

global retail bulletin

Fortnightly news analysis on the world's leading retailers

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Cold chain intelligence is 'hot'

By Sensitech, a global cold chain solutions provider

Today's customers demand affordable, high quality, year round produce and perishable products, putting tremendous pressure on the entire supply chain of grocery retailers. But perishable products - fruits, vegetables, meat, poultry, seafood, deli and bakery products - are also highly susceptible to quality loss based on time, temperature and humidity. This means that retailers are faced with the challenge to source products from all regions of the world, having it delivered to the shelves in optimum condition, sell it at a price that is reasonable to the customer, all the while maintaining consistent product quality - 365 days a year. Cold chain management and cold chain visibility solutions provide retailers with the information for taking mission-critical business decisions.

Cold chain management of perishable and temperature-sensitive products is a specialised element of supply chain management. Product deterioration is slowed by using a variety of temperature control techniques. Although loss of product quality can occur at each point along the chain, most damage to perishable products results from a breakdown in the cold chain and/or poor handling. By monitoring and analysing their cold chain, grocery retailers can minimise losses and maximise bottom line profits, while retaining the loyalty of their customers.

MEETING THE DEMANDS OF CRITICAL CONSUMERS

A primary driving force in the global food market is the consumer. Income growth, lifestyle changes brought about by urbanisation, and changing family structures have resulted in diet changes among consumers worldwide. Because of either increases in purchasing power or the increased opportunity cost of time required by preparing food, the demand for higher value and processed food products has expanded globally. Meeting the demands of today's critical consumer is becoming increasingly challenging.

Today's **environment-friendly** consumer prefers unprocessed food such as fresh fruit and vegetables. This involves controlled growing and the best possible preserving and packaging technology.

The **health-conscious** consumer wants products that are low-calorie,

are part of a cholesterol-reducing diet, are high in vitamins and minerals, and protect - or even improve - health. But above all, these products have to have an excellent flavour. This calls for modified preparation technology.

The **convenience-minded** consumer wants ready prepared meals. Novel technologies in the area of conservation and packaging can help achieve the desired combination of freshness and shelf life in the end product.

The **variety-seeking** consumer is perpetually looking for something new for a change. Products have shorter life cycles and constant innovation is essential.

Consumer choices are increasingly being determined by requirements in the area of quality and safety of food. Consumer demands with respect to ecological and socioeconomic sustainability of agricultural production and to

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issues of food safety are coming more and more to the fore.

Recent consumer concerns about food safety of fresh produce have put an enormous pressure upon the food and retail industry to improve farming practices in accordance with quality and safety standards, and to arrange transparency and traceability in the supply chain. This dimension of global sourcing results in demand for certified products.

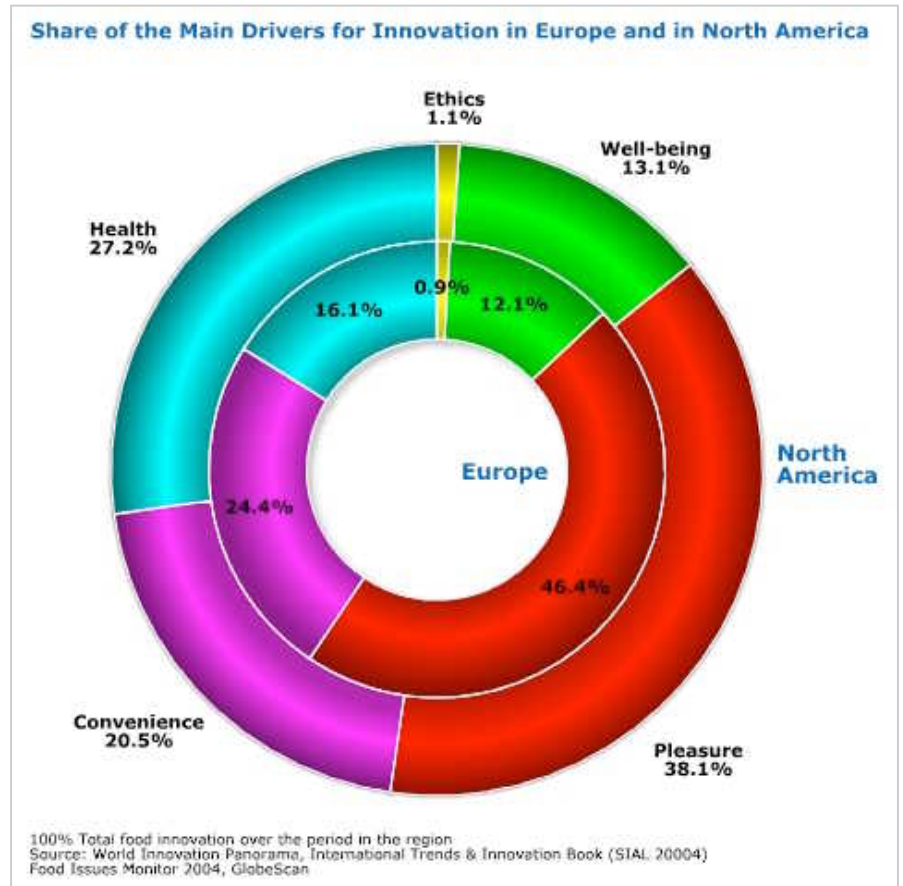
Dr Paul Chapman is a senior research fellow in the Centre for Logistics and Supply Chain Management at Cranfield School of Management (Cranfield University) in the UK. Dr Chapman specialises in supply chain management with a strong focus on the retail industry. His views on the benefits of cold chain to the retailer industry are based on two important factors that are putting the consumer centre stage:

Food Quality And Consumer Health

"In the UK, people are increasingly attentive to what they eat and how they treat their bodies," says Dr Chapman. "Food quality can never be too good and there is always room for improvements. Today's consumers expect their food to be fresh when they buy it, but equally as fresh after six days in their refrigerator. This means that shelf life is a critical factor in the buying process. Also, with the changing consumer attitude towards healthy products that are of outstanding quality, it seems inevitable that good cold chain management practices should become commonplace." Dr Chapman continues: "The other trend towards organic products would suggest that these products need to be monitored on temperature abuse even more."

Changing Demographics

"What we also see across Europe is a clear increase in families with two working parents. Obviously, these families do not have a huge amount of time, but still want a reasonably



priced, good quality meal for the family. They may not necessary prepare this meal in the home, so convenience foods and ready meals are important in their day-to-day lives." Dr Chapman adds: "In the UK, there is also a trend for healthier school meals. It can be expected that unhealthy meals and snacks will be replaced with healthy options, including, of course, fruits and vegetables."



Fresh produce provides an excellent opportunity to distinguish from competitors, although quality must be maintained all year round
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Total Quality Management

According to Dr Chapman, the concept of Total Quality Management (TQM) is highly important to the retail industry, specifically in the light of optimising cold chain performance. "If we go back to the example of ready meals, for instance, it is important that your cold chain works very well. Consumers expect these meals to be fresh, and so temperature control is extremely important in this supply chain."

Process-oriented Approach

"Optimising cold chains requires a process-oriented approach", concludes Dr Chapman. "It would involve different departments within one retail organisation working off a common platform geared towards process improvements to optimise their cold chain."

"It's easy to do it wrong, it's hard to do it right every single time. There's a real need for retailers and suppliers to work together to think through how to do it right and how to ensure control is maintained. This concept may sound obvious but the challenge is not to be underestimated. I have been working with ECR Europe (a pan-European retailer - supplier trade association) since 2000 on the shrinkage working group. This group brings together of all Europe's major retailers, such as Tesco, Ahold, Carrefour and Metro, and many major national players to work together to address losses in the supply chain and in store. Over the last six years our work has helped us understand the scale and causes of loss and the team has a number of notable successes under their belts. However we still battle with the issue of helping retailers maintain process control in every store every day. I am a firm believer that the answer is in designing and implementing better, easier processes. The ability to maintain control of these processes, and demonstrate control has been maintained, is likely to be enabled by supporting technology that can monitor temperature regimes and support performance analysis. Access to reliable, meaningful data provides the visibility of cold chain performance that is required to ensure consumers are safe and their families get the high quality food they deserve."

THE CHALLENGES OF THE COLD CHAIN

Suppliers of high-value food - farmers, manufacturers or retailers - face challenges in creating and preserving the unique characteristics of their products and conveying information about those characteristics to consumers. Often, suppliers must rely on numerous members of the food supply chain and work through downstream market intermediaries, such as processors and distributors, as their products move to consumers. This configuration of food chain

members complicates information sharing and the coordination of activities, product monitoring and quality assurance, and the provision of incentives to supply chain members to ensure equitable and efficient allocation of costs and returns. It also makes it more difficult to convey information about product attributes, especially the increasing number of attributes that cannot be observed or independently verified before or after purchase and consumption.

"Over the past decades Sensitech has monitored millions of trips within cold chains, and we see a clear increase in the demand for freshness, quality, safety and convenience, primarily in the chilled foods sector", adds Neil Simmons, manager Food and Retail for Sensitech EMEA. "In our experience chilled food technology has seen many breakthroughs, but still, that's not enough. You still need to monitor and embed a quality system based on critical control points throughout your organisation. Controls include microbiological safety, extended quality shelf life, temperature control and the retention of nutrients."

Mr Simmons continues: "Quality and safety of chilled foods is strongly determined by product-process-package (PPP) and time-temperature tolerance (TTT). In cold chain applications, temperature forms the biggest challenge and control of temperature is therefore essential."

Quality and safety of chilled foods during storage are largely

determined by time-temperature tolerance. These concepts refer to the relationship between storage temperature and storage life. Different types of food and different mechanisms govern the rate of quality degradation of foodstuffs. Therefore, the most successful way of determining practical storage life is to subject the food to long-term storage at different temperatures. Also, time-temperature tolerance relationships can also help in predicting the effects of changing or fluctuating temperatures on shelf life.

Chilled foods are easily temperature-abused and temperature control and monitoring is an important factor in the control of safety and quality. There is also the need to maintain awareness for potential growth of microorganisms such as Listeria, Yersenia and Aeromonas at chill temperatures.

Temperature Abuse and Shelf Life of Chilled Foods

Temperature control within chilled foods is most important from a food safety perspective. Abuse of temperature is likely to lead to increased occurrence and growth of pathogenic bacteria. The below table shows the minimum growth temperatures (MGT) of six, recognised food-borne illnesses:

Awareness of the need for temperature control at all stages in the cold chain and for a low bacteria count is of paramount importance to all involved with the handling of chilled foods - including the consumer.

Minimum Growth Temperatures of Some Bacteria Found in Foods

Class	Bacteria Species	Minimum Growth Temperature
Mesophilic	Salmonella	5.1°C to 8.7°C
	Staphylococcus aureus	9.5°C to 10.4°C (for growth) 14.3°C (for toxin production)
	Escherichia coli	7.1°C
Psychrotrophic	Listeria monocytogenes	-0.1°C to +1.2°C
	Yersinia enterocolitica	-0.9°C to -1.3°C
	Aeromonas hydrophilia	-0.1°C to +1.2°C

Source: Managing the Cold Chain for Quality and Safety, University of California Davis

In addition, temperature control also preserves both sensory and nutritional qualities. For example, vitamin C losses in vegetables can be up to 10% per day when stored at a temperature of 2°C. However, vitamin C loss can increase to more than 50% per day when stored at temperatures of more than 20°C.

COLD CHAIN: THE IMPACT OF TIME AND TEMPERATURE ON PERISHABLES

The effect of time and temperature on perishable foodstuffs cannot be discarded. Not maintaining the proper temperature can result in microbial growth and pathogens, reduced shelf life, product quality loss and, ultimately, revenue losses. Shelf life thus is intrinsically intertwined with the temperature (and humidity) zones a product passes through within the supply chain.

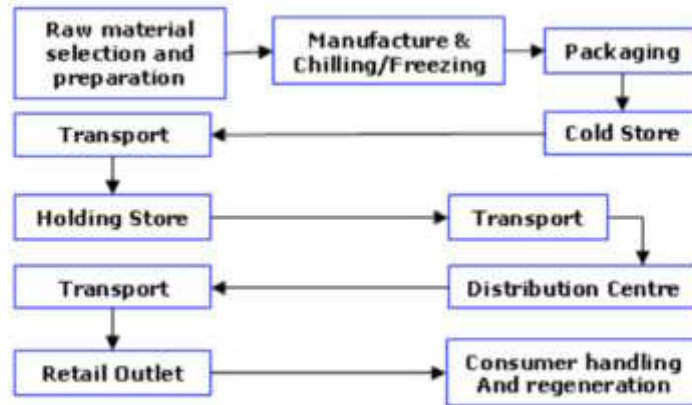
Temperature-sensitive foods is one of the fastest growing sectors of the grocery and food service industries. Continued success relies upon effective management of the cold chain, a term used to describe the series of interdependent operations in the production, distribution, storage and retailing of temperature-sensitive produce. Control of the cold chain is vital to preserve the safety and quality of these foodstuffs and comply with legislative directives and industry 'codes of practice'.

Increasingly, good temperature control is being achieved throughout the cold chain as a result of improved equipment design, quality control and heightened awareness of issues surrounding food safety and quality. However, it is important to avoid complacency and to integrate temperature monitoring as a part of the cold chain.

MAINTAINING AN UNBROKEN COLD CHAIN

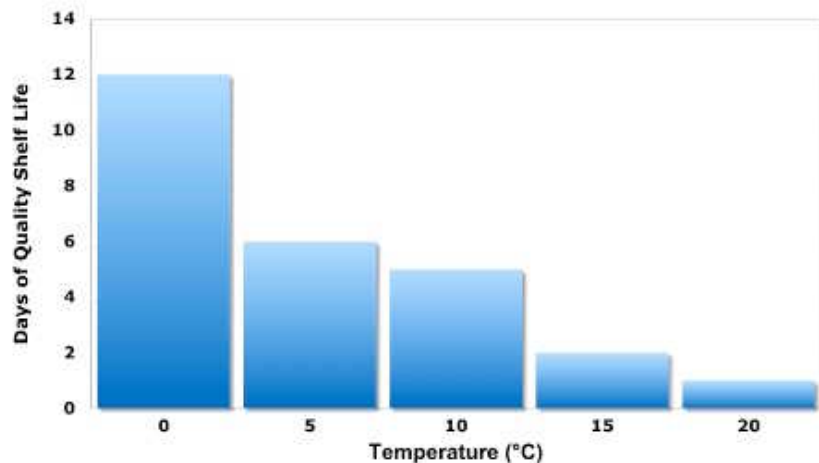
The distribution process of perishables is complex, with

A Typical Cold Chain



Source: Managing the cold chain for Quality and Safety, University of California Davis

The Effect of Time and Temperature on Fresh Salmon



Source: Doyle, J.P., 1992. Care and Handling of Salmon: The Key to Quality. Marine Advisory Bulletin No. 45. School of Fisheries and Ocean Sciences. University of Alaska, Fairbanks. 76 pp. Melvin, E. F. et. al., 1994. Recommended Procedures for Handling Troll-Caught Salmon. California Salmon Council. 16 pp.

multiple handoff points. Trying to transport fresh fruit and vegetables in controlled temperatures from a farm to a warehouse to a distribution centre to a retail store may involve refrigerated trailers, trains and cargo vessels. During this complex chain, mishandling often becomes part of the process.

Regardless of what point a perishable product is in transit, it is always susceptible to temperature abuse. The numerous interruptions in the supply chain may result in

having the perishables remain too long in an open air loading dock at a distribution centre or retail store, above an acceptable control-temperature setting at customs, or in the wrong section of a multi-refrigerated trailer.

Measures that assist control of product integrity include:

- Specific vehicles for specific jobs, such as vehicles for handling perishable products within specific temperature regimes.

- Ensuring that refrigerated temperatures are set prior to loading and maintained during transport.
- Temperature (and humidity) recorders and a wide variety of temperature measuring devices - ranging from probes measuring the internal temperature of products, to a series of recorders that remotely record in shipping containers.
- Specialised scheduling procedures, defining specific pick-up and delivery times and better scheduling of deliveries.
- Improved use of back-loading to optimise capital investment.
- Better handling procedures and increased use of mechanically assisted devices to load and unload shipments and thus minimise product damage.

Transfer points, such as chiller/ freezer to cold store, factory to distribution vehicle, retail cabinets to consumers' refrigerators are well-known problem areas. A useful concept is that of the 'relay system', where the food product is transferred safely from one responsible person to another, and where a signing-over system includes information on product temperature and history. Such a system necessitates thorough education and training of staff likely to come into contact with the product.

Monitoring the cold chain requires detailed information on food product temperatures. Temperature monitoring includes both measurement and recording.

END-TO-END COLD CHAIN VISIBILITY

A process-oriented approach towards cold chain has led Sensitech to develop an end-to-end cold chain visibility solution. This is based on a radio frequency-enabled network that can give managers a reliable and precise overview of what a perishable product has

Temperature-Related Problems Based on Sensitech Customer Data

1,000 Observations	Supplier to DC	DC to Store	Instore
Above Temperature Spec	30%	15%	74%
Below Temperature Spec	19%	36%	22%

Source: Sensitech



LEFT: Temperature abuse is liable to occur in almost any part of the supply chain, especially transfer points

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CASE STUDY: Mining the Cold Chain for Process Improvements

A medium sized US retailer with a corporate philosophy of working closely with their supplier partners and third party distributors to ensure value and high quality to their customers engaged Sensitech's services to address some temperature related shelf-life and quality problems.

The Challenge

The retailer began to experience some shelf life and quality problems with fresh cut salads, fresh packaged chicken and beef products. The retailer was receiving complaints from the retail stores about the quality of these perishable products upon arrival at the stores. The root cause of the quality problems was not obvious. Temperature abuse could have been occurring at the suppliers, during transit to the distribution centre (DC), at the DC or during transit to the store.

The Solution

Sensitech was contracted to determine the cause of the temperature related quality problems. Sensitech first assessed cold chain performance from end to end by conducting a Plant to Shelf Cold Chain Audit where a large quantity of monitors were placed in cases of product over a two week period at the point of manufacture and recovered upon stocking the shelf. Upon recovery, the monitors were returned to Sensitech for downloading and analysis. This audit provided an objective, unbroken picture of the cold chain.

The results from the Plant to Shelf Audit indicated problems in specific areas of the cold chain that would require more detailed investigation. Based on this, Sensitech also conducted Thermal Mappings of DC cold storage areas and trailer loads of product shipped from DC to stores. Thermal Mapping helps managers understand the variation in temperature from location to location and over time in a facility or trailer so that rational strategies can be developed to minimise that temperature variation. During both the Plant to Shelf Audit and the Thermal Mappings, Sensitech also made careful observations of the facility, equipment and practices.

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endured on its journey from the grower all the way to the shelf.

Wireless readers gather temperature data from active tags, placed on pallets and inside boxes throughout the trip. A software agent automatically downloads the collected data to a central repository where sophisticated analytical programs 'slice and dice' it into graphical reports. Now, a manager on the receiving end of shipments can view a diagram that shows the whole picture by trip segment, supplier, carrier or store, including when temperatures exceeded minimum and maximum specifications.

THE IMPORTANCE OF COLD CHAIN VISIBILITY IN FOOD RETAIL

John Fonteijn is responsible for Risk & Security within the Royal Ahold Group and is co-chair of the ECR Europe working group for shrinkage. He acknowledges the importance of cold chain for the retail industry: "I think cold chain and cold chain visibility are crucial for the retail industry for two reasons. First of all, I think maintaining product quality is a crucial element, and secondly there is a need to identify the risks that threaten products in a supply chain."

Mr Fonteijn continues: "When the supply chain is transparent, risks can be eliminated. These are process risks that may threaten the quality of products and lead to revenue losses, but also risks that are linked to the process and give rise to internal and external losses due to criminal activity. An effective control of the supply chain means that the retailer receives goods with a long shelf life."

Ahold's Experiences with Supply Chain Visibility

Ahold experienced the benefits of transparency and creating supply chain visibility in one of their Polish operations, reducing shrinkage in their freshly smoked meats product

CASE STUDY continued

The Results

The results of the Plant to Shelf Audit indicated problems in three key areas:

- Sporadic incidence of high temperatures on shipment from the plants to the DCs for the produce items.
- DC storage temperatures were variable and often too warm for the meat products.
- Backroom storage too warm for all products.

The Recommendation

Sensitech reviewed operating procedures with each of the suppliers involved and provided actionable steps for improvement that focused around processes such as trailer preparation and loading practices for the supplier to DC segment of the cold chain. That allowed the suppliers to ensure better temperature without significant equipment changes.

Sensitech likewise worked with DC and store operations to review their operating procedures and develop training materials to improve handling during shipment from DC to store and store level. Again, the focus here was on process improvement rather than purchase of capital equipment.

The DC Thermal Mapping was used to help DC personnel avoid storing product in areas where the temperature was too warm or too cold, to understand the effect of excessive door opening and to work with their HVAC (heating, ventilating and air conditioning) contractor on minimising the warm and cold spots.

line. Some of the challenges in this supply chain involved:

- Inconsistency in measuring the weight, including weight loss of packaged and non-packaged products at various points in the chain.
- Instances of non-refrigerated storage because of a delay at measuring points.
- Access from unauthorised staff to the non-processed food at the non-refrigerated storage points allowing for internal theft.
- Non-transparent paper packaging, making it virtually impossible to verify the content of the package at the checkout stand.
- Paper packaging which extracted moisture from the product, increasing the risk of quality loss.

"By mapping our supply chain and outlining the various processes, it was possible for us to streamline

our processes and maintain consistent environmental control throughout the chain, without harmful interruptions," adds Mr Fonteijn. "Also, it allowed us to minimise loss through theft, decrease quality loss based on product dehydration, and ultimately reduce our shrink substantially."

** Sensitech is the only cold chain solutions provider operating on a global scale, and provides data management along with consulting and analysis services that turn raw cold chain data into tools for decision making. Sensitech aims to offer customers solutions to improve their processes through audits and analysis. Services range from Cold Chain Analytics, to Facility and/or Trailer Thermal Mapping to Shipping Studies to Plant-to-Shelf Audits. For more information: www.sensitech.com (Corporate) and www.sensitech.nl (Europe, Middle East, Africa). Contact the author via fs@sensitech.nl.*