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ENHANCING BRAND VALUE

TRACKING AND TRACING SOLUTIONS IN THE
FOOD AND BEVERAGE INDUSTRIES

Introduction

Companies that manufacture consumer products invest considerable resources to establish and maintain the value of their brands. This means bringing to market a product whose value can be both perceived and measured. Brand value encompasses an understanding by the consumer of what the product is, how it looks, how it tastes and how it complements their lifestyle. Measured brand value is the investment made by the food or beverage company to establish the brand – in marketing, research and development, distribution, as well as sales performance and revenue of the product. At the same time manufacturers must manage production operations to achieve corporate profitability goals.

Building a strong market position, one in which the consumer has a well recognized and positive association with the product, requires that the manufacturer exercise a great deal of control over the product's components or ingredients and in managing the production processes to meet quality standards.

To improve the response to any event which could compromise the integrity of food and beverage products, manufacturers are focusing on food safety and security. The emphasis is on making sure there is no physical, chemical, or biological contamination of products, either accidentally or through some malicious act. To support this, the capability to monitor and track the production of their products and provide traceability has become a major issue for food and beverage manufacturers, particularly in the face of government regulations.

In addition, retail distribution channels are requiring more information from their suppliers about the status of production, order completion, and shipping. The ability to make rapid adjustments and find business opportunities in a changing environment will help determine success in managing the supply chain issues.

Manufacturers are finding that the processes necessary for consistent production, government compliance and supply chain efficiency go a long way toward helping maintain brand value. From raw material procurement through manufacturing, shipping and distribution, to stocking retail shelves, the timely information derived from tracking and tracing operations drive greater efficiencies into the operation and make a much more responsive enterprise.

This paper focuses on these issues and suggests how resource tracking and tracing can help in the quest to build and preserve brand value for food and beverage manufacturers.

Business Issues Driving The Tracking and Tracing Investment

Government regulations, efforts to improve operations, and pressure from supply chain partners have lead food and beverage manufacturers to review how they track and trace material through their plants. They are determining the best way to meet governmental regulations and requirements, and what new systems might be required for compliance. They are also looking at production operations and their supply chains to see how they can improve the distribution efficiencies and operations. Each of these responses has to be examined, prioritized, and reviewed in the context of ongoing continuous improvement projects. The business issues driving this review are:

Government Regulations

Food and beverage safety weighs heavily on the minds of most industry professionals. Over the past several years, there have been multiple incidents where contaminated products were distributed and had to be recalled. In several cases, it took days or weeks to identify and locate the contaminated products. Trade journal surveys report that food safety is consistently the first or second most important concern in the industry. Based on concern for the public safety, government agencies have passed a series of laws to mandate food and beverage companies maintain the records necessary to track material from the farm to the consumer.

Bioterrorism Act of 2002

The U.S. Food and Drug Administration published rules in the Code of Federal Regulations (CFR) to support the implementation and enforcement of the Bioterrorism Act on December 12, 2003. While there are limited exemptions, the law is intended to be broadly applied to all persons that manufacture, process, pack, hold, transport, distribute, or receive regulated food product.

On December 6, 2004, the FDA issued the final rule for the records that food and beverage companies must maintain. In addition, the FDA published a draft guidance document that detailed the internal procedures that the agency will follow before requesting access to records. The requirements in the rule include:

- Maintenance of records – companies must maintain records that identify the immediate previous source (including transporter) and immediate subsequent recipient of food (including transporter), including its packaging, in order to address credible threats of serious adverse health consequences or death to humans or animals.
- Response Time – Upon request, companies have 24 hours to respond to FDA inquiries.

EU Regulations

EU (European Union) Regulation 178/2002 is best known as the legislation establishing the European Food Safety Authority, and specifies the basic conditions for safeguarding food safety. Two provisions merit particular attention; the requirement that it should be possible to trace food and feed at all times; and the requirement that unsafe products should be withdrawn from the market. Article 18 of the Regulation states the following requirements:

On December 6, 2004, the FDA issued the final rule for the records that food and beverage companies must maintain. In addition, the FDA published a draft guidance document that detailed the internal procedures that the agency will follow before requesting access to records. The requirements in the rule include:

- Traceability must be guaranteed at all stages of production
- Businesses must be able to identify from whom they have received any products used or to be used
- Businesses must be able to identify to whom their products have been supplied
- Businesses must have in place tracing systems and procedures
- Tracing information is made available to the competent authorities on demand
- Products must be adequately labeled or identified

HACCP

Food safety is a concern for everyone. The United States Centers for Disease Control reports that as many as 76 million illnesses are caused by food contamination every year in the United States (source www.cdc.gov). Food-borne illness can be introduced physically, chemically, and/or biologically.

Global sourcing brings food products into the United States consumer market from around the world. Meanwhile, the FDA and USDA have limited resources for conducting physical inspections of the food supply. Recognizing these factors, and the opportunity to leverage new technology, they are taking a proactive approach based on internationally recognized methods for ensuring food safety – particularly by embracing Hazard Analysis and Critical Control Points (HACCP) methodology.

HACCP has a 40-year-old history, with its roots in the U.S. space program. Since then, the Codex Alimentarius Commission, which develops FAO (Food and Agriculture Organization) and WHO (World Health Organization) food standards and guidelines, has adopted HACCP as the international standard for food safety.

HACCP methodology consists of seven principals that food manufacturers work from as they tailor their HACCP plan to their particular product, production process, and method of distribution. Its basic concept involves using a cross-functional HACCP team to perform an analysis of the manufacturer's production process and to put a HACCP plan in place. Once set, HACCP plans are binding for all HACCP-regulated industries and subject to review by Food Safety Inspectional Services.

Recall Situations

The tracking and tracing procedures and applications also assist food and beverage manufacturers in responding to product recall situations. Many major manufacturers have had a recall where a product that could be harmful to the general public has been distributed. In cases where they have an issue with raw material, they make a determination of which products may contain the material, and then expand the recall to ensure that none of the adulterated product is left on store shelves. When these manufacturers have a tracking and tracing system, they have much more accurate information on where products were shipped and what ingredients were in each product. This enables them to protect consumers and minimize the number of products recalled, because they no longer have to recall product that might not contain contaminated material.

Supply Chain Management

Major retail outlets are demanding a more responsive supply chain to reduce extra inventory. To be more efficient, supply chains are evolving to a 'just-in-time' production system. They are communicating the quantity sold on a daily basis to food and beverage manufacturers and expect them to ship just enough product to replenish their shelves. This product demand can be managed by increasing the quantity of product in finished goods inventory, but that is not cost effective. Rather, the production process itself must be adapted to respond to the demands from the retail outlets and distribution channel. To effectively schedule production, food and beverage manufacturers require real time information on such variables as the status of current production, what is being manufactured, how much has been produced, and whether it has been shipped from the facility.

One of the benefits of a well-implemented tracking and tracing solution is the ability to view what is being produced. A manufacturing company generates work orders that specify what products are to be manufactured, the quantity of product to be manufactured, and the deadline to complete it. Many companies are using systems (computerized or manual) that pass the work orders to the production floor and only provide feedback when the product is entering finished goods inventory. This does not give the company sufficient visibility into operations to allow a response to customer requests for information on delivery dates or to confirm that it can deliver an expedited order. By having a system that tracks production through each manufacturing area, it has sufficient data to make informed decisions regarding actual completion dates, or reschedule high priority products.

Documentation of Product

Another issue facing food and beverage manufacturers is the need to know the components in the product. Labeling requirements are driving companies to provide more information to the consumer about the composition of each product. Tracking and tracing systems allow the manufacturer to accurately identify each of the components in the product, its batch or lot number and the information needed to meet the labeling and country of origin requirements.

Europe is a leader in requiring food and beverage manufacturers to identify any genetically altered components in their food or beverage products. EU regulations require specific labeling if the content contains more than 0.9 percent of genetically altered products. Products above the 0.9 percent threshold require documented traceability. The main sources of genetically altered material are soybeans and corn. Because the United States - the largest producer of genetically altered products - exports over \$1.1 billion per year of soybeans to the European market, it is incumbent upon tracking and tracing systems to provide information to food and beverage manufacturers that can be used to determine the actual level of components in the final product and also to produce the required documentation.

The RFID chip, which Wal-Mart and many major retail outlets are beginning to require of manufacturing companies, contains information specific to the pallet on which it is affixed. This requires the manufacturer to know the product, batch, and SKU of items put on each pallet. A tracking and tracing system gives them the ability to collect this data so it can easily be documented in the RFID chip on the pallets.

Continuous Improvement Opportunities

Food and beverage manufacturers understand that the true value of tracking and tracing applications extends beyond their ability to achieve regulatory compliance and meet retailer requirements. The data derived from the tracking and tracing applications provide information that can be used to provide visibility into the production process, analyze operations, identify root causes of production problems, and implement changes to improve operations. There are multiple areas where food and beverage companies have improved operations based on the data in tracking and tracing applications.

Inventory Management

The focus of many continuous improvement programs is the measurement, management, and reduction of raw material, work in progress, and finished goods inventory. The reduction of these inventories reduces the amount of capital invested and frees it for other uses. It also reduces the costs associated with the extra inventory.

Inventories within a manufacturing facility can be reduced by implementing tracking and tracing systems that monitor and record actual usages of material in real time. Since most manufacturers do not have these types of systems, they assume that a standard quantity of raw material is used in each step of the process. The standard usage is then deducted from the quantity of inventory maintained in the business system. The actual quantity of material in the inventory is reconciled with the business system only weekly or monthly. Since the actual usage may vary significantly from the standard, the inventory quantity is not likely to be accurate. Companies must then maintain costly safety stock to ensure that they have enough raw material to meet the demands of their customers for product. The safety stock is manifested not only in raw materials, but is also maintained in the finished goods inventories.

Tracking and tracing solutions can gather data on actual material usage in each step of the manufacturing process. The actual usages can then be deducted from the inventory levels maintained in the business systems. This lets the manufacturer know precise inventory levels, which gives them the ability to order just the amount of raw material needed, eliminating the cost of extra quantity.

Product Quality and Consistency

Product quality efforts are not focused solely on meeting quality standards, but also on making sure that the finished product's taste, texture, shape, smell, and consistency is the same from batch to batch and at all manufacturing facilities. Brand quality is maintained by ensuring the product is the same, no matter where it is purchased.

To achieve a high level of quality, manufacturers must take into account the manufacturing process dynamics. For example, in the food industry, is there an impact on the final quality based on which mixer was used? Which oven the product was baked in? The relative humidity? Who supplied the ingredients? In the beverage industry, is there an impact on the final quality based on which filter was used? Which vessel the product was aged in? What is the raw material variability? Is each operator using the same set points to control the process?

Answers to these questions are not always easy to recognize. To understand relationships and causes of product quality problems, manufacturers need a systematic approach to data collection and the ability to easily analyze the data, and properly implemented tracking and tracing solutions collect this critical production data.

Production Costs

Food and beverage manufacturing companies are under great pressure from retailers and from corporate management to reduce operating costs. They need to track operations and identify the costs at each step of the production process to find where the best opportunities for improving operations are. Then they know where to focus their continuous improvement efforts.

Tracking and tracing applications collect information about the actions at each step of the production process. This includes the actual amount of raw material used, the yield from conversion processes, the quantity of good product produced, and the amount of waste. The data collection also includes the amount of labor that went into each process step, what utilities were employed and their quantity, and the cycle time for each step. Other data associated with the performance of the equipment can be monitored such as production rate, downtime, and cycle time.

The data in the tracking and tracing application can be correlated with the actual cost data that resides in the company's business system. In this way, the actual costs based on the activities at each step of the process can be determined. Superior production days can be compared to sub-par days to understand the differences in cost and the potential value to the company.

Implementing Tracking and Tracing Solutions

Food and beverage companies are deciding how they want to deploy systems which allow them to track and trace operations and provide the data for continuous improvement initiatives. The solutions need to be scalable so they can add functionality, and also easy to integrate with existing plant control and information systems. The systems implemented should be plant-wide and cover operations from the receipt of raw material to the final goods storage warehouse, then out the door to the logistic carriers. The requirements for each of the processing areas are different, and the solution that is deployed must be able to accommodate the requirements of the different manufacturing areas.

Components to Be Tracked

There are many operations in the plant that can be tracked and different components that can be traced. When minimizing the amount of data collected, companies can deploy a system that meets regulatory requirements, but it gives them no additional value. The scope of this system is a critical decision that must be made before deployment. Elements that can be tracked include the following:

- **Material** – The material or ingredients that are used in the manufacture of the products are the key items that need to be tracked to meet governmental regulations. The tracking procedure begins with the receipt of materials at the plant. The receipt time is recorded along with the shipping information. Product name, batch/lot number, and quantity are recorded before the material is stored for usage and the information is entered into the business system for inventory management purposes. Each ingredient must undergo a set of tests required before it may be used in the manufacturing process. This may be data from a Certificate of Analysis (COA) provided by the supplier. Other material requires visual inspection or on-site laboratory tests before acceptance for usage. The material is then assigned a specific ID number, which identifies the type of material, supplier, quantity received, and supplier lot/batch number, and that number is associated with the material throughout the manufacturing process.

As material is used, the amount removed from raw material storage is recorded along with the location that it is being transferred to. This transfer may be to a specific batch of product, storage in a staging area, or a bulk container. At each step, the quantity used or transferred is recorded with the destination (physical location or piece of equipment).

During the manufacturing process, different material or batches may be combined or split into new intermediate products. For example, a batch of cookie dough may be used for both a product with nuts, and the rest for a cookie with chocolate. The intermediate product is assigned and tracked, just like raw material received at the plant.

In each step of the manufacturing process, the material is recorded. This includes ingredients like flour, spice, and nuts in the food industry or syrup, malt and coloring for the beverage industry, and also packaging material like bottles. Products then have the material ID or batch/lot number of the final product and the packaging material used. The final product ID follows standard codes, usually based on EAN-UCC product codes. These are used in RFID type devices that are being required by the major retailers.

- **Equipment** – The material that is being processed to create intermediate or final products passes through many pieces of equipment. The equipment may be a weigh scale, mixer, oven, blender, evaporator, conveying system, filler, or palletizer. Besides tracking the equipment itself, a tracking and tracing application should capture data about what happened at the piece of equipment. For example, how long was the material in the equipment, and what were the operating conditions (temperature, pressure, speed, etc.)? The history of the equipment is also important, such as data on when it was cleaned, what it was cleaned with, and what products were run on it.
- **Personnel** - Anyone involved in the manufacturing process is tracked, which includes the people who receive the material at the plant, weigh and stage material, run the lines, and run the warehouse. They have the greatest impact on the safety and security of the final product. Currently, the personnel performing the operations are not recorded. Regulations are evolving and may require that specific operator actions such as adjustment of setpoints, batch initiations, and variances all be tracked to the specific operator. New electronic systems that are deployed should ensure that the tracking of specific operators and their actions are recorded to meet the standards of 21CFR Part 11.
- **Order** – To more easily manage the supply chain operations and to perform an effective recall, it is also important to track production and customer orders through the manufacturing facility. A production order specifies the type and quantity of product produced. The production order also includes the information on the shipper and final destination. As the product is manufactured in the plant, it is associated with a specific production order. This impacts how it is packaged, palletized, and stored in the warehouse. This information is critical in a recall effort.

Tracking and Tracing Requirement

- Forward – The system that is deployed must be able to achieve forward tracing, which is the ability to take a single raw material (e.g., cinnamon or malt) and trace its use through the manufacturing operation. This includes being able to correlate data on each piece of equipment that the material passed through, operating conditions of the equipment, and the operators that handled the material. Companies must be able to identify each of the final products that contained a portion of the material lot, the customer for each of the products, and the shipper that took the final product from the facility.
- Backward – Backward tracing is the ability take a final product and identify what raw materials were used to manufacture the product. Backward tracing also includes information related to how the product was manufactured, what equipment was used, what the operating conditions were, and who the operators were.
- Order – Tracking and tracing applications must also have the ability to relate orders in the business system to the product produced. In manufacturing plants, a production plan is generated that defines the products that are to be manufactured each day. The schedule may be developed on a business system, computer spreadsheets, or paper. The products are either designated to meet the needs of a specific customer, or for storage in the finished goods warehouse. When the product is shipped out of the warehouse, it is associated with a specific customer order and shipper. All of this information must be collected so that each product can be associated with an order.

Automatic and Manual Data Collection

Tracking and tracing solutions must be able to handle both automatic and manual data collection, since many plants have operators adding ingredients by hand. The information about the ingredients and quantity then needs to be manually entered into the system. Manual data collection may include information about which operators were on the shift and may also include the work order that is being processed.

Automatic data collection requires the tracking and tracing application to interface with a variety of automation and other computer systems. Companies frequently have different automation and information systems deployed at each of their facilities - from ISA S88 batch compliant systems, to home grown systems developed by the plant staff. Much of the data resides in the process controllers and HMIs at the plant.

There may be multiple types of physical interfaces, such as Ethernet or a vendor-supplied network (ControlNet, Modbus, etc.). Data may also come from standalone systems like weighing systems.

Reporting and Visibility

To view reports and analyze system data generated, operators prefer to use Web-based applications. These applications are connected to the data repository for the tracking and tracing application. From the Web interface, the user can view current status, get standard reports, and query the database to analyze operations.

Value to Food and Beverage Manufacturers

Tracking and tracing applications can be used to improve operations and respond to governmental regulations, which is essential for all food and beverage manufacturers. The systems will provide the data necessary to make that happen. The value brought by implementing these systems are providing measurable value to food and beverage companies and enable them to improve operations and achieve a quantifiable return on investment.

Customer loyalty is key to the success of your business, and maintaining high-levels of customer loyalty is achieved through consistently manufacturing high-quality products, batch after batch. Doing this helps you add value to your brand. And after striving for so long to establish brand equity, you are going to do everything you can to keep it.

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