OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

16356

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

COMPUTERS IN THE MEAT PROCESSING INDUSTRY:

A CASE STUDY OF APPLICATION AND IMPLEMENTATION

EXPERIENCE IN A DEVELOPING COUNTRY*

by

Antonio A. Pardo**

Summary

The Philippines is a republic composed of 7,100 islands in the South Pacific. Although its land area is small, it possesses one of the world's most rapidly growing populations with presently 54 million inhabitants. Consumption of food is therefore an important aspect of the country's development plans.

The RFM Corporation, one of the largest food conglomerates in the Philippines, is a company with several divisions which are independent profit centres. These are: Flour, milling, agribusiness, livestock and food division, feeds division, soya bean refining division and the meat processing division.

In 1979 the newly established meat division was expected to produce a commodity acceptable in terms of quality and price and able to compete in a market monopolized by one brand for the past 70 years.

The highly perishable nature of the products and the reliance of the meat plant on other affiliates for raw materials required a highly up-to-date method of communication and information.

How the meat plant was able to implement a scheme of computerization through its existing staff is the subject of this paper.

Contents

Meat processing

This is the business of processing raw materials into consumer-oriented food products. These products are spiced and seasoned to conform to taste patterns of the consumer of the end product. They are sold in various forms and stages of the cooking process.

To be able to understand the business, the production process can be classified as follows:

(a)   **Livestock feed lot** - This is the operation of receiving, grading and maintaining salient features of the various animal herds to be used as raw material in the meat process. Common animals used are cattle, goats, chickens and pigs. .Unlike other industries where the raw material is simply housed in warehouses, in meat processing the animals are alive when bought. The animals are bought by weight. Maintaining this weight and its physical properties is an integral part of the business. The feed lot area is therefore a warehouse for live animals where they are fed prior to slaughtering.

(b)   **Slaughter** - The process of systematic slaughtering of animals is a basic part of meat processing. Considering the fact that the animal is the major part of the production cost and is the first step in the operation, great care is taken to ensure that slaughtering is done professionally without damage to the flesh of the animal. In most cases, machines do the slaughtering to minimize waste.

(c)   **Portioning** - This is an integral part of the slaughtering operation but is separated due to its importance in the production process. Portioning is the systematic and corresponding break-up of the complete animal into the prescribed cuts needed by the production process. Its basic products are the carcass,.bulk meat and numerous by-products. The product mix of the production process dictates the portioning method. There are hundreds of ways of portioning, each one of which would produce a different set of products.

This process is the major step where waste control must be exercised. Wrong portioning produces costly excess cuts which will negatively reflect on the efficiency of the production process.

(d) <u>Meat processing</u> - The operation of blending, curing*/, spicing, cooking and mixing to produce various meat products in consumer images. Processing at an industrial scale connotes batch continuous process with special emphasis on hygiene and clock-work precision. The proper mix of raw materials is necessary to produce and maintain the taste of the end-products for future use and/or distribution to the consumer markets.

(e) <u>Cold storage</u> - The use of freezing (cryogenics) to preserve raw materials, semi-finished products and end products for future use and/or distribution to the consumer markets.

(f) <u>Canning/packaging</u> - The process of packing the meat products by the most hygienic methods into containers suitable for sales distribution. It is composed of the packaging, the labelling and the casing operations.

(g) <u>Warehousing</u> - The process of storing products properly cased in an orderly fashion during the incubation**/ period. This period is the time when quality tests are undergone to check the contents of each sample from each batch to meet quality and health standards. Only after this incubation period is the product judged to be suitable for distribution.

As evidenced, the meat processing section is the most complicated operation. This section handles various steps as follows:

(a) <u>Curing area</u> - The process of treating the meat cuts with salt and other chemicals to soften and preserve it;

---

*/ Curing - the method of salting meat to preserve it.

**/ Incubation period - period of observation. In food products it may mean up to 14 days, depending on bacterial growth or factors observed to avoid food poisoning or quality defects.

(b) **Smokehouse** - The process of giving the taste of smoked hickory to meat slabs;

(c) **Blending** - The process of putting together ingredients to arrive at a taste pattern conducive to meeting a particular demand, e.g. blending beef with pork to produce Bologna sausage meat;

(d) **Spicing** - The process of seasoning and adding of various taste mixtures to the meat slab to imbue distinct taste patterns to the end product;

(e) **Cooking** - The process of softening and conversion of raw meat to cooked meat either through frying, steaming; broiling, baking, sautéing etc.

Data requirements in meat processing

There are many data requirements in production planning and control. It requires a knowledge of what materials are available in the environment. Such materials can be classified as:

Zssential ingredients   —   The meat portions
Spices and additives   —   Taste-oriented additive components
Colour and image additives   —   Product image improvement aids
Casings and others   —   Food items used as containers such as hot dog casings.

Considering the perishable nature of the products, one normally only produces what one can sell.

The data requirements are closely related to the product mix. This is important as the act of killing an animal for its steak will produce thigh or leg meat which will rot if not used. The portioning of the animal must be determined at the time of slaughter to consider the end products that will be produced out of the animal's meat. The by-products must therefore be projected and must be converted to saleable products.

Most important is <u>cost control</u>. What is bought must be converted to saleable end-products. It is therefore a continuous job to oversee both the number and weight of product batches as they proceed from one stage to the other. Inventories are therefore described in pieces and in weight. As such, each production stage begins and ends with weighing. Every component that enters the product is reported in both weight and units. Costs thus vary as the product increases and decreases in weight due to added moisture.

Cost data tracking likens bulk meat to a train that moves from station to station. At each station a given number of kilograms of meat is expected to yield a given number of kilograms of semi-finished product kilograms. The initial cost of the product on entering the plant plus the cost of materials added is not the final cost. Losses have also to be considered due to dehydration.

Mechanizing cost tracking is a major challenge as each batch produced must be sold as soon as possible.

Blended meat products are made from beef, pork and other meat trimmings that are ground and chopped by machinery and then seasoned and spiced to suit the trade for which the product is intended.

This semi-finished preparation, in a semi-liquid form, is automatically stuffed This semi-finished preparation, in a semi-liquid form, is automatically stuffed into prepared casings and then cooked, smoked and/or chilled. Blended products include Frankfurters, various types of sausages, Bologna, minced ham and many varieties of sandwich meats.

Each of these products is blended according to a specific recipe which is governed by the availability of ingredients, consumer tastes and federal/state/local regulations. Its basic goal is to produce standard taste and quality by conforming to recipes and to do these at a minimum cost.

The company

The RFM meat plant makes Swifts Products (licensee of Swifts, USA) and MacDonald Hamburger patties, amongst other items. It is a vertically and horizontally integrated operation that starts from its own feed lot, its

slaughtering operation, its meat processing operation, its cold storage plants and packaging sections, its own specialty outlets, its nationwide distribution and sales network, and its own accounting/staff functions.

Its sales and distribution operation is a highly complex operation employing the use of refrigerated trucks, vans, ship bottoms and air cargo as it distributes highly perishable frozen or chilled products throughout the 7,100 islands of this tropical country.

Its customers number approximately 7,000 active "rush-oriented" clientele. The rush nature of delivery is due to most customers' tendency to avoid storing large quantities of meat because of storage costs. Hotels, huge supermarket chains, small corner stores and even direct orders of housewives are serviced through a centralized order-taking operation which can service an order within eight hours lead time on a wholesale basis.

RFM is a company that is relatively young and aggressive. It challenges a 50-year old monopoly which controls 95 per cent of the nation's meat market. After one year's operation, it had absorbed 20 per cent of the market share.

In this environment, its top executive decided to introduce computers, not to solve the company's accounting problems but to obtain information which would provide relevant data immediately and so provide the company with a competitive advantage. Having an information base that could plan operations, control waste and provide management with up-to-date information were sufficient grounds for immediate action.

Thus in 1978, the Cabuyao meat plant decided to acquire an IBM System 34 with terminals operated by their own line people (not by EDP). This decision was cautioned by the fact that the company wanted a distribution system that could have a direct interaction with each function of the operations. And the priority was to mechanize production.

The approach to mechanization

A committee for mechanization was created. This was composed of the Plant Manager as Chairman with the MIS Manager as Facilitator/Vice-Chairman. Each major function was represented by the corresponding head of that operation. These functions were:

- Accounting
- Personnel
- Product planning
- Brand marketing
- Sales
- Production superintendent
- Distribution (delivery and warehousing)
- Purchasing and logistics
- MIS Project leader

Instead of allowing the committee to go its own way, each member was educated in computer systems design (especially report format design) and the computer hardware through a special in-house series of training sessions, while the EDP staff was trained in meat operations, both conceptually and in actual assignment. This training took six months.

After the committee had been trained meetings were called to plan which steps should be taken in the actual mechanization. This stage of the BIS (Business Information Systems) study was called the Appreciation/Introduction Stage. It taught the meat people more about computers, and the computer people something of meat processing. By the end of this stage both sides respected each other's functions and spoke a common language. Its main achievement was that the fear of computers was minimized at the supervisory level.

The study team then identified the phases of entry into computers, its requirements, its justifications, its expected output, its level of reporting and the machines it would use. At this stage IBM consultants were introduced to discuss their equipment.

A Project Management Chart (PERT-CPM) was created for Phase I that considered among other things:

    (a) Training/appreciation of terminals by functional personnel

    (b) Systems design and programming

    (c) Site installation and considerations

    (d) Parallel runs

    (e) File conversions

    (f) System acceptance standards

    (g) Procedure and policy changes

It was understood that to be able to obtain the maximum advantage from computers, everyone involved had to be approached in such a way as to rid them of their fear of computers.

The method chosen was the micro-computer. At about this time, in 1979, the Apple computer was making its presence felt. The micro was seen as a potential because computer games had become a fad in most entertainment outlets. And so in 1979, the meat plant was given several micros which were placed at strategic locations with games. These were used during work breaks for the entertainment of employees. It was noticed that the people eventually learned how to care for files (in the form of diskettes), the various functions of the keyboard, the operation of the micro and the knowledge of software versus hardware. This was done without any formal training but by word of mouth through informal teach-ins.

The result was astonishing. Classes in computer appreciation that followed (which were used to teach users how to operate terminals) were easy. Each person was out there trying to prove that he or she could learn it easily as it was after all just another toy - but a toy which could also help them in some way.

The implementation

While the acceptance of the meat plant personnel was being secured through the intentional introduction of the Apple micro-computer, a company-wide survey of the meat plant was carried out by the EDP staff. This survey was found to be comparatively easy as the staff were by this time very knowledgeable with the terms used by the industry. The corresponding assistance by the EDP-oriented management was also not to be underestimated. The EDP appreciation seminars did a lot to bolster the support of the plant's managers.

The survey divided the operation of the meat plant into several functions. These functions were then given priorities and presented to the Screening Committee where it was adjudged that the central and focal point was production planning.

With these major points identified, three major project teams were formed, viz:

(a)   Finance applications;

(b)   Customer service systems;

(c)   Production system.

The rest of this paper is devoted to the improvements affected in the production system. The production systems, however were found to be a totally new area of experience.

In order to produce maximum results in the minimum time several areas were chosen as start-off points based on a detailed survey of the production operation. These were:

Meat blending - The heart of the production process was identified as being where the blended meat product is made. Everything was found to be a support activity. According to the production manager, if these stages could be mechanized, costs would be so controlled as to justify purchasing the

computer, so much so that all other activities would just be icing on the cake. This is where the planner or nutritionist together with research and development creates the formula for each product based on the available raw materials and within the constraints of the market and governmental/trade regulations.

Portioning section - Next to blending, the cutting up of the meat is the area where costs could be controlled as this section considers the product mix while identifying the components according to the way the meat is cut.

Material requirements planning - Due to the daily changes in formulation and cut up/portioning approaches, the uses of raw material vary. Mechanization of the raw material replenishment schedule would greatly improve purchasing and production planning. Better planned alternatives would be available to reduce inventory holding costs and spoilage due to unused raw materials.

Large animal purchasing - This is the information data base which assembles the evaluation of supplied batches of large animal (cattle, pigs etc.) deliveries according to lean meat yield to fat ratio. This is due to inherent breed performance characteristics which should be a known factor to properly establish buying prices based on yields and not on external appearances of herd stocks purchased.

Electronic power and other energy consumption control - This is the use of micros to control the opening and shutting off of motors in the various cold storage and chilling chambers interspersed throughout the meat processing plant. In the Philippines, after a certain level of energy usage is met the price per kilowatt becomes higher. To avoid reaching these ceilings, energy consumption is monitored by turning switches off whenever possible.

Weight measuring data collection - This is the tracking of the weight of the production batch as it goes through the production floor so that the cost of the finished product is distributed on a kilogram basis. The weight measure at every end point will be a basis not only for inventory control but also for production yield analysis.

The production systems project team was composed of OR-oriented EDP people with engineering backgrounds. They established coding structures for inventories and production steps and documented the whole existing production processes. With such in-depth knowledge placed on paper, the group then proceeded to establish the process used in the trial and error work of arriving at an acceptable formulation for some products. These steps were carried out to achieve a least-cost blend of meat materials to meet formula restrictions on ingredients, composition, capacity, moisture, shrinkage, binding and colour. It then established and secured approval for the phased-in plan for production mechanization, namely:

Phase I:

    Fixed asset inventory (equipment)
    Inventory control on stores and production floor
    Finished goods inventory
    Raw materials cold storage inventory

Phase II:

    LP meat blending
    Material requirements planning
    Cut-up optimization
    FG goods cost simulation

Phase III:

    Production yield analysis
    Large animal purchasing
    Purchasing operations
    Energy optimization
    Capacity planning
    Production synchronization

It was understood that to facilitate the use of OR techniques in LP Meat blend and cut-up optimization, the afore-mentioned applications should be very user friendly. All mathematics should be transparent to the users.

The micro was seen as a start-off point and the initial development of the Linear Programming System on Meat Blending using and Apple was undertaken. The programmes and the model were set up relatively quickly over four months, using Apple DOS Basic language in an Apple.

The use of a micro which appeared at that time on the market allowed a smooth implementation of Phase I and II applications. The corresponding ease of implementation of cut-up optimization, another heavy operations research system using Parametric Programming involving grading of all large animals and establishing corresponding standards per grade while identifying the various output of cutting styles, could be directly attributed with the approach of using a simple micro to do the hardest task - and doing it far better than experienced people. The saving derived from the first product successfully formulated was about 45 per cent of its raw material cost.

The eventual complete implementation of the meat blending operation led the way to the successful attainment of the other phased-in targets.