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Computer Applications in Dairy Industry

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ABSTRACT

Computer Application will optimize solution in dairy industry. Using solution, user has optimized their production in the reducing production cost and unit costs. Computer application/ automation will improve the physical working environment considering the number of monotonous, repetitive tasks to be eliminated or minimize, increasing efficiency in production. Computer application available in the agriculture today, makes it possible to manage a dairy industry on a more detailed level than before. The dairy manager can make more rational decision through acquiring amount of information, the dairy manager has to operate several computers each day and manually transfer data from one unit to another. The paper aims to analyze information feasibility and the application of computer in modern dairy industry, this system as dairy management tools to describe, document and control all processes on dairy production, especially the multi-purpose and multi-agent system application support management of the dairy and provide documentation for entire dairy supply chain members. Customization of IT platforms for use in dairy industry is emerging as a major opportunity for change.

Key words: Dairy Industry, IT, Computer application.

INTRODUCTION

In many respects the dairy industry occupies a special position among the other sectors of agriculture. Milk is produced everyday and gives a regular income to the numerous small producers. Milk production is highly labor-intensive and provides a lot of employment. The dairy industry is the sector with the highest degree of protection due to the economically vulnerable position of small milk producers. Milk - also known as white gold - can be used to make an enormous variety of high quality products. The high cost of milk as a raw material has necessitated a high-tech processing industry. The special nature of milk (perishable and bulky) leads to the necessity of strict and comprehensive quality regulation and to high transport costs. The large dependence of milk producers on the dairy processing industry has resulted in a strong position held by the co-operatives in milk marketing and in the processing industry.

The whirlwind of changes, which is passing through the world, is also exercising a growing influence on the dairy industry. The number of milk producers is falling rapidly, the dairy processing industry is becoming more and more highly concentrated, and the international

dairy markets are increasingly liberalized and are giving greater opportunities to low cost producers, including many from developing countries. (http://www.ilri.org)

Today's dairy processing plants face enormous challenges. Many facilities still using outdated dairy automation systems must now make major upgrades in spite of difficult economic circumstances. And as dairy processing regulations tighten and profit margins narrow, consumers are demanding a broader selection of healthy, grab-and-go dairy products. Dairy processing plants must develop a sustainable approach to innovation in order to succeed in this environment. (http://www.mavtechglobal.com) A growing range of products, high hygiene standards and the legal obligation to provide supporting documents leads to the continuous introduction of new requirements for the dairy industry. The complex production processes must be controlled, monitored and analyzed in an integral and secure manner. The development of intelligent automation solutions for dairy industry companies demands more than just system know-how. Industry experience and knowledge about complex structures and processes in a dairy or cheese making environment are just as important.

Dairy Industry in India has been an important aspect in the development of the agricultural sector in the country. Dairy farming has been transformed into an industrialized system, creating optimal integration between the production unit (the cow), technologies and equipment (engineering), the operator (the farmer) and the production environment (the dairy farm). Producing more milk with less dairy cows improves the economic performance of the farm unit and also drastically reduces the ecological imbalance in the country. India is not bound by agricultural traditions, and India farmers integrate many new ideas into their farming systems. Integration of co-operative ideas has provided even the small farmer in India with technological access to modern and to up-to-date know-how, through extension services. (http://www.israeldairy.com)

The most important thing is that the technology needs to be an economical investment. It's important to be careful not to invest in something just because it sounds like a good idea. It has to provide a return. The technology should fill a void or need on the farm. If you already do a great job with visual heat detection, maybe an automated heat detection system isn't for you. Technologies also need to be easy to use, reliable, and come from companies that put a high priority on customer service.

Computer is used for varieties of purposes in dairy industry. The requirement has been increasing due to its attractive features. Its application as management information system (MIS) for effective decision making, optimizing product mix, product composition, procurement and distribution routes**,** inventory management and maintenance of plant–machineries etc. has been found very popular.

Specific features of the dairy industry

The dairy industry has a number of specific features which distinguish it from the other sectors of agriculture in a number of respects. The dairy industry is a special case in world agriculture. The specifics of the dairy industry are due to four, partly interrelated, factors. The first factor is to be found in the specific properties of milk as a raw material. Milk is basically a liquid consisting of 90 per cent water, which means that it is a bulky and heavy commodity; also, milk is produced on a daily basis. As a consequence, milk requires high-cost transportation and there is a cost limit on the range over which it can be sold. Furthermore, milk will only keep for a few days, which places a time limit on the period during which it must be used or processed and transformed into a more stable, longer keeping form. On top of that, milk is highly perishable and also potentially subject to adulteration, whilst the quality of the raw material is highly dependent on farm management. Strict and comprehensive quality regulations are therefore customary and necessary, and they are much more far-reaching and comprehensive than in other agricultural sectors.

The second factor distinguishing the dairy industry within agriculture as a whole is the socio-economic position of dairy farmers. The vast majority of them are small-scale producers, with a

weak and vulnerable position on the market; the nature of the business (involving a high percentage of fixed costs) means that they are only able to adjust to market changes in a limited and gradual way. Furthermore milk is produced everyday and is a regular source of income to the numerous small producers. At the same time, milk production is a highly labor-intensive production and therefore provides many employment opportunities, not only in the dairy farming business itself but also in the transport and processing of milk and in the agricultural supplies sector. For that reason, in many countries the dairy industry is considered to be highly important for the live ability of rural areas. Due to this factor and its economically vulnerable position, in Western countries the dairy industry is far and away the sector with the highest degree of protection. More recently, in a number of countries dairy farming has come to be regarded as increasingly valuable in terms of nature and countryside conservation.

To an increasing extent, dairy farming is becoming multifunctional. In many European countries, dairy farming is more that a purely economic activity. An illustration of the special position of dairy farming in the rural community is a recent incident in Ireland. In that country, milk quotas were sold from the sparsely populated East of the country to the far more densely populated West, purely for economic reasons. The Irish Government considered this situation to be extremely undesirable for the live ability of the rural areas in the East, and made efforts to ban the sale of milk quotas from Eastern to Western Ireland. In another sector of agriculture, such an action would be unthinkable - and impossible.

The third factor highlighting the special position of the dairy industry is the strong position held by the co-operatives in milk processing. According to a survey by the International Dairy Federation (IDF) in 1984, in 21 countries, together accounting for 55 per cent of the world's milk supply, producer co-operatives marketed 86 per cent of the total sales of milk from farms. This was true, especially in Northern Europe (Scandinavia, the Netherlands, Germany), New Zealand and India where the co-operative milk processing industry is very strong, with the co-operatives often holding a share of over 90 per cent in the processing of milk. In the United States, in particular, the milk marketing co-operatives have succeeded in building up a strong position with a share of 80 per cent of milk supply vis-à-vis the dairy processing industry, which consists mainly of private enterprises.

The background to the strong position of co-operatives in the dairy industry can be explained by, on the one hand the strong dependence of small producers on the milk price and on the other hand by their weak position on the market. They are able to keep the milk for at most a few days and unlike grain producers for example, they are unable to defer selling their product until a more favourable moment on the grain exchange. As long ago as the 19th century, this led dairy farmers to want a direct influence on the processing industry, on which their livelihood was, and still is, so crucially dependent. The small family farm with such a vulnerable and difficult product as milk to market needs and assured outlet and a guarantee of a known price.

The fourth and final factor involved in the specific structure of the dairy industry is the fact that milk is a very valuable but at the same times an extremely expensive raw material. On the one hand, milk can be used to make a wide range of products which combine the features of being highly palatable, nutritious and at the same time high-quality. Indeed, milk is also known as 'white gold'. On the other hand, its high cost price includes the necessity of using milk to make products which have a high added value. The result is that the processing industry is very important to the dairy farming sector, far more important than in many other sectors of agriculture. In the dairy industry, the processing operations have to satisfy high technical and quality standards.

Over the years, the four above-mentioned factors have helped to form the very special position which, as stated above, the dairy industry today occupies among all the other sectors of agriculture. However, the great changes which are affecting the world as a whole are likewise leaving their mark on the dairy industry. The forces generated by these changes, such as the fast pace of technological progress, economic liberalization, privatization,

scale enlargement, internationalization and globalization, are also exercising a growing influence on the dairy industry. A whirlwind of change is passing through the world, and it cannot fail to have an impact on the dairy industry. For that reason, the lines which originated in the past cannot simply be extrapolated directly into the future; the nature of the dairy industry is undoubtedly heading for changes in the years ahead.

The structure of dairying in developing countries

From the historical viewpoint, the origin of dairying lies in the developing countries, in Mesopotamia to be precise, at around 6000-7000 BC. From this region, milk production and milk consumption spread to other regions in Europe, North and East Africa, and Asia. The developing countries can be divided into traditional and non-traditional milk producers. Traditional milk-producing regions are, roughly, the countries of the Mediterranean and the Middle East, the Indian subcontinent, the Savannah regions of Western Africa and the Highlands of Eastern Africa, and to some extent South and Central America. Further, the consumption of milk and dairy products played an important role among the nomads in Africa and Asia.The majority of the humid regions, South East Asia, China, Korea, and Japan, account for the non-traditional milk-producing countries. Nevertheless, for example in China, milk was regarded as very beneficial for the ill and the elderly.

In the 'traditional' milk-producing regions in Asia and also partly in Africa, the structure of milk production is characterized by small farms with not more than three or four animals. Dairying there is nearly always part of a mixed farming system. The dairy cattle are often used as draught animals as well. Livestock are fed principally on agricultural residues and waste, and are grazed on natural pastures of non-arable land. Cattle husbandry and milk production is largely supported on the by-products of agriculture. In this way, a nutritionally superior product is produced in an ecologically and environmentally favorable way.

In Central and South America, the scale and design of dairying are medium, with mixed beef and dairy operations. The average milk production per cow is higher than in the regions mentioned above, at about 1000 kg per year, but it ranges from 1400 kg to 1900 kg in Chile and the Eastern part of the Argentine, the whole of Uruguay, and the Southern part of Brazil. Nevertheless, here too the small producer also plays an important role. Estimates indicate that in the majority of the Latin American and Caribbean countries between 60 per cent and 80 per cent of the milk producers can be classified as small-scale producers, accounting for 25 to 30 per cent of milk production in these countries.

In the 'non-traditional' milk-producing countries the structure of dairying is more varied. Especially in the tropical and subtropical regions, besides small farms there are also large-scale specialized dairy farms, sometimes with several hundred cows or more, most of which were founded in colonial times or after the Second World War. In the economies with a centrally planned history, there are often still large-scale capital-intensive and specialized state farms, for example in Cuba, China, Ethiopia and Tanzania. Saudi Arabia, for instance, also has large-scale dairy farms with up to several thousand dairy cows.

Characteristics of the future

The future of smallholder dairying in the tropics will be characterized by a number of unique factors. These will be increasingly recognized as characteristics of importance in their own right rather than variations from a desirable norm in dairy production, as may currently be the case. Such characteristics would include:

a. Production of milk as one of many outputs from integrated farming systems
b. Reliance on smallholder dairying for the majority of local area milk and milk product supply
c. A increased focus for low cost fresh milk production for local towns
d. Production of boutique milk products, in many cases oriented to local tastes
e. Utilization of waste and by-products as principle animal feeds
f. Adaptation to and utilization of available local inputs
g. Development based on self-help, leading in some cases to communally-owned

processing facilities

h. Optimizing rather than maximizing milk production within a low cost production system

i. National agricultural research system investment in smallholder dairying research

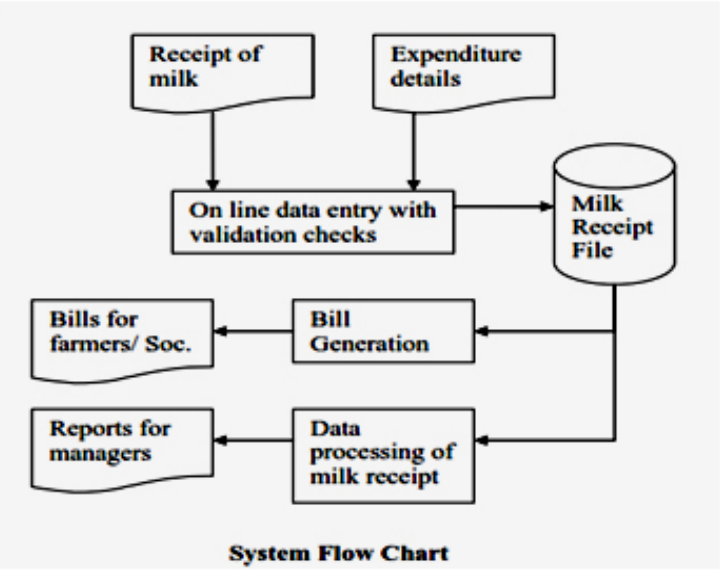
j. Linkages between rural and urban areas through provision of transportable nutritious and, in a preserved form, non-perishable product.

Application of Computer in Dairy Industry

From a distinguished and misunderstood history to the present day, with the application of a number of indigenously developed techniques, and the increasing application of adapted technologies from international research, smallholder dairying in the tropics has established a viable and expanding future. The application of knowledge has been advocated by many, they provided respectability for a field which in the 2000s should come of age. Nevertheless, in linking social and natural scientists in support of further development of smallholder dairying in the tropics, a wider understanding by scientists and educators is needed. Scientists must understand the indissoluble link between adoption, new technology development and socio-cultural requirements, and small farmers who have traditionally been neglected and who need education about the inter-relationships between technologies. As with many aspects of less developed country agriculture and indeed integrated farming systems, it is difficult to define an individual as a smallholder dairy farmer alone as this may be simply one of many occupations. The paradigm used in our analysis of such enterprises is in itself a limitation to our ability to further improve complex, efficient, integrated systems. The challenge for development agencies, scientists and educators remains one of further increasing their own knowledge of the variables and relationships within such highly integrated systems and the central role of the smallholder in them. (http://www.ilri.org)

Milk Procurement & Billing:

Analysis of data for number of milk supplying centers based on quality and quantity was a tiresome job before the computerized billing system came in dairy industry. One can visualize receiving milk in two shifts from thousands of procurement centers. Added with this dynamics, there are other complex payment conditions relating to milk procurement and pricing policies, fat basis, double axis basis, total solids basis, incentives for promoting milk procurement quantity and quality, negative incentives for controlling non-genuine and poor quality milk etc. A number of persons were required in manual system to manage this, which was time consuming and less flexible too. But the computer application made it feasible to frequently bill and pay. Computer application has proved a



System Flow Chart

boon in managing huge information relating to milk collection, quality monitoring, technical inputs, monitoring of artificial insemination activities and providing timely payment to milk producers. Computerized information system can help to determine milk procurement cost and its impact on sale price. Quick analysis of milk value would be helpful in effective purchase of milk and conserve commodities.

Data bank about milk routes, capacities of vehicles, reception timing and quality status helps in scheduling of routes. Following shows the flow chart for milk receipt and billing system. (http://dairy-technology.blogspot.in)

A package had been developed by the Computer Centre to generate bills for payment to farmers periodically for supply of milk based on its fat and SNF content. Though it did not have much relevance to NDRI where procurement of milk from farmers is not in practice, yet the package has its usefulness in situations where milk is being procured by the milk plants and payment is made at suitable intervals based on SNF and fat content. The package could be suitably modified to incorporate any other parameter as per the requirement. (D.K. Jain and R.C. Nagpal, 2005)

Optimization of Product Composition

Measurement of milk composition is essential for the dairy industry and management of dairy farm. The quality of milk has direct influence on the quality of processed milk products. Frequent measurement of the milk composition of every individual cow is important for animal breeding, efficient usage of cows and for nutrition management (Svennersten-Sjaunja, Slaunja, Bertilsson, & Wiktorsson, 1997). Identification of silent variants of milk proteins; Control of the quality of milk samples submitted for routine analysis; Effects of milk composition on cheese yield and quality.(Ashwani Kumar Kush, 2005)

Plant Automation

Automation with fully integrated or part wise is done to suit the dairy's requirement. Fully automatic plant employs automatic operations for the entire operations. As discussed earlier, data are captured on computer system for milk quantity and quality. Based on the collection and demand of the market for milk and milk product, planning is done. Full automation with on line displays/ messages keep informed for timely monitoring. All information regarding stock of milk and milk products, receipt / dispatches, losses etc. are known without any lapse of time to manage the operations. Computerized operations can control the product quality in better way. For this sensor or good sensitivity is employed to measure the process outcome. Sensor feedback is given to controller for adjustment of variable that are responsible for quality attribute. They convert the farm produce into products with desired attributes using unit operation such as drying, evaporation, cooking, etc. Process control is used to run these operations economically to give safe products consistently.

A computer model is developed for accurate control of milk temperature as affected by fouling. It can calculate accurately the increase in steam temperature required for maintaining the desired milk sterilization temperature. The results with steam control are compared with the results without any control and this procedure was found satisfactory for controlling the milk outlet temperature. (P.K. Nema, A.K. Datta, 2005) Computer-aided computation, being fast, facilitates on-line monitoring of the quality. The techniques used center around planar electromagnetic sensors operating with radio frequency excitation. The sensor technology proposed has the ability to perform volumetric penetrative measurements to measure properties throughout the bulk of the product. (Mukhopadhyay, S.C. Gooneratne, Chinthaka P. ; Sen Gupta, G. ; Demidenko, S.N.2006)

Consumption of dairy and food products can be traced back to antiquity. However, the dairy and food industry lagged behind other manufacturing industries such as automobiles and petrochemical industries in introducing automation and computerized process control.

The dairy industry is uniquely positioned for easy adoption of computerized process control because it requires extensive record keeping, finished products generally homogenous with relatively few ingredients and fluid operations

are often of long duration, sequential and adaptable to software systems developed for continuous processes. The high capacity of modern continuous pasteurization was made possible by the development of the hygienic automatic diversion valve, used in conjunction with very reliable temperature sensing and equally reliable logic control (initially with relays, then with programmable logic controllers).

Standardization of milk is the primary operation after receipt of milk in a dairy plant. If the fat content of incoming milk is known and it is supplied at constant rate, it is sufficient to measure and control the flow of cream from the separator to obtain milk of desired fat content. Standard control configuration of spray dryer includes two loops. In one loop heat measuring inlet temperature of hot air controls heat input. In the other loop feed rate is controlled by measuring the outlet temperature. As well as, in the process of making cheese, Controlled stirring of the curd during coagulation gives control of consistency, which is a function of entrapped air. From the preparation vats, curd flows at a controlled rate on to a whey removal conveyor. The amount of drainage is controlled by varying the speed of the conveyor. (K. Narsaiah, 2005)

Computerized Accounting System

Computerized accounting is a normal phenomenon in most of the organization. All the input data of transactions are fed into the system on batch or on-line basis. The system gives all the report as per the management requirements. Finalization of account is possible within a short time. All the financial reports including trading account, profit & loss account and Balance Sheet can be taken out promptly. Computerized system also helps in employees' salary payment, vendor payment and furnishing of all legal return along with deposition of contributions. Similarly accounting of milk and milk products to monitor and control handling losses is quite effective to have control over losses by the use of computers.

The daily data on milk handled and products manufactured, if entered in appropriate software, says MS-Excel, can be used to determine handling losses in fluid milk in absolute and percentage terms. Similarly, losses in fat and SNF content could also be studied during the manufacturing of various dairy products. Reports can be generated on daily basis or on batch basis or periodically to indicate losses incurred in various operations which could be compared with the admissible losses or norms so as to check the excess losses, if any. (D.K. Jain and R.C. Nagpal, 2005)

Applications of Management information system (MIS)

Information systems refer to computer-based information processing systems that are designed to support the operations, management and decision functions of an organization. Information systems in organizations provide information support for decision makers at various management and decision levels. Thus, they encompass transaction processing systems, management information systems (MIS), decision support systems, and strategic information systems. MIS is a system required to obtain tactical information. MIS raises management from the level of piecemeal spotty information, intuitive guesswork and isolated problem solving to the level of system insights, system information, sophisticated data processing and systematic problem solving. Hence, it is a powerful method for aiding managers in solving problems and making decision. The MIS must fulfill the following characteristics:

a. The correctness of input data and that of the processing rules leading to accurate resultant information,
b. Information should be complete, i.e., it should include all possible data,
c. Information should be reliable, i.e., it should not conceal vital information,
d. Information should be regular and timely,
e. Information should be relevant and concise, i.e., should be presented in such a way that one may immediately perceive its significance, e.g., the information in a graphical form.

Software tools can be applied to generate useful information relating to processing of milk and milk products. Some of the possible applications include: procurement and billing system, handling losses, cost of production of dairy products,

labour efficiency, formulation of ice-cream mix and sale proceeds of dairy products. The cost of manufacturing dairy products needs to be worked out off and on so as to fix the selling price of products which should, as far as possible, match with the prevailing market price. Software can be developed to find out these costs instantly by providing variable inputs costs, e.g., raw material, labour, etc. and by using the pre-determined overhead costs in the process of manufacturing.

Software can also be developed to find out labour efficiency in milk plants. The data maintained on labour employed in different shifts and milk handled could be used to work out the turnout per man-hour employed and compared with the norms available in this regard. The information so generated can serve the basis to determine quantum of bonus payment to be made to the workers engaged in dairy operations. Suitable packages like LP-88 can be employed to formulate linear programming applications, say in the preparation of ice-cream mix, to minimize the cost of production in order to maximize the sales margin, i.e., profit earned. The sales proceeds of different products, if maintained on daily basis, could be used to generate a daily report and periodical reports showing product-wise, product group-wise and overall sales volume by developing suitable software for the purpose. Such a report was developed at NDRI on monthly basis for several years in the past. (D.K. Jain and R.C. Nagpal, 2005)

Based on the data being updated on computer on daily basis, various reports, both tabular and visual, are being prepared and passed on to all concerned in addition to the Manager for their perusal and corrective action where needed. The periodicity of these reports is Daily, Monthly, Fortnightly, Yearly, any other period.

Computerized Network

Organizations are utilizing benefits of Networking by connecting one department and /or organization through computerized system. More information and better monitoring is feasible with the help of wide area networking applications. National Dairy Development Board (NDDB) Anand has developed computerized networking system by networking of all the milk unions and federations. Some of such usage of computer includes use of GIS, National Information Network (NIN) etc. Computational Neural Networks based models have been successfully applied in various real-life problems at NDRI. The research in this field is still under development across the globe. There has been relatively little research into application of Computational Neural Network in the field of agriculture in general and dairying in particular especially in India. (Adesh K. Sharma and R. K. Sharma,2005)

Some potential applications of connectionist models in dairy processing are briefly presented:

a. Modeling of pH and acidity for cheese production has been made using Computational Neural Network
b. Shelf-life prediction of pasteurized milk has been achieved using connectionist models
c. Neural networks have been successfully employed to predict temperature, moisture and fat in slab-shaped foods with edible coatings during deep-fat frying
d. Model predictive control (MPC) of an Ultra-High Temperature (UHT) milk treatment plant has been realized using a neural system
e. The Computational Neural Network technique has been used to determine protein concentration in raw milk
f. Analysis of dairy patterns from a large biological database has been performed using neural networks
g. Neural network models based on feed-forward back-propagation learning have been found useful for prediction of dairy yield
h. Computational Neural Network have been employed for dairy yield prediction as well as cow culling classification
i. Prediction of cow performance with connectionist model has shown better results than conventional methods

Packaging

Computerized system or Robots help to alleviate monotonous, repetitive tasks for employees - all while making the production process more economical. Tools for the packing of dairy products

often feature several function. The function depends on the configuration of the product in question. Tools for suction, slicing, clamping or gripping may be used. It is also possible to combine a variety of tools that can be used to handle separation sheets, products, boxes, pallets etc. It develops and supply complete solutions including labeling, separation sheets, and palletizing products ready for shipping. (https:// www.bila-automation.com)

The computerized system used by Siemens Global system Germany, it includes filling and packaging in plant represent high cost factor on the path ready to deliver dairy packaging, this results from heterogeneous and isolated solution. An efficient alternative with optimize packaging, the integrated automation solution for filling and packaging with machine. The Siemens optimized packaging Line integrates filling and packaging systems in a common automation and communication standard. The standardization and integration of individual machines delivers cost- and energy-savings throughout the entire production line. Integration risks are lower and allow the use of scalable production data acquisition and evaluation systems from optimized packaging Line like line overview, diagnostics, OEE, tracking and tracing, and energy recording and management. Moreover, the costs of training, operation, and servicing can be reduced significantly with optimized packaging line. Additionally, dairy packaging line efficiency, productivity, and availability during operation are all noticeably improved. (http://www.siemens.com)

Preventive Maintenance

The data /information of each equipment /machine with required periodicity is helpful in carrying out preventive maintenance effectively. Operator / Technician in manual system and auxiliary equipment in the automatic system will perform the operation of preventive maintenance as per the displayed instruction of computer based on the input data. This will help in automatic generation of break down and maintenance information required for management decision of optimum resource utilization.

Supply Chain Integration and Traceability

ICT applications are also helping supply chains become more vertically integrated. Better cooperation between farmers and buyers along the supply chain mitigates default risk. Amul in India has installed Automatic Milk Collection Unit Systems in village dairy cooperatives. These systems enhance the transparency of transactions between the farmer and the cooperative and have lowered processing times and costs. The application uses computers connected to the Internet at the milk collection centers to document supply chain data such as fat content, milk volumes procured, and amount payable to the member (Bowonder, Raghu Prasad, and Kotla 2005) Dairy Information Services Kiosks at collection centers describe best practices in animal care to enhance milk yield and quality and assists dairy cooperatives to effectively schedule and organize veterinary, artificial insemination, cattle feed, and related services (Rama Rao 2001). Delivery of such comprehensive information helps to improve integration of the supply chain, thus reducing default risk. The early detection of production volatility makes it possible to take preemptive measures to address the underlying risk.

ICT applications, particularly GIS and RFID technologies, have had an impact in mitigating two additional forms of risk in the supply chain: sanitary and phytosanitary (SPS) risk and default risk. Larger aggregators and traders use software systems to collect and track information about who is growing what and whether farmers are adhering to the food safety and quality standards imposed in Europe and North America, especially for perishable foods.

Traceability technologies and software to increase integration in supply chains, such as Muddy Boots (http://en.muddyboots.com/) (see Module 10), help to mitigate default risk when suppliers rely on large numbers of small-scale farmers.

Application in Vendor Development

The more common system of inventory management that is used in conjunction with a product date stamping system is FIFO (First In,

First Out). Using FIFO, the product with the soonest expiration date is preferentially placed on the retail shelf for sale. With this system, it is still possible to put spoiled product in front of a customer that is not fresh to the taste, or possibly not wholesome or safe. This is because the variation in the temperature history of any given product parcel is fairly large, and some may actually expire before the expiration date says they will. Thus when abuse temperature conditions are encountered during storage, transport and handling, the FIFO policy is unable to compensate for the increased deterioration, and the uniformity in the quality of the product distributed from the stockpile is compromised.

An alternative to this would be to determine issue of store on the basis of observed or estimated food quality rather than elapsed time in storage. This is called Least-Shelf-Life, First Out (LSFO) or Shortest-Remaining Shelf-Life (SRSL) policy. In this system, if the temperature sensing and the integration function of the tags shows an earlier signal in the three dots of the tag (signaling a lower remaining shelf life), then the product is rotated to the retail shelf. This rotation is totally independent of the product dating. Under this scenario, the possibility of placing "bad product thought good" in front of the consumer is almost reduced to zero. This policy would thus reduce food waste and provide more consistent quality at the time of issue for food items which have been exposed to differing temperature conditions.

Computer is used in material management function for inventory control, report generation, generation of orders and vendor performance assessment. This ensures cost effective sourcing of quality materials.

CONCLUSION

Most computerized systems are capable of generating accurate and detailed documentation of dairy processing under computer control. What is important is that the computer generated records contain all of the information required by the system. The use of computerized systems within the dairy industry continues to increase. The use of computerized system technology is expected to continue to grow in the dairy industry as the cost of components decrease, as components are continually improved to withstand the rigors of dairy processing environment, and as dairy companies continue to update production facilities, equipment and manufacturing processes in an attempt to produce high quality, high value products, at the same time reducing production time and cost. The use of computerized control systems in the production of dairy products lends itself to fulfilling those goals.

As computerized systems become instrumental in providing for the safety of dairy products, it verify that proper controls were employed to assure that accurate, consistent and reliable results are obtained from computer control and data storage systems.

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