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Strengthening the Cold Chain

BY ANDY PEARSON, PH.D., C.ENG., FELLOW ASHRAE

We all know that a chain is only as strong as its weakest link but what does this mean in practice when we think about the cold chain? Is it weak in terms of effectiveness only, or should we consider efficiency, reliability, climate performance and other factors as well?

It is clear that the weak link in the cold chain varies depending on the context. In developing countries, where up to 50% of harvested crops will perish without reaching the consumer, the weak appears to be in the processing of perishables immediately after they have been picked. However, there is little point investing in that part of the chain if everything downstream is in poor shape. This would just shift the problem slightly further down the path. Incremental investment at all stages is necessary to ensure that costly development of one section doesn't just create a weakest link somewhere else.

In more developed economies, characterized by increased city-dwelling and reduced dependence on subsistence farming, the majority of food loss occurs after the product has been sold to the consumer. This has been likened to buying three bags of groceries and throwing the contents of one of them out of the car window on the drive home. The most effective investment here would be one that modifies the behavior of the food-buying public. Everything else is of secondary importance.

A key consideration is the extent to which the food is processed along the way. Processing can add value by making the crop more attractive or by extending its life, and in our urban lifestyle the benefit of shopping in bulk once a month is substantial, however increased processing seems to be linked to increased waste after the point of sale. Educating and informing the consumer in new and effective ways must, therefore, form part of the strengthening of the cold chain. One intriguing suggestion is that "best before" dates will be eliminated, replaced with a "time-temperature budget" for

the produce that will be monitored continually by sensing elements in the produce packaging. The life of the produce will be assessed based on its temperature profile history, denoted on the packaging by a change of color or a series of bars being progressively filled in until the product has been too warm for too long and needs to be put in the trash.

There is also still room for improvement before the point of sale. Improved sensors and computing power give opportunities to improve efficiency and reliability in the way that has been achieved in the automotive industry, for example. Engine management systems now record the way in which the car is driven over its life, and estimate the time to next service as a variable depending on the driving cycle. The same technique can be used for compressor maintenance, especially when variable speed capacity control is used.

Additional monitoring in a cold store can be extended to water usage, defrost control and management of door openings. Condition-based monitoring of temperatures, oil quality, vibration levels and many more parameters will further improve performance, but the questions on many people's minds are "at what cost?" and "who will be able to afford it?"

The answers come in two parts. Sensor technology and computing power are getting cheaper all the time. Meanwhile a growing focus on reducing food waste, coupled with increasing energy costs, leads to the counter-question "who can afford not to do it?" Strengthening the cold chain is about more than just making it more efficient or less carbon-emissive. Ultimately it is about making it more fit for purpose. ■

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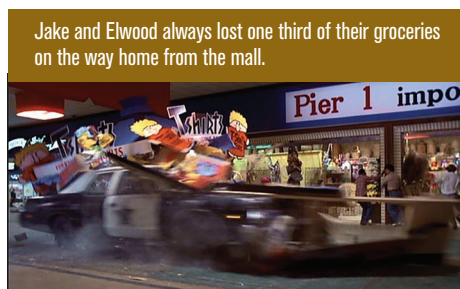


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