The dairy industry and its food safety challenges

Just like any other perishable food industry, the South African dairy industry today faces many challenges in the food safety discipline, whether upstream or downstream in the value chain. These challenges go beyond what was perceived in the past, as little or no real threats were experienced.

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Food fraud, globally imported raw materials that may be contaminated, inadequate and unsafe water supply, animal disease control, chemical residues in milk, multidrug-resistant micro-organisms and spore-forming heat-stable bacteria that produce enzymes, are aspects of which the economic risks are often miscalculated.

To add, the inability of government parastatals to fulfil their constitutional obligations places even more significant emphasis on what is considered necessary to uphold a thriving dairy industry from a food safety perspective. These concerns are real and lapses in control will evidently allow regulators abroad to stop imports of our products for purely food safety reasons or for broader motives.

High national priority

Many countries today declare food security as a high national priority of which food safety is a mere component. Having a strong domestic dairy industry is surely judged a better route to food security than importing the perfect product, especially from companies that may sometimes decline to supply less favoured customers if there is a supply shortage.

Today modern dairy farming strives to produce milk of high quality, but farming practices evolve, sometimes bringing with them unforeseen and adverse quality consequences to milk itself. For example, for decades, in parts of South Africa cattle have been grazed mainly on pasture, with supplementary feed such as baled hay and grass silage in winter.

However, it is now common practice for farmers to store plastic encased bales. This is an anaerobic environment in which spore-forming, heat-stable bacteria can grow. If such bacteria enter milk, they will be transported to a processing plant and can gain entry, surviving most heat treatments. They may be able to colonise within fouling films that can build up on milk-contact surfaces and ultimately contaminate the product.

Another example is the use of palm kernel expeller (PKE) as supplementary feed, a waste product of the palm oil business, made and stored in uncontrolled environments which can also be a great haven for spore-forming bacteria or toxin-producing moulds. Although it is often claimed that the threat to milk from such feed is negligible, common sense still requires the most vigilant certification and testing.

Analytical detection methods

Increased use of feeding pads and housing systems can also potentially provide more opportunity for disease organisms to pass between animals in a herd than in the past. Subsequently, we cannot assume that some new way of doing things on the farm will have no effect on milk. That will require demonstration by means of modern analytical detection methods sensitive enough to detect even low amounts of chemicals, posing a threat to animal and human health.

It is of little comfort to consumers who are increasingly wary of official reassurances, that the concentration of any regulated chemical is well below a certain prescribed limit. Dairy companies in South Africa cannot assume that the development and approval of processes for new agricultural chemicals will ensure zero contaminants in milk.

Needless to say, the dairy industry will need to increase their active participation in the interface between farm practices and milk quality. And they need to be scanning for new threats looming in future.

As the threat posed by raw material has increased, so too has the threat posed from within dairy product processing. Twenty years ago, bacteria were considered planktonic – free floating. They came in with milk and we either killed or removed them, or they were in the finished product.

Biofilm hazards

Now we realise the size of the hazard posed by biofilms, a consortium of bacteria that cluster on process surfaces and grow, later to be shed into the product. If the biofilm sheds bacterial spores, these are unlikely to be killed downstream. In dairy processes, the major heat treatment is usually early and most surfaces do not provide favourable growth conditions for pathogens. Instead spoilage organisms grow as some process surfaces in dairy plants are at or near 37°C for extended periods.

While pathogen growth is of more obvious concern, the growth of non-pathogenic spoilage bacteria can have serious economic consequences in downgraded or rejected products, or in spoilage effects that may show up in the market as flavour defects and shortened shelf lives of even ultra-high temperature dairy products, for example, gelation and flocculation.

Over the past decades, dairy processes have changed dramatically. Plants are widely spread in South Africa and raw milk is often transported over much longer distances. Modern equipment with large product contact surface areas, operating for long hours very efficiently, are common. Processes provide vast amounts of surface for biofilms to grow and, therefore, surface areas that must be cleaned thoroughly, not to be affected by the accumulation of a combination of organic boundary layers and microbes on process surfaces.

Computer-controlled plants

As our dairy processes gain in size, they also become more computer-controlled and increasingly complex. Gone are the days when operators interacted manually with process and product. The larger dairy factories are massive, operated by a small staff over long shifts, typically twelve hours. Operators do not see the product. They must discern the health of the plant and product from control screens.

But what happens if pathogens enter these highly engineered systems? What happens if it is a bacterial strain or species not reported previously? New pathogenic strains of “old” organisms are indeed arising every few years and challenging a dairy company’s food safety regimes.

As our dairy products become more complex and incorporate more ingredients from other sources, which add further potential sources of contamination and complicate backtracing, the more the industry needs to prepare itself for new and unknown threats.

But how well is the South African dairy industry currently placed to spot food safety challenges coming over the radar and to deal with them?

Food safety

In principle, the industry has a risk management based food-safety approach in place. It has good laboratories. It does good environmental monitoring. It has the ability to deal with the challenges from pathogens such as Salmonella and Listeria.

Generally speaking the food culture, especially among the larger dairy processors and manufacturers, is strong. This means is that most large plants have a sound food safety record. The same, however, is not true in terms of the sale of unpasteurised packed and retail bulk milk as well as pasteurised retail bulk milk which, although of little significance in terms of the bulk of milk, is sold as fresh milk in the country.

Overall, the picture is of a highly competent industry, but one which can expect new and different threats in future that it may not yet be fully prepared for, philosophically or systemically.

There is a good deal to commend the food safety system and the self-regulatory initiatives established in the supply chain that the South African dairy businesses have built. In this case, the risk-based approach is playing a key role.

Risk-based culture

Well run companies with vested top management interest, are much more able to find and fix the extremely great number of small food safety issues that can arise, than a visiting auditor or law enforcer. A sound, risk-based food safety culture instilled in all employees, designed into the plant and coupled with the necessary knowledge, systems and support is definitely the right way to go.

The major resource is best invested in a risk-based proactive position and not reactive. Yes, there is always a place for finished product testing both for process control and for regulatory assurance purposes. But this ‘ambulance at the bottom of the cliff’ approach has its limitations.

Overall, it is conceded that the self-initiated South African dairy industry food safety assurance systems have made good progress up to today. But is this good enough from what is required to prevent a train crash in future?

One challenge stands out above all – that there is a definite need for continuous change from a general reactive to a proactive approach to be able to face current challenges and, even more, those of the future.