AN INTEGRATED DATA CAPTURE AND DATA PROCESSING SYSTEM FOR MEAT INSPECTION ON THE SLAUGHTERLINE

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INTRODUCTION

The Danish pig production is gradually concentrating into fewer and larger herds with increased emphasis on rational working methods. A decisive factor in the production economy is the herd health condition, which has a major influence on the growth rate and feed utilization.

The health condition is reflected in disease remarks recorded at meat inspection in the abattoirs. It is therefore important for the optimization of the production economy at the individual farm, that the owner receives a feedback on all the relevant remarks quickly, so that he can utilize the information for preventive action as soon as possible.

A structural development towards fewer and larger units has also taken place in the slaughtering industry where the slaughter of approx. 16 million pigs annually today is carried out in 25 abattoirs. The slaughtering industry is in the middle of a powerful technological development and especially information technology is currently being introduced in many plants. In order to have a sound basis for the costly investments in data processing equipment in the next few years, the DMRI is preparing a general action plan for the introduction of CIM (Computer Integrated Manufacturing) in the Danish pigmeat industry. Essential elements in this action plan are an increased exchange of information between the abattoirs and the producers, and work on a quality management system. In both these areas the role of the meat inspection is essential.

The State Veterinary Service which is responsible for meat inspection plays a central role in both the health condition of the live pigs and the quality assurance at the abattoirs, and has shown a considerable interest in achieving a better utilization of the technological possibilities for a better and more effective control system at the abattoirs.

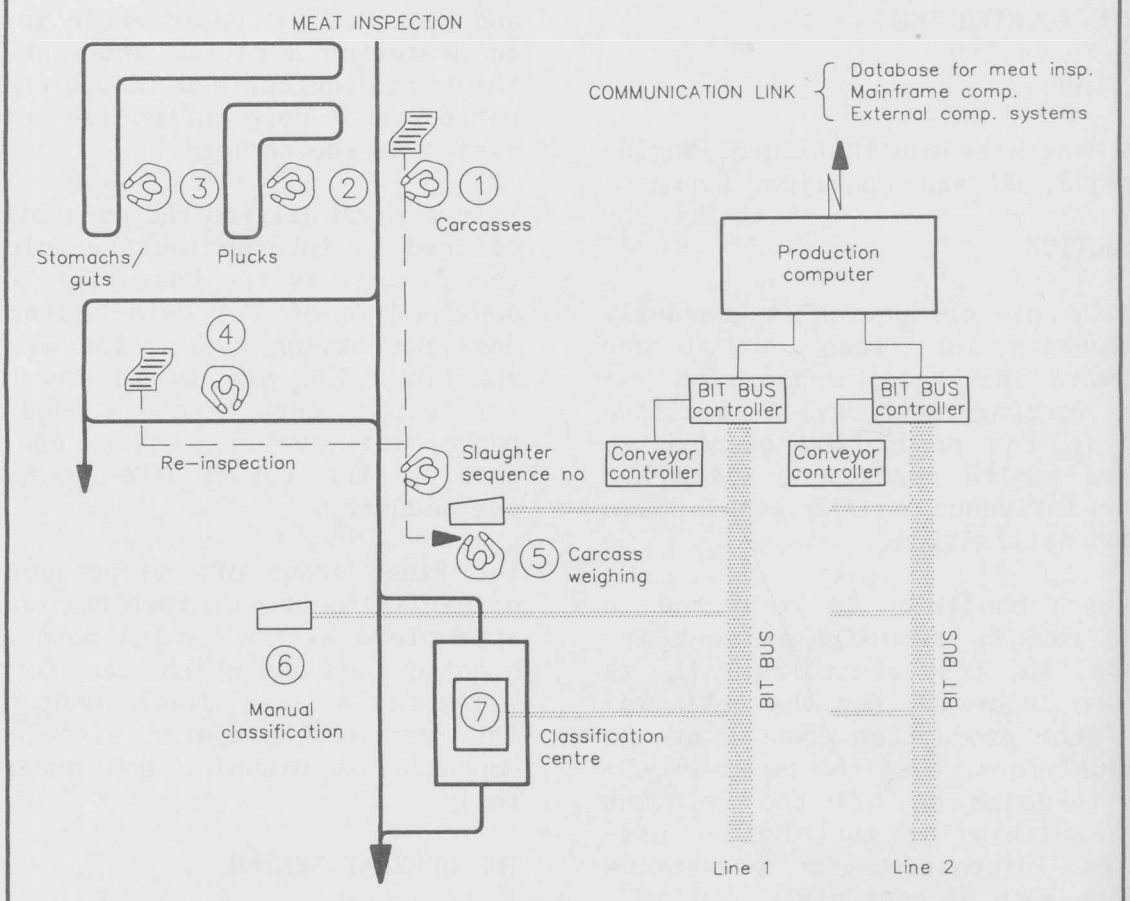
This wish to utilize the possibilities offered by information technology in the future, is the basis for the new development of the data capture and data processing system for meat inspection. The aim is to develop an integrated data capture and data processing system, which can form part of the future CIM-concept for the industry.

The first stage of the project will primarily focus on a more rational data capture system, and a data communication system which can form the basis for a later development of the data processing system with special emphasis on planning and management tools.

THE PRESENT SYSTEM

In the present system for meat inspection on the slaughterline, see sketch lay-out fig. 1, all carcasses which receive disease remarks from the carcass inspector (1), are being directed for re-inspection via a push button activated by the carcass inspector. The carcass inspector is in audio-visual contact with the two other line inspectors (2) and (3) examining plucks and stomachs/guts respectively. These two inspectors can therefore let the carcass inspector know if they find anything which requires that the carcass should be re-inspected. Disease remarks from (2) and (3) are not recorded. At the re-inspection station (4) the final diagnosis is made. Condemned carcasses and carcasses requiring BE (Bacteriological Examination) are identified on a list. Approved carcasses are automatically returned to the main slaughterline. Disease remarks (maximum 2 remarks per carcass) from (1) and (4) are recorded on a label, which is placed on the muscle surface of the hind leg, where the natural moisture acts as an adhesive.

FIG. 1: SKETCH LAY-OUT FOR MEAT INSPECTION – PRESENT SYSTEM



At the carcass weighing station the label is removed, and the remarks are keyed in by the weighing operative together with the number of the supplier and the slaughter sequence number.

The present system which was introduced in the late 70'ies has been functioning satisfactorily and has provided a basis for an effective and safe meat inspection system. If an increased number of disease remarks has to be recorded e.g. to include remarks from the plucks inspection it would be necessary to increase the number of meat inspectors/assistants, and the strain on the carcass weighing operative could increase with a requirement for an extra operative as the result. The recording of disease remarks is made in two places, namely by label at the inspection site and later transferred to the data system at the carcass weighing station; the present system is heavy on resources if more than the present two remarks are to be recorded.

THE NEW SYSTEM

The requirements for a new data capture and data processing system are as follows:

Data capture:

* Recording of disease remarks directly at the meat inspection site.
* Operative dialogue requiring minimum of resources.
* Optimum security for recording correct data.

Via an integrated data communication system the data must be available for direct use for:

* A database (internal and external) for the meat inspection.
* The payment system.
* Classification and sorting system

* A quality assurance system.

The data processing system must also satisfy the following criteria:

* Provide an effective planning and management tool with continuous updating.
* Provide a facility for on-line search by pig producers.

The first stage of the project, which is described below, includes data capture and data communication up to data processing.

The new system is primarily based on three developments within information technology: Automatic identification, industrial terminals and data communication networks.

The first system for automatic identification of pig carcasses based on barcoding of the gambrels was implemented about three years ago. By the end of 1989 automatic identification will be implemented at five or six Danish slaughterhouses. All gambrels are individually marked with a barcode and the corresponding number in plain numerals. The gambrel number thus replaces the slaughter sequence numbers stamped on the carcasses. At the carcass weighing station the gambrel number is coded to tie up with the supplier number.

Industrial terminals are data capture terminals, which are designed to withstand the conditions on a slaughterline and for a satisfactory hygienic operation. Within the last five years an increasing number of cheaper and more suitable terminals have become available. A number of industrial terminals which can be used for various applications in an abattoir are on the market today.

To satisfy the increasing need for data communication and for connection between different types of computer-based equipment, a number of Local Area Networks (LAN's) have been developed. They range from standardized high level LAN's, to company or equipment specific low level LAN's. In Denmark we have reached an advanced state in the selection of LAN's for the meat industry. It has been decided to use the "BIT BUS" developed by INTEL for data communication on the slaughterline. This a low level, low cost network especially suited for an industrial environment. "BIT BUS" is currently being installed on all Danish slaughterlines cf. fig. 1.

It has also, based on an investigation, been decided to recommend a LAN of the ETHERNET type as high level LAN.

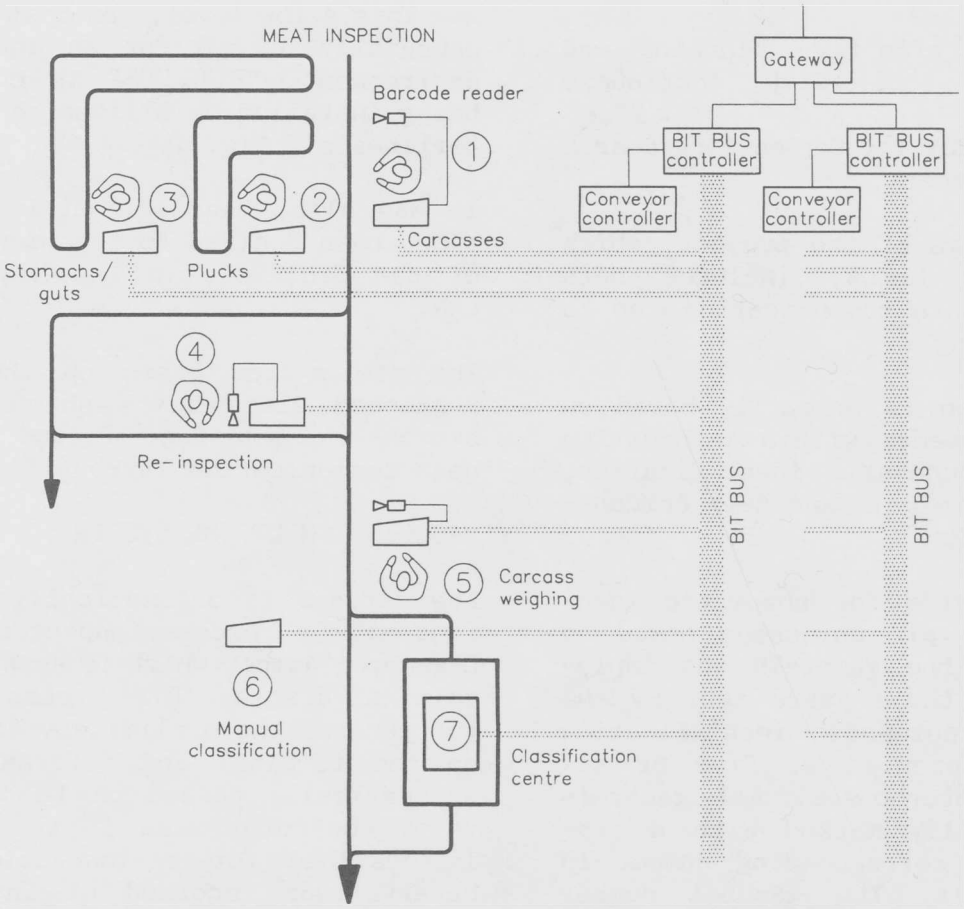
The new system based on the above mentioned elements is shown in the sketch lay-out fig. 2 and in the data communication lay-out fig. 3.

DESCRIPTION OF THE SYSTEM

The carcass is automatically identified at the carcass inspector (1) as a gambrel number which is shown on the terminal display. The carcass inspector records the preliminary diagnoses on the terminal and information is automatically passed on to the conveyor control system if the carcass is destined for re-inspection. Any observations recorded at inspection sites (2) and (3), which require re-inspection have the same function. All recorded disease remarks are displayed on all three terminals together with the identification number. Correct data connection for each carcass at (1), (2) and (3) is as in the present system ensured by a syncronized control of the three conveyors.

At the re-inspection site (4) the final diagnosis is made and is recorded on the terminal together with the automatically read gambrel number. As an assistance in making the final diagnosis all remarks which are recorded by (1), (2) and (3) are displayed on the terminal at (4). A printer at (4) prints out all the remarks which are recorded by (1), (2), (3) and (4) for each carcass. Remarks and identification for condemned carcasses and BE-carcasses are entered manually onto lists which are then keyed in on terminal (4), alternatively on a separate terminal.

FIG. 2: SKETCH LAY-OUT FOR MEAT INSPECTION – NEW SYSTEM

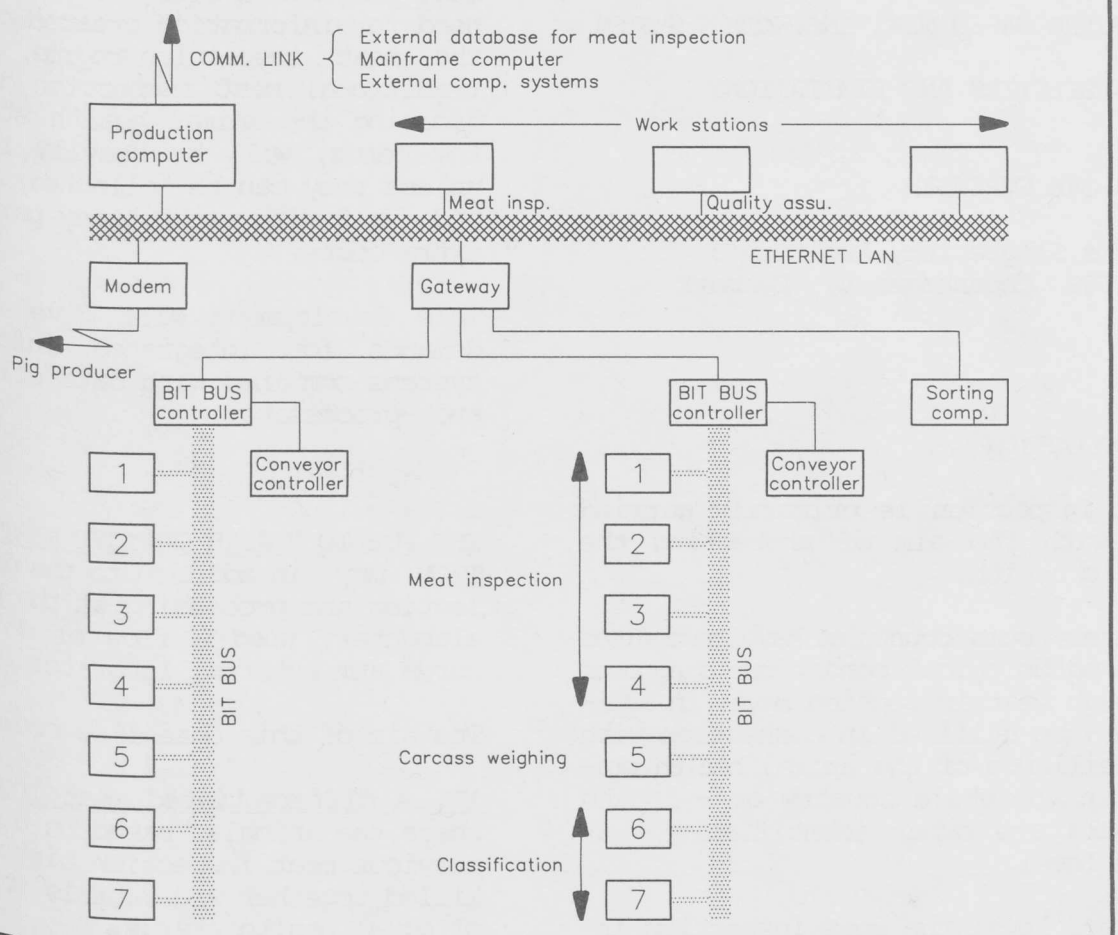


At the carcass weighing station the gambrel number is again read automatically. With the gambrel number as a reference the disease remarks are then connected to the supplier number, the sex and the hot carcass weight.

Data communication via the "BIT BUS" net means in principle that all the different systems which are connected to the net are able to exchange data freely. In the "BIT BUS controller" related data can be assembled into various records e.g. a record of individual carcasses giving information about identification number, supplier number, sex and remarks from meat inspection. Via the "GATEWAY" the different records are then accessible for the superior LAN which is of the ETHERNET type.

The superior high level LAN is the information "backbone" of the company, where large data quantities can be transferred at high speed. At th level all the connected units h free access to the data from the i dividual sub systems, either via central database or via distribut databases. In the system shown he the so-called production computer microcomputer) acts as a database f all carcass records and for connecti to the mainframe computer and extern data systems. The various work st tions (personal computers) select t required data in the carcass databa and then perform the desired proces ing. The results of the data pr cessing in the work stations are th stored in the database. Each p producer (supplier) has a dire connection via a modem to the databa and the work station for meat inspe tion and can through this link recei information in the form of process data and statistical informati about the health condition of t slaughtered animals.

FIG. 3: SKETCH LAY-OUT FOR DATA COMMUNICATION



Recording of remarks from the ante-mortem inspection can be made on hand-held terminals. Data from these terminals can then be transferred to the BIT BUS net or directly to a work station see fig. 3. As an alternative to hand-held terminals the present hand-written lists can be entered on one of the terminals (1), (2), (3) or (4).

Some slaughterhouses collect blood for edible use. For these slaughterhouses it would be an advantage to establish an information flow about carcass condemnation from the meat inspection to the blood treatment unit. The information controlling a possible condemnation of the blood will originate from the terminals (1), (2), (3) and (4) and the BUT BUS net.

CONCLUSION

The system outlined above has being conceived as an open, modular system which can be implemented in stages according to each company's requirements and possibilities.
The first stage will be a more rational data capture system where disease remarks are entered directly onto terminals at the meat inspection sites. The terminals will be connected to the already established "BIT BUS" LAN and data transmission and data processing is carried out by the existing system.

The new data capture system will require less resources than the present system when up to two disease codes per carcass are recorded. Even when the number of disease remarks per carcass is increased this will still be the case.

It must be emphasized that the design of a complete system concept has been considered already in this first stage of the project. This gives each company the possibility to plan a staged implementation, but it is also an important factor in ensuring that the system can be integrated in a proper CIM concept.