EFFECTIVE LOGISTICS TO IMPROVE ANIMAL WELFARE IN THE PRODUCTION CHAIN, WITH SPECIAL EMPHASIS ON FARM-ABATTOIR SYSTEM

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Introduction

In relation to global marketing system and structural adjustment, transport of animals for slaughter and breeding is increasing. During transport and handling animals are subjected to unfavorable conditions that compromises their welfare and the meat quality. Beside this, spread of infectious disease and the associated environmental questions are becoming the main societal concern. Therefore, eeffective logistics and control system could be the key issue for the improvement of welfare, meat quality and environment.

The objectives of the current work were to map out the logistics system of meat production chain and develop a system to monitor the environmental conditions in the vehicle.

Material and Methods

The logistics chain mapping study was based on interviews, measurements and observations of activities during animal transport and slaughter operations. Detailed data collection was made at four levels; (a) truck driver interviews, (b) transport route on-board activity registration,´(c) delivery point activity registration (including vehicle and animal activities), and (d) slaughter chain activity registration.

The registered data were analysed to determine the impact of frequency of arrival and duration of activities, on queues, capacity utilisation and other system constraints. 22 routes were registered, all with start and stop at the abattoir. The routes were the second or third route of the day for the drivers involved.

Development of data collection and data transfer system: The development was made at two phases. In the first phase, the data logging was made using a PC system. In the second phase, sensors, data logging and data transfer is made using one unit. The unit is developed in cooperation with a company that may produce the unit for commercial purposes in the future. Data collection and data transfer experiments were made using the unit. The measured and transferred parameters were environmental conditions (temperature, relative humidity, and vibration) in the loading compartments of vehicles, geographical positions (GPS) and speed of vehicles and transferred data continuously to stationary or mobile database stations using GSM.

Results

Description of operation: The logistics chain was divided into four components: (a) Ordering and planning cycle, (b) Vehicle route activities, (c) Animal reception activities at the abattoir (unloading, lairage), (d) Slaughter chain activities (from stunning to cooling room)

Planning:. Cattle were delivered to slaughter for three reasons; slaughter weight reached for meat production cattle, milking cows removed from production due to lameness and other diseases, or the entire production at a farm closed down**.** The detailed planning of transport operations including scheduling and transport routes was done by transport operators after receiving order from the abattoir on a weekly basis. The suppliers and the animals to be delivered were scheduled at the abattoir in order to meet the market demand and production capacity, and the arrival of each delivery preliminary scheduled.

Documentation on the identity of animals, and transport operation, followed each delivery, to enable traceability in the meat production chain and to be used as the basis of payment to producer and transporter. All documentations were carried on paper, although all animals were already registered in the meat cooperative's database of production. Changes in time of arrival and loaded animals were communicated by telephone between driver and abattoir.

Vehicle (DL1 - Transport activity chain (vs abattoir activity chain) activity chain: According to the drivers, transport between farms was limited and the abattoir was the destination of 98% of their transport routes. The working day started in the early morning, at around 5 a.m. and involved 1-3 routes. If routes could not be finished within normal working hours, the driver was replaced during the route. Collection routes normally involved loading at 5 (from 1 to 9 occurred) farms, 3 (1–15) cattle at each farm.

Loading at farms normally required slightly less than 30 min per farm, with variations from 10 to 180 min. Major factors determining loading times were (in order of rated importance): vehicle design, drivers' behaviour, number of animals, farmer's behaviour, farm design and penning system, and the animals' reactions. According to observations of 22 routes involving 90 collection stops at farms, the effective loading time was 13 min, while the time required for preparations before and after loading (i.e. parking and preparing the vehicle and contacting the farmer), was 7 min. Drivers' estimations of unloading time at the abattoir, when there were no queues, varied between 15-60 min, with an average of 24 min. The drivers interviewed regarded queues as a principal problem of current transport operations. Queues were said to occur at around 20%, or less, of the deliveries at the abattoir, and likewise before vehicle wash. Waiting times in case of queues, were estimated by the drivers to on average 22 min (max 80) before unloading and 30 min (max 80) before washing. Important factors behind the build-up of queues were said to be that vehicles arrived before or after the assigned/expected arrival time, and that the limited stable capacity of 350 pigs; marginally more than one vehicle load. Except for queues, major factors determining the unloading time were, according to the drivers (in order of rated importance): abattoir design, behaviour of abattoir staffs and driver, vehicle design and the animals' reactions. After unloading, washing the vehicle took 60 min (30-150). Observations of unloading included 59 deliveries (during observation at the abattoir and some of the route observations). The duration of unloading, including waiting time and preparation, varied between 7 to 98 minutes, with an average of 23 minutes. The effective unloading time (waiting time and preparation excluded) was 17 min, distributed as indicated in Figure 3.19. Waiting and preparations before unloading took on average 6 min, but delays of up to 85 min were observed.

Route optimisation: The average route registered involved 4 collection points, 2:58 hours driving time and a total distance of 161,5 km. Departure time varied from 8:22 to 12:00, and arrival time at the abattoir from 11:30 to 19:02. The differences between registered and calculated driving times for the 19 routes were approximately normal distributed around an average of 6.4% of registered driving time. The analysis revealed potential savings for individual routes of up to 23%.

Animals' activity chain at the abattoir: After the unloading the cattle were moved by the abattoir's staffs, either directly to the stunning station, or to lairage boxes. Moving cattle after unloading at the abattoir, from the vehicle to a lairage box, normally took about 30 seconds, but observations of up to 4 minutes were made. The mean value from observations of movement was 1.3 minutes.
The waiting times in the lairage box for 55 observed animals were on average 45 min. For 15 of the same animals (27%), lairage time exceeded 1 hour (maximum was 2.2 hours). During a technical breakdown in the slaughter chain (which was considered a very exceptional incident), which temporarily stopped all production, lairage times for 17 observed animals increased to on average 3.8 hours; minimum 2.2 hours and maximum 6.5 hours was observed.

Data recording and transfer system: Continuous recording and data transfer from vehicles during transport to a stationary database is important for information monitoring system for surveillance of animal welfare. In Sweden, development of the recording and transfer of data system has been made at two phases. The first phase system has been developed to record relevant parameters and transfer to the stationary database using GSM-system. An instrumentation system was developed to carry out the measurements of the parameters mentioned earlier and additional parameters simultaneously and continuously during transport from the farms to the abattoir. The instrumentation may be classified into four groups. Instrumentation for measuring: animal behaviour (digital video), heart rate, transport route, geographical location, vibration sensors mounted both on vehicle and animals, climatic conditions (temperature and humidity), emissions, and information transmission from vehicle to stationary database.
All instrumentation groups were monitored using on-board portable computers from the cabin of the vehicle.

A compact unit has been manufactured by Mobitron for monitoring of environmental data . The unit system is composed of measuring sensors for temperature; relative humidity and vibration, storage, and data analysis and data transfer to mobile or stationary stations. The measurements are initiated and analysed by means of a PC / Windows program. The user can easily, by menu run procedures, start the measurements and then read and evaluate the measuring results. Once carried out, the measurements can easily be analysed for every minute of the measuring period.

Discussion

Frequent queues, at the abattoir's delivery point and especially at the vehicle wash facility, was one of the major problems reported by the drivers. At times, queues extended unloading and washing with more than one hour. Queues at the abattoir's delivery point frequently cause problems for drivers and for the abattoir staffs, creating a stressful work environment, which could also negatively affect the animals' conditions. Another problem was the extended waiting times for animals before slaughter. Animals were frequently kept for more than one hour and occasionally more than two hours in the lairage box. In order to effectively utilise the conveyed slaughter chain's capacity, a smooth flow of animals is essential. Uneven supply to the chain would result in costly idle times transplanted throughout the slaughter chain, and/or queues of animals waiting for slaughter. In the observed logistics chain, the lairage box functioned as a buffer, in order to ensure continuous supply to utilise slaughter capacity. The uneven distribution of arrivals of deliveries affects the handling of animals at the delivery point.
The smart system that has been developed for measuring, storing and transfer of data performed satisfactory. However, further development is required to include video pictures, and to improve the speed of wireless data transmission from the moving in the field to any mobile or stationary stations.

Conclusion

Effective logistics could be the major key solutions to reduce stress inducing factors emanating from road conditions, transport time, environmental conditions in the vehicles, stops related to traffic conditions, queuing at the abattoirs, at border controls etc. Queues at the abattoir's delivery point frequently cause problems for drivers and for the abattoir staffs, creating a stressful work environment, which could also negatively affect the animals' conditions. With the surveillance system it could be possible to trace all animals from the farm to the abattoir while animal welfare can be monitored by measuring transport performance and animal conditions gives an additional guarantee to the consumer.

Acknowledgements

The work is part of the EU-funded project CATRA: *Minimising stress inducing factors on cattle during handling and transport to improve animal welfare and meat quality*