

## RFID solutions for logistics in poultry industry

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Many experts have written and discussed how the logistics system will be applied to many industries but only a few focused on the logistics of animal movement for poultry industry. Management of transporting grown broilers in the poultry industry is associated with various events that compromise the welfare of broilers and the quality of meat. The effective logistics system is necessarily required for taking into consideration the delivery time from farm to slaughter house. The delivery time depends on road and traffic conditions, climate, distance, and queuing at the checkpoint. For delivery-time optimization, Radio frequency identification (RFID) system is an innovated solution for automatically collecting data at the farm, at the checkpoint, and at the slaughter house.

Prior to examining the details of the logistics, it is important to consider the principles of animal identification that is important when collecting information for broiler movement. In August 2006, Department of Livestock Development (DLD) in Thailand and National Electronics and Computer Technology Center are two main organizations promoting the standardization of identification number of 15 digits. The benefits of the identification system are not only for collecting information for logistics purpose in the business perspective but also for traceability and animal disease control such as Avian Influenza H5N1 or bird flu. RFID tag contains a 15 digit number which is unique to the individual animal or group animal. The ID itself does not contain all information about the animal. To obtain more information, one would need an access to the databases that may store such information and match it to the individual ID number. Each time the broilers moves from one owner to the next stage through the production chain, the date of each occurrence would be recorded. This information would be stored in the previously described database. Officials or business owners could access the database and track the animal back and identify where and when the animal had been.

The objective of this research was to study the logistics chain of broilers transport before entering the slaughter house in order to demonstrate potential effects of operations planning and route optimization on broiler welfare, meat quality and the environment. Improving the loading and unloading facilities and methods at farms, vehicles and slaughter house with RFID is required to reduce the duration and variability of loading time which may have positive effects on animal welfare and the meat quality.

**Keywords:** Poultry, RFID, Logistics, Animal welfare, Time optimization

## 1. Introduction

Poultry is the leading meat export industry in Thailand. After avian Influenza H5N1 or bird flu outbreak in Thailand put doubt and fear on the customers, both domestic and international customers concern a great deal on the quality of meat product. The lack of confidence in the product causes the poultry farmers to adjust significantly toward the better animal welfare and higher quality of meat. The transport and handling of animals every step of the process is the key solution to this adjustment. The outbreak in 2004 eradicated a large number of broilers and caused non-hygiene slaughter house to close down due to the strict requirement from the DLD. The decreasing number of allowed slaughter houses leads to the increased transport time and distance in circumstance. Currently, there are about total of 184,326,752 broilers reported by Department of Livestock Development (DLD) in year 2006 [1]. The effective logistics system is necessarily required for taking into consideration the delivery time from farm to slaughter house. The delivery time depends on road and traffic conditions, climate, distance, and queuing at the checkpoint. For delivery-time optimization, Radio frequency identification (RFID) system is an innovated solution for automatically collecting data at the farm, at the checkpoint, and at the slaughter house.

Traffic in Thailand is a big concern in animal transport between locations. Time and routing optimization will not only save time but also save fuel-energy for transport and thus will reduce the cost of transportation. The logistics chain of transportation process includes activities from loading of animals at farms, transport from farm to slaughter house, to the last operation of unloading of animals at the slaughter house. Charoen Pokphand Foods (CPF) Public Company in Thailand installed a transport surveillance system a global positioning system (GPS) receiver to control the driver transportation route [2]. RFID is a great tool to effectively manage the transportation process by utilizing the GPS system. The company should adapt the GPS system to connect with RFID reader and send both location and identified animal number directly to DLD database based on the reference of 15 digit animal identification number by using mobile communication network such as GSM. This adaptation allows extra information transfer of identified animals along with the unloading place and time, temperature, and movement which are useful information for improving logistics system. In addition to optimization of the delivery time, it is also important to care for animal welfare during transport. Gebresenbet 2003 suggested two ways to improve animal welfare during transport: (a) minimizing stress inducing factors through improving animal transport logistics system and handling methods (improve handling, loading, unloading facilities, and optimized activities at the checkpoint and slaughter house (b) minimizing and avoiding transport by encouraging small scale slaughter house of developing a mobile or semi-mobile slaughter house [3]. The development of small scale slaughter house is not possible because of the strict DLD requirement. Thus, the stress reduction factors by improving delivery times and methods will then be the focus of this study.

## 2. Methodology

The study was based on the staff interview of a private company chosen by the DLD authority. Charoen Pokphand Foods (CPF) Public Company Limited and its subsidiaries or “CPF Group” is the leader agro-industrial and food conglomerate in Thailand. CPF Group is capable of handling the whole logistics chain from farm to processed meat product. NECTEC researchers interview the staffs at these locations: (1) CPF Srimahosot farm in Prajinburi province (2) Slaughter house visit at CPF Established No. EST. 03. and (3) DLD Checkpoint visit

### 2.1 Activity registration prior to movement

Broiler life cycle for meat production is about 40-45 days. Broiler will be delivered to slaughter when it reaches the weight of about 2 kg. In prior to animal movement, the producers (farm) must submit to DLD a movement request documentation that indicates the number of animals, average weight, along with the swap samples for H5N1 laboratory test. This process must be done at least a week before the movement date. After the review process, DLD will allow the movement by issuing the documentation that states the numbers of animals, the way of transportation (license plate requirement) and the transport routes. Therefore, animal transport collection routes from farms to slaughter house will be registered in advance. With this prior knowledge, DLD checkpoint can expect the registered number of movement daily.

### 2.2 Activity registration for the delivery process

During the transports between farm and slaughter house, the deliver truck is required to stop at checkpoint located within the route. At the checkpoint, DLD veterinarian at the checkpoint will observe the animals closely to see if there is any sign of disease, then sign the movement document and register the time on logbook. There are reports of maximum of two veterinarians located at each checkpoint. The rest of the staffs include a few hourly wage personnel who are hired for handling labor work such as identifying animal number and recording on papers. The observed activities during delivery can be classified to vehicle activities and animal activities. Vehicle activities were based on observation of the vehicle while animal activities were based on observations of animals. The registered data were organized and stored in a database for further analysis.

### 2.3 Analysis

The analysis of results will compare the current operation with the proposed operation with RFID enhanced system. The registered data were analyzed to determine the impact of frequency of arrival of animal on-board vehicles and duration of activities, queues, capacity, and other system constraints. The comparison will focus on time and number of people involved and the case of benefits from adopting 15 digits animal identification number.

### 3. Result and Discussion

Although the transport of the broiler is arranged in advance with DLD, seasonal and short-term variations in supply and demand created challenges to the planning of broiler transport operations. For example, Chinese New Year in Thailand increased the number of poultry sale and in turn increasing the number of animal movement to slaughter house. All documentation associated with the transport was carried on paper. The transporters or the truck drivers carried paper documents for each animal to be collected and checked by officers at the DLD checkpoint. The planning of deliveries under unpredictable conditions requires some flexibility in animal transport and slaughter house. The transport of animals was operated by contracted transport operators or the truck company, and the planning of transport operations was based on a pre-registration of delivery information received from producer after DLD issued the movement document. The DLD staff interview process revealed there is still no usage of arranging the departing and arriving time at the checkpoint to avoid queuing when multiple trucks arrive simultaneously. Most of the planning is done solely from each company's contracted transport operators.

#### 3.1 Vehicle activity chain

The producers informed the slaughter house that their animals were ready for delivery after receiving the movement of document before delivery date. At the slaughter house, the delivery orders were provided to the contracted transport operators. Each transport operator made their detailed scheduling of collection routes of the coming week and contacted each producer to inform about the time to collect the animals. Changes in time of arrival and loaded animals were communicated by telephone between truck driver and slaughter house. The loaded truck must go through the sanitization process before leaving the farm and again at the checkpoint. This sanitization process involves driving through the wash basin at the farm gate and at the slaughter house, and spraying on truck tires at the checkpoint which usually takes 5-10 minutes. While waiting for the lot number assigned for the slaughter process, the truck is parked temporary in the cool air room for keeping broilers from stressing out the hot weather.

#### 3.2 Animal activity Chain

About 8-10 broilers at farm will be captured and put into a cage at the day of delivery. The loading process takes several hours to move all required broilers out of the farm. At the checkpoint, the DLD veterinarian detects the animal health condition. During the sanitization process, the truck driver must get out of the car and hand the documentation to DLD veterinarian who will later sign the documents and stamp the date and time. The check-up record will also be entered into the logbook at the checkpoint and once a month DLD personnel will summarize the report of number of moved animals passing through the checkpoint.

### 3.3 Discussion

The current logistics system requires a lot of paper work. Queues at the delivery gate and vehicle wash for sanitization delay the operation time and affect animal directly in the hot climate as in Thailand. RFID identification system can reduce the checking time significantly. The usage of RFID E-Seal attached at the back of the locked door can easily improve the time for truck identification. As mentioned earlier, the life cycle of broilers is much shorter than cattle and the whole group of broilers in a house is raised with the same condition of feed and medication. Therefore, it will only be suitable to identify broilers in term of group identification. Attaching RFID to the broiler cage will identify the group of broilers in a truck. RFID tag can be recycled by rewriting the newly assigned group identification number for the next lot of movement. The identification number therefore must be the standard number in order to transfer data between database of farms, slaughter houses, and DLD central database. One way to achieve the database connection is through web service setup. The transport logistic chain depends strongly on the process visibility. RFID reader collects data read from RFID tags on the truck and the cage and enters to the database. This process can be done within minutes and the process can be paperless and avoid the human error in jotting down 15 digit long number into the paper. The web application with web service can help the producers (farm) and the DLD officials to have more visibility of the transport process in real time. This information is the new phenomenon for helping in planning and avoiding the queue at the checkpoint or the slaughter house. In an advanced system of RFID and GPS with mobile telephone network integration, the collection of time not only can be recorded at the certain location, but also during the period of travel can also be stored. The CPF surveillance system controls the truck driver with the data collected from GPS receivers installed in the truck. However, signals from the GPS satellites have a good general coverage only when there is a good visibility of the sky, otherwise the signal may be temporarily obstructed by trees, tall buildings, weather conditions and inadequate placement of the receiver inside the truck. The new paperless process with RFID integration can shorten the time of operation and the real-time information accessed to the database can help in planning for route and waiting time optimization at the checkpoint and also at the slaughter house.

### 4. Conclusions

The goal of managing a logistics chain is to obtain a smooth flow through all operations, with effective utilization of the available resources in transport and processing operations, acquiring the desired service level (in lead times, deliver frequency, and reliability) with minimum cost, under the constraints of capacity and product quality [4]. RFID is a tool to reduce the duration and variability of loading time that has the positive effects on animal welfare and meat quality. Operations with RFID develop an enhanced logistics chain to accommodate queuing and planning for route optimization; thus help improving the loading and unloading time at farms, checkpoints and slaughter house. Also, the number of dead or stressed broilers from dehydration in the hot climate can be

reduced from the reduction in transport time. Comparing to the current system involved paper filling method, RFID reader can quickly identify group of broilers based on the previously assigned animal ID with confirmation on DLD database. For the advanced system, RFID reader connected with mobile communication system installed inside the delivery truck sends real-time reading of RFID animal tags from the delivery truck to company and DLD database. The real-time exchange of vehicle status information during the delivery routes would be resourceful for planning at slaughter house on handling uncertainty in arrival times and animals supplied in addition to the clear benefits for tracking and tracing animals for traceability purpose. This delivery time can further be used to synchronize with the preparation of staffs and equipment to avoid delivery queue which generates the better condition for animal welfare and meat quality.

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