed it following the scheme shown in Figure 1. Animals were observed during pre-slaughter handling to identify possible injuries and harm during truck loading. Fasting period was recorded and compared to the recommended ones in the literature. In addition to that, stocking densities were recorded and again compared to the recommendations in the literature. Different studies had argued that the ideal fasting time is between 10 to 24 hours within stocking density of five animals to be handled for turn (REIS et al., 2012; DALLA COSTA et al., 2007).

In the slaughterhouses, trained employees evaluated the animals after unloading, checking for carcass bruises and injuries. Afterwards, the farmer was paid in kilograms. Pork industry includes in final weight the animals that have died during the transportation.

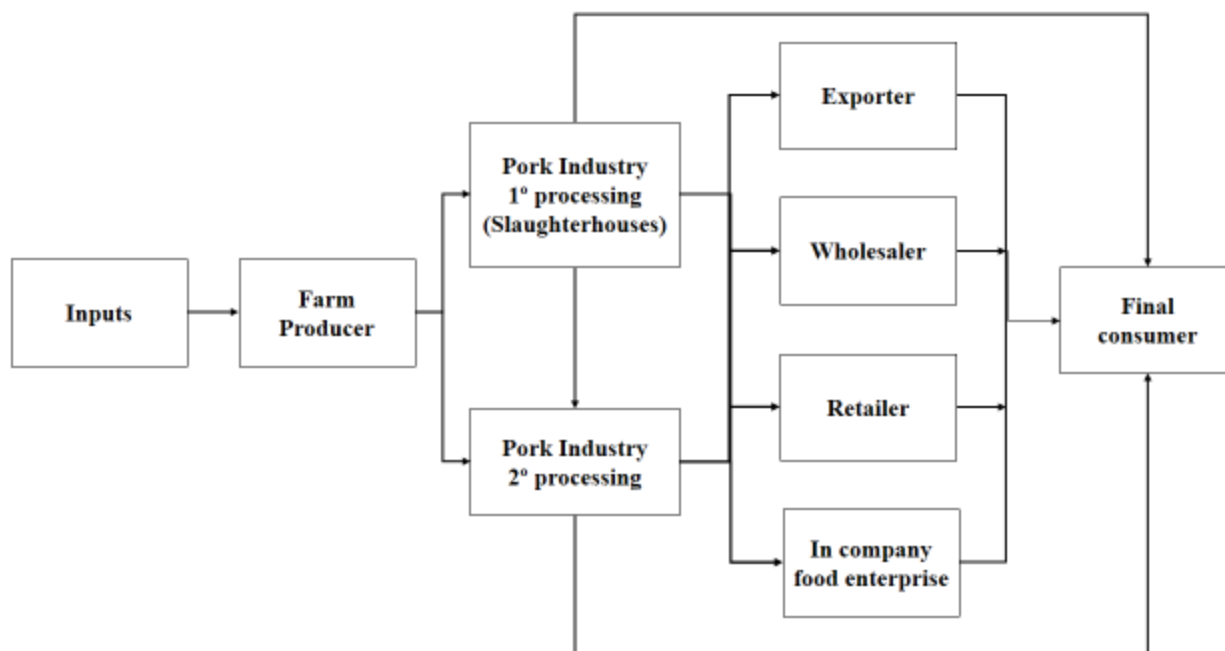


FIGURE 1. Pork supply chain scheme.

The focus of this study was a financial analysis of living weight losses during pre-slaughtering. According to RITTER et al. (2009), this condition refers to death rates during live animal transportation. Our analysis has also considered the condemned animals by slaughterhouses due to carcass bruises and those injured during transportation.

In this study, we used the five main clients of the farm. Slaughterhouses were selected based on their volume of commercialized carcasses and labeled as follows CL1, CL2, CL3, CL4, and CL5 respectively. We used seven indicators to analyze the data, such as distance between farm and slaughterhouses (km), travelling time (h), truck stocking density (head m⁻²), type of truck body, point of the day when loading occurred, truck type, and the driver behavior.

The local mean temperature was obtained from EMBRAPA (2014), a government agency for agricultural and livestock researchers. This study was carried out during the first semester of 2012.

Financial Losses

To estimate financial losses, swine weights were calculated based on information provided by the slaughterhouses. We considered three different scenarios to quantify the values, which were based on the point of view of the farmer, the slaughterhouse (pork industry) and the retailer.

These point of views were: (1) Farmer: amount of condemned carcass (kg) multiplied by the mean price paid by slaughterhouses; (2) Pork Industry: same procedure in (1), but considering the mean price paid by retailers; and (3) Retailer: same procedure as in (1) and (2), however using the mean price of fresh meat paid by the market.

For monetary calculations, we considered the rate of BR\$ 1.95 (real) per US\$ 1.00 (dollar), which was the exchange rate at that time when research was performed. Financial annual losses were calculated and compared with those from German, as this country is one of the largest swine producers.

RESULTS AND DISCUSSION

Pre-slaughter handling

The swine losses due to problems in pre-slaughter handling were estimated at 2.12%, 11.70%, 9.48%, 0.7 and 76% for CL1, CL2, CL3, CL4, and CL5, respectively. This analysis included total losses in slaughterhouses, and the percentage refers to the sum of this universe, such result can be seen in Figure 2.

This paper discussion emphasizes the pre-slaughter handling of CL2 and CL5 that represented 87.7% of the total losses. This fact occurred due to access to manage operations allowed by Farm Producer. When pigs were finished, they were transported to the pork industry. SILVEIRA (2010) reported that transport operations involve the last operations in pre-slaughter handling, and any failure in this process might compromise animal welfare.

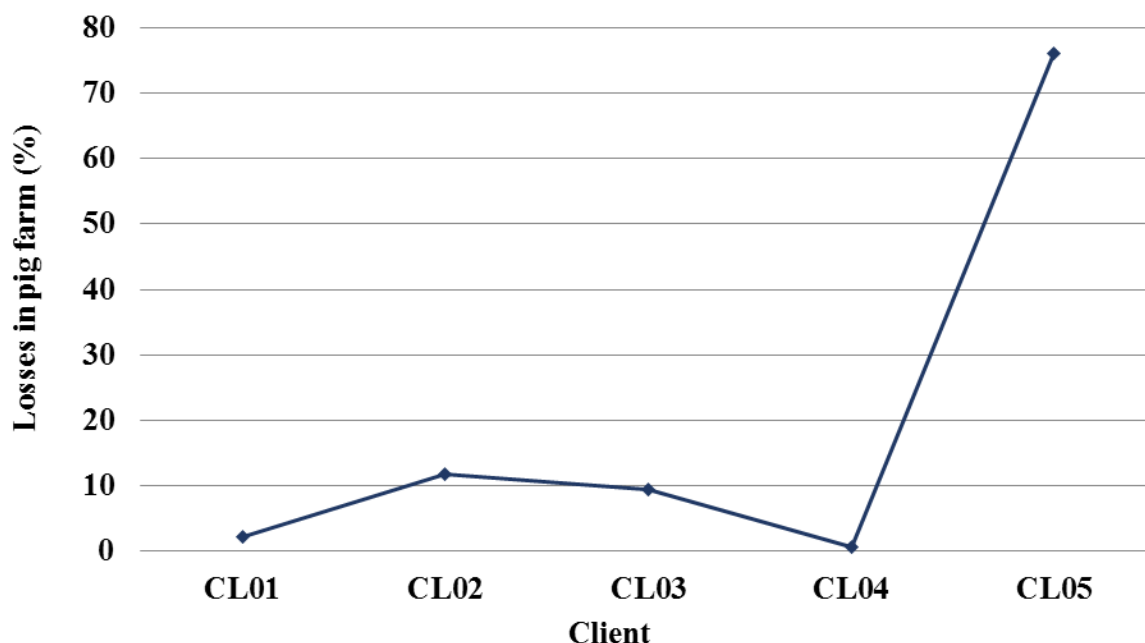


FIGURE 2. Swine losses during transportation of the five primary farm clients (%).

Mean time of fasting recorded in this research was 6 hours, which includes ten pigs at a time. Another stressful item during animal loading consists of access ramps to the truck interior. They were very sloping, fact that may hurt overweighted animals during boarding.

Regarding the point of the day when trucks are loaded, we noted that CL2 performed it after 4 P.M., and the mean traveling time was of 4 hours. However, CL5 loaded truck in the morning, after 7 A.M., and the traveling time was 9 hours. Travelling is a stressful process for animals. The local temperature was very high in this period of the year what would have helped in animal stressing process; however, cold days can also be stressful for the animals either (TABLE 1).

TABLE 1. Maximum and minimum temperatures in Mato Grosso do Sul State, Brazil during the 1st semester of 2012 (in °C).

	Month						
	January	February	March	April	May	June	July
Maximum temperature	31.8	32.7	31.5	28.6	25.9	24.7	25.5
Minimum temperature	21.0	20.7	18.6	18.1	15.5	14.2	11.9

In addition, another issue related is the wind speed while travelling (TABLE 2). Management process speed may cause stress for animals during truck loading, travelling and unloading operations (LUDTKE et al., 2012). Assessing this stress may further help reducing the losses (CORDEIRO et al., 2012; MIRANDA et al., 2012).

TABLE 2. Wind speed in Mato Grosso do Sul State, Brazil during the 1st semester of 2012 (in km/h)

	Month						
	January	February	March	April	May	June	July
Wind speed (km/h)	1.05	0.96	0.87	0.86	0.75	1.0	0.98

According to EMBRAPA (2012), after three-hour trip, animals require especial attention as they get very stressed, which can be further damaged by fasting. CL2 swines were transported in the afternoon, when the temperatures are less high. SILVEIRA (2010) stated that pigs are highly sensible to heat stress. Pigs from CL5 were transported during the morning time, fact that has increased their heat stress.

CL2 truck type, used for animal transportation up to the slaughterhouse, is made of three axis and has a container with weight capacity of 14 metric tons. The vehicle uses wooden trunk and can transport 110 pigs with 105 kg each. CL5 has pigs transported by a tractor-trailer with metallic trunk and weight capacity of 240 pigs with 108 kg each.

According to GADE & CHRISTENSEN (1998), the compartmentalized body trunk appears to be more comfortable for the animals, than those in the wooden trunk type. Therefore, these authors recommended the use that type for swine transportation. Based on that, we considered that body truck type has not influenced losses during transportation between farm and CL5. On the other hand, body truck could be a factor of importance in CL2. The vehicle that transports animals for CL5 was open and followed the characteristics suggested in current literature (DALLA COSTA et al., 2007; GADE & CHRISTENSEN, 1998). The vehicle transporting the pigs from CL2 was in severe conditions departing from the recommended characteristics (DALLA COSTA et al., 2007).

Stocking density during transportation in CL2 and CL5 agrees with the recommended density of 0.45 m² per 100 kg (DALLA COSTA et al., 2007). Nonetheless, they were distributed in an irregular way. Some pigs were able to lay down inside the truck, but others could not move in the vehicle. The farm needs to adopt control systems to assure the uniform distribution. One solution can be to use scales in pre-slaughter process to allow a truck loading process well distributed. It was possible to observe an overload on lower decks, which were usually composed of female pigs. Males occupied the upper decks, where there was a low density of animals. On the upper deck, animals remain exposed to sunburns and stress caused by high temperatures.

Another important factor responsible for causing high mortality and carcass harms is related to driver behavior during the traveling time. In both cases, we could verify that drivers received training to transport the swines. However, during loading time, drivers work as helpers to reduce delivery windows. Consequently, the lack of training of drivers for that activity can usually harm animals and cause carcass bruising.

Therefore, we concluded that the main issue in the transportation process is related to outsourcing of services. Freight carrier pays transporters; consequently, they try to reduce trip time to increase profitability. PILECCO et al. (2012) suggested that an appropriate training is crucial to reducing carcass losses and death rates. MOTA-ROJAS et al. (2006) found significant losses during the transportation process related to swine discomfort, high stocking density, group distribution, high temperatures and humidity, water sprays, trip distance, type of truck, noise, smells, travelling time, sunlight, wind speed, among others (DALLA COSTA et al., 2007; LUDTKE et al., 2009; EDWARDS et al., 2010; SILVEIRA, 2010; MOTO-ROJAS, 2013).

Financial losses

At all five analyzed slaughterhouses, the total amount of losses were accounted in 3,079.1 kg month⁻¹. In monetary terms, this value corresponded to US\$ 3,294.64 month⁻¹ to the producers, considering a living weight commercialization price at US\$ 1.07/ kg (ASUMAS, 2012).

Annual losses were estimated in US\$ 39,535.68 a year, which may increase when analyzing all the pork supply chain. Carcass yield is commercialized in 80%, with a value of US\$ 2.56 kg in the pork industry (FAMASUL, 2012). In this case, annual losses would correspond to US\$ 94,589.95. Similarly, when we focused on retailer point of view, the losses could reach US\$ 159,990.00 a year, using a market value of US\$ 4.33 kg⁻¹ (FAMASUL, 2012; TABLE 3).

TABLE 3. Estimated losses of revenue related to mortality and condemned carcasses (US\$ year⁻¹).

Farm	Slaughterhouses (Pork Industry)	Retailers
39.535,68	94.589,95	159.990,00

Pre-slaughter handling losses are three times higher than the calculated, when analyzed the whole pork supply chain. When we reviewed the mean value of losses for pig transportation in different countries, the farm financial losses are considered very high (FIGURE 3; ETCO, 2012).

Producer losses, especially those from this study, were calculated as 14% per year, which was higher than results found in Germany (FIGURE 3). This evidence indicates that swine farmers have to rearrange pre-slaughter management to reduce these financial losses. In addition, our results showed that the analyzed pork supply chain lost 160 thousand dollars in 2012, owing to inadequate pre-slaughter handling of pigs for all five primary clients (slaughterhouses).

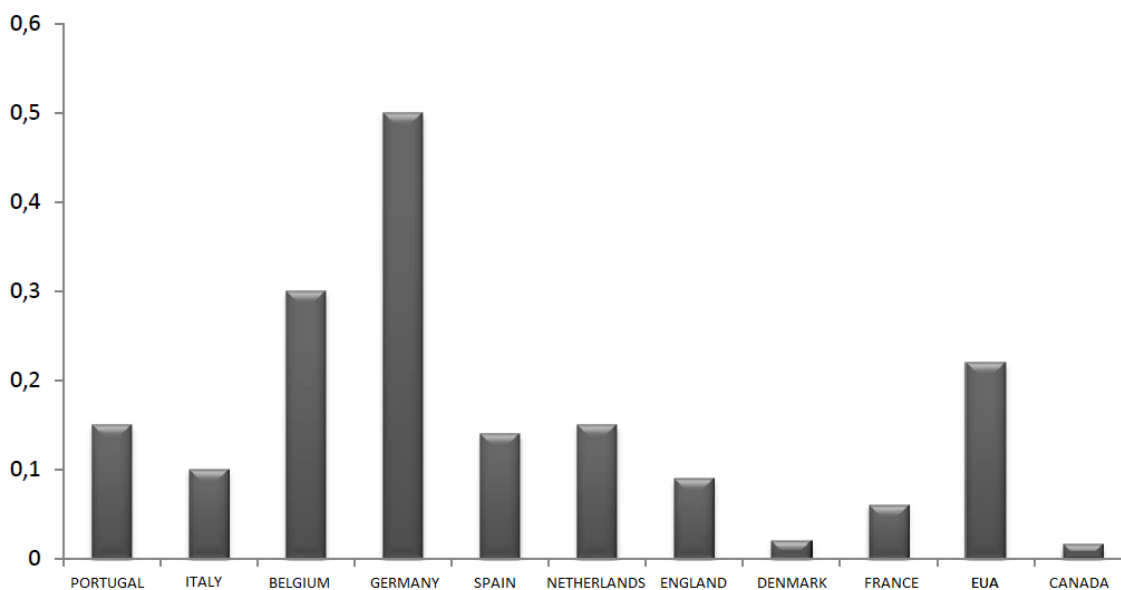


FIGURE 3. Death rate during swine transportation in different countries.

Source: Adapted from ETCO (2012).

CONCLUSIONS

It was possible to conclude that pre-slaughter handling, mainly transportation process, can cause significant financial losses in the pork supply chain. Furthermore, it is not possible to analyze these losses solely in one node of the chain, it is also needed to take into account the price paid by the final consumer, which rewards all the players in the pork supply chain.

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