KEY INFLUENCERS RESHAPING THE NEXT DECADE IN FOOD PROCESSING

Strategies for Industry Readiness



WHAT'S NEXT FOR THE FUTURE OF *food processing?*

stellar
TAKING SOLUTIONS FURTHER®

stellar.net | 904.260.2900

Key Influencers Reshaping the Next Decade in Food Processing
Strategies for Industry Readiness

© 2024 Published by Stellar

Stellar
2900 Hartley Road
Jacksonville, FL 32257

All rights reserved. Except as permitted under U.S. Copyright Act of 1976, no part of this publication may be reproduced, distributed, or transmitted in any form or by any means, or stored in a database or retrieval system, without the prior written permission of the publisher.

Content and design by Stellar | **stellar.net**

TABLE OF **CONTENTS**





1 **Demand for variety, flexibility, and efficient manufacturing** 5
- Making versatile equipment selections
- Optimizing manufacturing processes

2 **Health, safety and quality** 10
- Reducing airborne contamination
- Building material selection
- Proper equipment usage and maintenance
- Automation technology
- 11 food safety best practices that stand the test of time

3 **The evolution of packaging** 16
- How can manufacturers adapt their packaging process to meet consumer demand?

4 **Increased attention to transparency and traceability** 19
- What are the benefits of food traceability?
- How can your business do it?

5 **Automation and data** 23
- Automation
- Robotics
- Industrial Internet of Things (IIoT)
- The future is now
- The role of automation in today's world

6 **Cold storage supply chain management** 27
- Micro-fulfillment centers
- Cross-docking
- The last-mile delivery conundrum

7 **2024: A year of shifting consumer preferences and trends** 31

Food and beverage companies must deliver quality and food safety that meets and exceeds consumer expectations. Of course, customer demands are ever-evolving, but a lot has changed since the COVID-19 pandemic disrupted the world as we know it a few years ago.



Not only are consumer taste preferences shifting to include a more comprehensive array of flavors, but they also want access to more significant varieties of their favorite products. Increased scrutiny of where food originates and its preparation is also top of mind. Emergen Research predicts the global food traceability market size will experience a 10.2% compound annual growth rate (CAGR) and reach $9.75 billion in revenue by 2028. And let's not forget the rise of online grocery shopping that gripped the nation as social distancing policies went into effect and became the preferred shopping method for many, even after restrictions were lifted.

Unfortunately, COVID also exacerbated problems in certain areas, requiring food manufacturers to shift their business strategies and think outside the box to maintain their competitive advantage — or, in some cases, just to stay afloat. The food manufacturing sector historically has suffered from labor shortages, which drastically worsened in 2020 and are persisting, according to the Consumer Brands Association. In response, more companies are turning to automation solutions to fill the gaps in the most critical areas and boost their production capacity to meet growing consumer demand.

The landscape is evolving, but what does this mean for food companies who want to thrive in this new food processing and manufacturing era? How can food and beverage companies respond to the new environment?

industry readiness

FOCUS ON THESE **SIX KEY FACTORS:**

1: **Demand for variety, flexibility and efficient manufacturing**
2: **Health, safety and quality**
3: **The evolution of packaging**
4: **Increased attention to transparency and traceability**
5: **Automation and data**
6: **Cold storage supply chain management**

1: DEMAND FOR **VARIETY, FLEXIBILITY AND EFFICIENT MANUFACTURING**

The COVID-19 pandemic disrupted supply chains, rattled the restaurant industry, and created a shift in demand as more people cooked at home. Food manufacturers pivoted to adjust to this unforeseen market event and had to pivot again in the post-COVID landscape.

How can food and beverage processors safeguard themselves against unpredictable market changes and minimize losses?

INVESTING IN FLEXIBILITY IS A GREAT WAY TO ARMOR YOUR BUSINESS TO *withstand market fluctuations and ever-changing consumer needs.*

MAKING VERSATILE EQUIPMENT SELECTIONS

Whether building a new facility or renovating or expanding an existing facility, you should always have one eye on the horizon. While it's important to address existing business needs during design, it's crucial to consider what future needs might also arise.

Capacity needs

It is essential to consider what happens when the capacity needs of your best-selling item or consumer demand shifts. Can the equipment you selected for your production line be adapted to expand your product offerings? Or will you need to purchase new equipment because what you chose based on last year's trends can no longer meet current consumer preferences?

While selecting machinery that provides flexibility for various stock-keeping units (SKUs) comes with a higher price tag upfront, the investment can make all the difference between treading water and swimming laps in the event of market shifts. Being proactive with your solutions tends to be more cost-effective than reactive ones. Plant owners can also work directly with an original equipment manufacturer (OEM) to design new equipment with better flexibility and lower changeover times.

Choosing machinery that can accommodate various SKUs is a proactive investment that can adapt to changes in the market, and it's worth spending a bit more now to save on future funding and succeed later down the line. Working with an expert OEM is a great way to customize specific machinery to achieve the same goals but tailor it to your needs and budget. Proactive solutions help your company stay ahead of the game and remain proactive in the face of every market change.

OPTIMIZING MANUFACTURING PROCESSES

Over time, food and beverage manufacturers developed processes for forecasting consumer demand and tailored their inventory accordingly. However, the make-to-stock (MTS) production strategy thrives in a predictable environment — far from the present reality.

As the market shifts, we're seeing manufacturers realign their production strategy to be more flexible and responsive to factors such as an unpredictable supply chain and consumer desire for variety.



Make-to-order (MTO) is a production approach where products are only made after a confirmed order is received. This approach benefits customers as they get products tailored to their specific requirements. At the same time, producers benefit from avoiding losses incurred from unsold products that expire on the shelves. Overall, it is a win-win situation for everyone.

MTO production is more complex than MTS as it is subject to fluctuations in customer demand. Poor management practices can lead to a waste of time, which is a valuable resource for MTO-driven facilities. Such facilities must conduct frequent changeovers to produce different SKUs, which can be expensive. Inefficient changeovers can lead to production cost overruns, resulting in losses of thousands of dollars. Hence, optimization is vital to maximize profitability with this methodology.

Efficient logistics management requires a delicate balance between customization and supply chain efficiency. As the manufacturing landscape changes, it is essential to maintain this balance to meet the diverse needs of the industry. To achieve this, developing a comprehensive strategy that optimizes the supply chain while accommodating customization demands is essential. This approach will enable businesses to adapt to the changing demands of the industry while maintaining high levels of efficiency.

So, the question stands: How can owners improve changeover efficiency to minimize downtime and manage a growing number of SKUs?

a win-win for everyone

Process simulations

"Digital twin" software creates simulations of physical assets, empowering facility managers to make educated decisions regarding changes to their processing approach. Virtual models showcase how real-time adjustments to a production line will affect operations and output, eliminating a potentially costly trial-and-error process, minimizing inventory loss, and granting superior visibility over work-in-progress (WIP) products.

Scheduling software

Production scheduling software tracks resources in real-time, including ingredients, equipment, and WIP products, enabling operators to make educated daily operations decisions. Scheduling software can work in tandem with digital twin software to ensure that the required ingredients are available from the supplier before a changeover is complete.

Just-in-time delivery

MTO depends on facilities managing **just-in-time (JIT) delivery,** which is where a business receives raw materials as close as possible to when they are needed. Inventory costs are reduced since materials are only delivered as required, but manufacturers must constantly be prepared since delivery could arrive mere hours before a scheduled changeover. Accessing real-time information is paramount to efficiently conducting a changeover that relies on JIT delivery.

How do operators know if they have enough ingredients for the SKU order? Is further collaboration with suppliers necessary?

Finding answers to important questions becomes increasingly difficult when a production line runs more SKUs. Companies must gather relevant data and make it accessible to prevent any disruptions. Equipping personnel with the necessary information allows them to perform their duties effectively. As the number of products increases, so does the number of SKUs, which can pose a challenge.

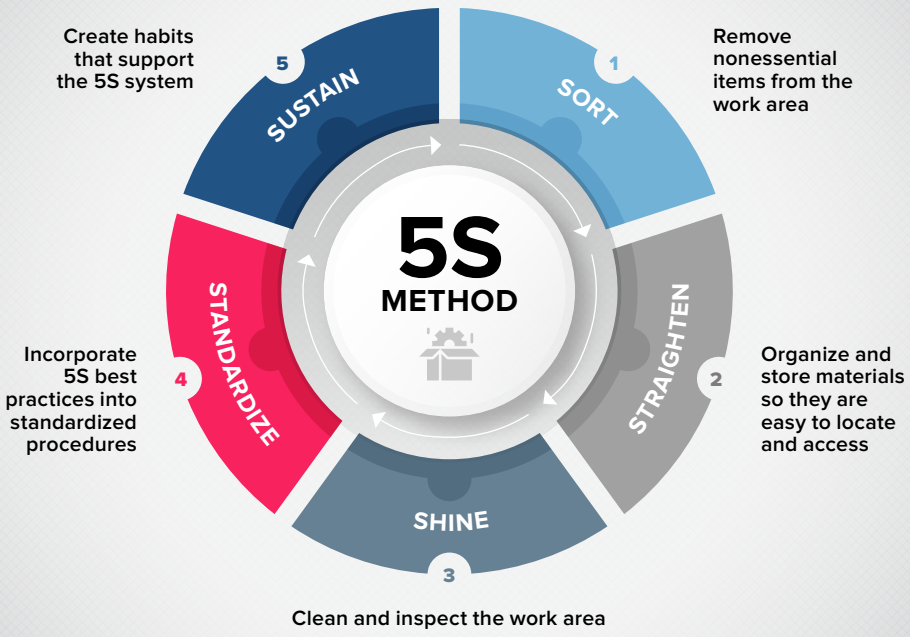
To overcome this challenge, companies should actively collect relevant data from all inventory information, including production schedules and specifications. This data should be easily accessible to the production team's appropriate groups to prevent disruptions. By making informed decisions quickly, companies can stay ahead of the game despite having diverse product ranges.



The 5S methodology

Ensuring workspaces are organized for efficiency and effectiveness can help minimize downtime and increase machine utilization. For example, consider all the time spent searching when an equipment part cannot be found. Every lost minute is a lost production opportunity, and that time adds up.

Creating a detailed checklist for maintenance and operational aspects will help ensure that each employee knows exactly what they need to do and where they can find the tools necessary for their job. The **5S methodology** is a commonly used technique that optimizes productivity and can be incorporated into every process to enable JIT manufacturing. For best results, each operator should receive formalized training on the 5S method.



While we're on the subject, don't push off that upcoming maintenance check. The inconvenience of performing routine maintenance is nothing compared to the cost of a halted production line due to preventable equipment failures.

Strategic configuration

Facility managers can minimize idle time by strategically configuring processing and packaging. Scheduling packaging lines to run as the production line shuts down for cleaning helps maximize productivity during changeovers. By the time packaging is done, processing should be ready to ramp up on a new SKU.

SKU rationalization

SKU rationalization, or inventory optimization, requires companies to analyze the profitability of their products and eliminate underperforming SKUs. In a nutshell:

- **Is this a high-demand product? Keep it. Perhaps even refine it to debut a new item.**
- **Is this product selling, but not nearly as well as the others? Retire it.**

Retiring outdated or unpopular products periodically will help with your changeover and make room for newer, more attractive items.

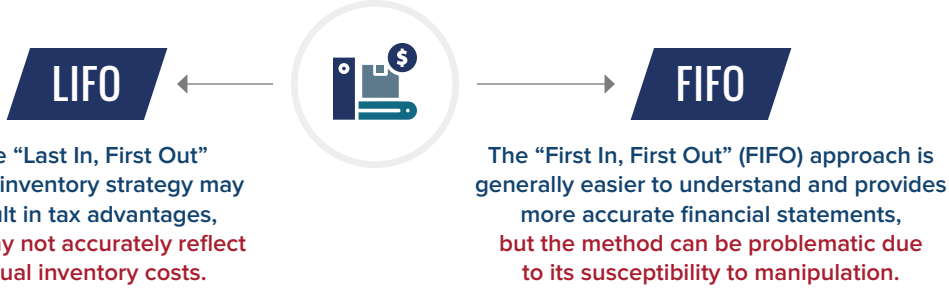
Line speed

Is it better to have high-speed lines or low-speed lines? It depends, as they are critical variables in the production and profitability equation. Two commonly used methods for calculating the cost of goods sold are FIFO and LIFO. FIFO, an acronym for "First-In, First-Out," assumes that the oldest products are sold first, following the natural inventory flow. This results in a reflection of the actual cost of inventory and fewer chances of errors in bookkeeping. As a result, it is considered more transparent and trusted.

LIFO, an acronym for "Last-In, First-Out," enables a business to use the most recent inventory costs first, which are typically higher than the cost of older inventory. This can result in lower profits. Although LIFO may result in tax advantages — since it allows companies to deduct the cost of inventory at the price of the most recently acquired items — it may not accurately reflect the actual inventory cost. On the other hand, using the LIFO method can make underestimating the value of older inventory easier.

The FIFO method is generally considered a best practice because it is easier to understand and implement and leads to more accurate financial statements. On the other hand, the LIFO method can be more problematic due to its susceptibility to manipulation. As a result, it is recommended that businesses use caution when selecting a method for calculating the cost of goods sold.

Fast-moving inventory typically sells within a few days, while slow-moving stock can occupy storage space for months. Processing fast-moving products on high-speed lines can help meet consumer demand but would cause speed loss on a low-speed line. To maximize production, plants can utilize fast-paced inventory lines. Unfortunately, this can reduce profits since they require large amounts of energy, and SKUs may stay in warehouses for long periods.



2: HEALTH, SAFETY AND QUALITY

WORKER SAFETY & FOOD SAFETY ARE THE *highest priority* IN THE FOOD INDUSTRY.



In our post-pandemic world, long-established standards are facing higher scrutiny from consumers than ever before.

Manufacturers must elevate their food safety practices beyond the strict requirements already established by government agencies such as the U.S. Department of Agriculture (USDA), U.S. Food and Drug Administration (FDA) and Occupational Safety and Health Administration (OSHA).

Health and safety considerations must be integrated into the very design and foundation of food processing facilities.

THE TOP FIVE GERMS* that cause foodborne illnesses:

Norovirus
Salmonella
Clostridium perfringens
Campylobacter
Staphylococcus aureus

Reducing airborne contamination

COVID-19 broadened public understanding of how HVAC systems can circulate airborne bacteria like *Clostridium botulinum, Salmonella, E. coli, and listeria*. Food plant owners can integrate various clean air solutions and procedures to protect employee health and mitigate food contamination to protect public health.

highest priority

*Source: CDC



Proper airflow

An adequately designed airflow system is the first layer of defense against airborne contaminants. Food manufacturers should ensure their systems can accommodate the appropriate load and capacity for even air distribution throughout the building. A well-designed system will also create positive pressure environments in high-risk areas with critical air quality. For example, air pressure should not push air from raw processing areas into ready-to-eat (RTE) areas, but the reverse could be acceptable.

Upgrading an existing facility to optimize airflow and pressurization may require interior renovations or installing high-performance components to improve air quality. Consult an experienced architect and mechanical engineer to define current conditions and develop cost-effective solutions.

HEPA filtration

99.97%
EFFECTIVENESS
for 0.3-micron particles

The FDA recommends using HEPA filters in areas where RTE foods are processed or exposed. These high-capacity filters are designed to remove potentially harmful airborne particles — including dust, mold, pollen and bacteria — with an effectiveness of 99.97% for 0.3-micron particles, according to the U.S. Environmental Protection Agency (EPA).

It is recommended that filters be changed every 90 days to guarantee the most sterile environment possible. Filter replacements should be accounted for in your maintenance budget. However, depending on your plant's needs, you may be able to substitute a less costly option. Compare air filters using the EPA's Minimum Efficiency Reporting Value (MERV) scale. For reference, HEPA filters surpass MERV 16, the highest rating on the scale.

UV light decontamination

Ultraviolet (UV) light sources may be used to enhance sterilization processes and the overall food safety of products. Within the UV spectrum, UV-C light is the most effective at killing microorganisms and can be installed throughout an HVAC system to help purify air.

UV-C germicidal lamps are a food-safe and low-maintenance option, but they can be harmful to people who are directly exposed and, therefore, should be strategically concealed.

Bipolar ionization

Bipolar ionization (BPI) technology has been used in food and beverage processing settings for pathogen control since the 1970s. In a nutshell, the ionization device produces negatively charged ions that neutralize and cluster airborne particles like mold and bacteria and then uses positive ions to attract and remove the harmful molecules from the air. BPI technology works proactively within HVAC systems and requires little maintenance.

The downside is that outfitting extensive facilities with adequate BPI could require numerous ionizers, driving up initial costs, especially compared to HEPA filtration and UV-C lighting.

high-performance



Building material selection

Every surface in a facility has the potential to affect product quality. Special consideration must be given to the exact material installed throughout a plant, regardless of whether it is a new-build or single-area renovation. Using innovative design and high-performance building materials, food manufacturers can open facilities designed to mitigate food safety risks at their very foundation.

Flooring

- **Surface** – Floors should be non-porous as well as crack-free and water-resistant, and they may include antimicrobial properties to comply with FDA and USDA regulations. They also must be high-performing to endure a variety of spills and chemical washdowns, the weight and vibration of heavy equipment, fluctuating temperatures, and foot traffic. Seamless, non-porous surfaces can enhance sanitation by minimizing joints and cracks where bacteria could harbor and create contamination risks.

- **Drainage** – It is important to ensure that floors are properly drained to avoid accumulating water and excess moisture, which can lead to mold growth. Proper sloping and drain locations will help minimize the risk to employees and food products. Using slot drains instead of traditional trench drains is an effective way to protect areas of your facility susceptible to food safety hazards, such as bacteria, pathogens, odors and pests. Slot drains allow for the use of potent cleaning agents, like caustics, to maintain a hygienic system without causing harm. These caustics are useful in automated clean-in-place (CIP) systems for removing stubborn buildup and sanitizing conveyors in a plant. In addition, slot drains enable single-sloped flooring and provide greater flexibility in the layout of your food processing facility.

- **Slip resistance** – Smooth floors may increase sanitation in food processing areas but can create slip-and-fall hazards when wet. Particular floors can be textured with aggregates to improve slip resistance; however, it should not affect the ease of cleaning. Maintaining a regular cleaning schedule is crucial to prevent floors from becoming slippery due to contaminants.
- **Caulk maintenance** – Regular maintenance of flooring is necessary to prevent potential hazards. Cracks in the flooring can lead to moisture buildup, which can cause mold and mildew growth, posing health risks. Therefore, inspecting your flooring slabs regularly, especially at the joints, and sealing any openings with caulking is crucial. This will prevent moisture and contaminants from entering your facility, ensuring a safe and healthy indoor environment.

Walls & ceilings

Beyond flooring, porous materials should typically be avoided in a food and beverage plant because they can be difficult to clean thoroughly. Concrete walls can be coated with epoxy or urethane, which are both monolithic, to address this issue in existing buildings.

FDA-compliant metal panel systems are moisture-resistant, durable against high-pressure washdowns, and easy to clean. Insulated metal panels (IMPs) are a great solution because they're quick to install, cost-efficient, and cleanup-friendly.

Doors

A plant's doors are among the last sanitation barriers between different areas. Doors should have non-porous surfaces and be highly durable to resist cleaning procedures. Additionally, interior facility doors should have proper air seals on all four sides, while exterior doors must maintain rubber sweeps at the bottom in good condition. This is important to ensure adequate ventilation, temperature regulation, and pest control.

Proper equipment usage and maintenance

As an owner, you have invested significant time and money into selecting the right personnel and equipment for your operation.



Establishing strict and robust safety procedures is CRITICAL to ensure your employees are safe on site and your equipment remains at optimal performance.

Proper equipment usage

Operators and other employees who interact with equipment in a plant must be thoroughly trained to use it properly. It's not only a matter of product quality; it's, more importantly, a safety concern. Improper use can lead to accidents. Therefore, plant owners and managers must establish precise instructions for equipment use and make manuals and other relevant resources readily available.

Maintenance

Maintenance tasks should never drop on the priority list. While facility owners may be reluctant to halt production for minor maintenance, not doing so can lead to safety risks, trigger future failures, shorten equipment lifespan, and lead to unplanned costs due to emergency repairs. Overall, your facility's maintenance program must be proactive, not reactive.

Automation technology

Regarding nonfatal occupational injuries and illnesses, the food manufacturing industry has a 4.8 incidence rate, according to the most recent data from OSHA. This is significantly higher than the national average of 2.9 injuries and illnesses per 100 full-time workers.

Given the data, it's no surprise this remains a pressing question: How can plant owners continually evolve to better workplace safety?

In recent years, process automation has entered the food manufacturing stage to mitigate accidents on the factory floor while boosting production capacity. With workplace safety in mind, these are some automation technology investments to consider:



Automated guided vehicles (AGVs)

AGVs are computer-controlled and carry loads safely without a driver on board. These machines can be precisely controlled to move at a set pace along a determined path and usually feature automatic obstacle-detection bumpers.

Co-bots

Collaborative robots offer more human-like dexterity to handle smaller items beyond pallets, helping minimize human interaction. These systems are designed for agility and flexibility, allowing them to be easily moved to different spots within the manufacturing process as needed.

Automated storage and retrieval systems (AS/RS)

AS/RS technology is designed to store and retrieve stored products, with abilities such as automatically balancing and distributing the weight of pallets so they don't collapse, which helps ensure the safety of surrounding plant personnel.

TIP! KEEP AN EYE OUT FOR *annual changes* TO THE FOOD SAFETY MODERNIZATION ACT.

11 FOOD SAFETY BEST PRACTICES that stand the test of time



1: **SANITATION —** Establish standard cleaning and sanitation procedures and schedules to be followed by all personnel. Investing in a clean-in-place system to automate your sanitation process can also help maintain food safety requirements while freeing personnel for other tasks.

2: **PERSONNEL FLOW —** Ensure proper separation of ready-to-eat (RTE) and raw food operations, including dedicated workspace access for the respective employees.

3: **LAYOUT —** Incorporate hygienic design principles to ensure your facility's operational flow minimizes contamination risks.

4: **MATERIALS —** Select building materials that are easy to maintain, clean, and resistant to the various demands of food processing.

5: **PROCESS EQUIPMENT —** Select process equipment that is easy to clean, disinfect and maintain.

6: **PEST CONTROL —** Use a robust pest control strategy to treat potential problems early.

7: **CONTROL MOISTURE —** Keep the production spaces dry and free of standing water.

8: **MAINTENANCE —** Proactive maintenance measures help prevent equipment failures that impact production and food safety goals.

9: **TEMPERATURE CONTROL —** Cooking and storing work-in-progress (WIP) and finished goods at the correct temperature is essential to food safety. Bacteria multiply rapidly between 40°F and 140°F.

10: **PERSONNEL HYGIENE —** Establish protocols to control foot contact, ensure proper hand washing and maintain proper use of personal protective equipment (PPE).

11: **PERSONNEL TRAINING —** Establish regular training sessions with employees to ensure they understand and follow all food safety practices.

3: THE EVOLUTION OF **PACKAGING**

Shifts in consumer preferences and the rise of online shopping, grocery delivery, and meal kit services are increasingly driving the development of packaging design and materials. E-commerce has placed a greater emphasis on packaging that can withstand the rigors of shipping and handling. Meanwhile, modern-day consumers demand more eco-friendly packaging and better access to product information from the brands they support.

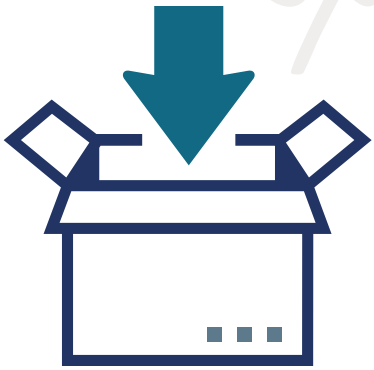


How can manufacturers adapt their packaging process to meet consumer demand?

The demand for efficiency and sustainability in the manufacturing industry — in addition to challenges navigating a volatile labor market — is leading more owners to embrace automation in their facilities. Here are technologies, strategies, and solutions you can integrate into your plant's packaging areas to effectively speed up production while preserving product quality:

Toolless changeover

Toolless changeovers can help to reduce the time and effort required to transition between SKUs, improving the accuracy and efficiency of equipment setup and operation. Integrating visual indicators and guides into packaging equipment allows operators to make precise machinery adjustments without relying on memory or reference manual instructions. Equipment with toolless changeover features can also be more accessible and quicker for operators to learn and use, making them particularly useful in training and onboarding new personnel.



speed and quality

Servo-driven packaging equipment

Servo motors are electric motors designed to rotate to a specific position at a set speed. In processing areas, servo motors allow for precise and efficient control of the packaging process, enabling faster and more accurate production with minimal waste. Servo motors can be used in various equipment, including packaging robots, conveyor systems, and filling, labeling and wrapping machines.

Dual-mode packers

Packaging machines are typically designed to handle one case style: regular slotted containers (RSCs) or wraparound cases. Manufacturers may invest in packers that can support both cases to streamline operations and reduce the need for multiple machines, yielding significant cost savings over time. Dual-mode packers offer operators more flexibility and versatility to adapt to changing consumer demands.

Virtual reality

Facilities can use virtual reality for training and troubleshooting on the plant floor. Operators can be trained on a virtual interface to use and service packaging equipment, facilitating learning in a simulated environment that removes the risk of personal injury and equipment damage. VR can also enable technicians and original equipment manufacturers (OEMs) to access and diagnose equipment remotely, significantly reducing downtime.



Standardized packaging sizes

A standard package size that can be used for multiple products reduces the amount of changeovers needed and increases your line efficiency. This will not only support production's overall equipment effectiveness (OEE), but it will also help from a procurement perspective. For example, if a customer has a 12-, 10- and 8-count carton, using the same carton size may be better for all three. This way, your procurement department does not need to buy three die-cut cartons and manage three different case sizes. Ultimately, the procurement team retains a higher buying power while production performs fewer changeovers. Standardizing packaging design also enables you to standardize packaging equipment.

Sustainable packaging

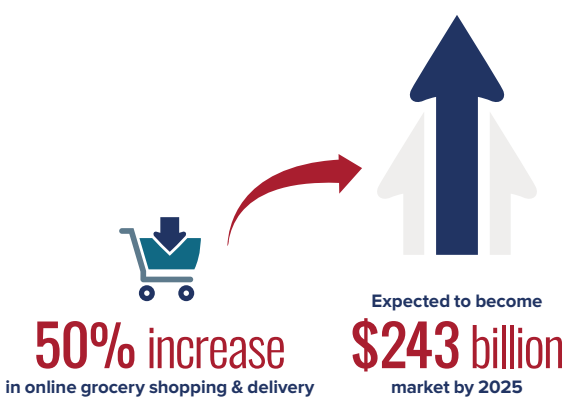
As modern-day consumers become more aware of how their purchasing decisions impact the environment, they seek products that align with their values and beliefs. Food manufacturers can increase the sustainability of their packaging process in numerous ways, including choosing recyclable or biodegradable materials, optimizing packaging size to reduce waste, and developing reusable or refillable packaging. Selecting lightweight materials can also reduce transportation costs and a company's carbon footprint.

Intelligent packaging

Companies can implement technology like radio-frequency identification (RFID) tags, temperature sensors, QR codes, and smart labels to improve efficiency and quality control. Intelligent packaging, or "smart packaging," provides real-time data on production and inventory levels to streamline the physical packaging process. This technology can also track information about the food product condition, enabling companies to track items throughout the supply chain and quickly intervene before unsuitable products reach customers. For example, a dairy manufacturer may use sensors to validate that the temperature on distribution trucks doesn't go above or below safe conditions. QR codes provide a convenient way for consumers to access information about their favorite foods to support them in making informed purchasing decisions and boost their satisfaction with the product.

Packaging designed for e-commerce

Online grocery shopping and delivery increased by 50% during the COVID-19 outbreak, and the digital grocery shopping market is expected to become a $243 billion market by 2025, according to a report by Inside Intelligence.



Food and beverage companies who want to gain and maintain an edge in this niche sector must adapt their packaging design to ensure products arrive undamaged. Depending on the individual facility's business objectives, this may mean developing more durable and lightweight packaging, considering the cost-benefit of using dunnage — such as bubble wrap, molded foam, or air pillows — to help protect the package, or adopting tamper-evident seals and easy-to-open packaging. Since online shoppers do not physically interact with the food product before purchasing, greater emphasis is placed on visually appealing designs that can grab a consumer's attention.

UPGRADING YOUR PALLETIZING PROCESS is one way to explore the potential benefits of automation in your operations while minimizing risk.

- Transitioning from a manual palletizing line to a machine-operated one can enable increased throughput and headcount reduction in an area that does not require skilled labor.
- That personnel can then be trained to take over open roles in different plant areas.

4: INCREASED ATTENTION TO **TRANSPARENCY AND TRACEABILITY**

Food companies face increasing pressure to be more dilligent and transparent with their food safety. Modern consumers want to know as many details as possible about what they're eating, including where their food comes from, how it's made, and its environmental impact.

In a **2022 consumer survey** conducted by The Food Industry Association and NielsenIQ...

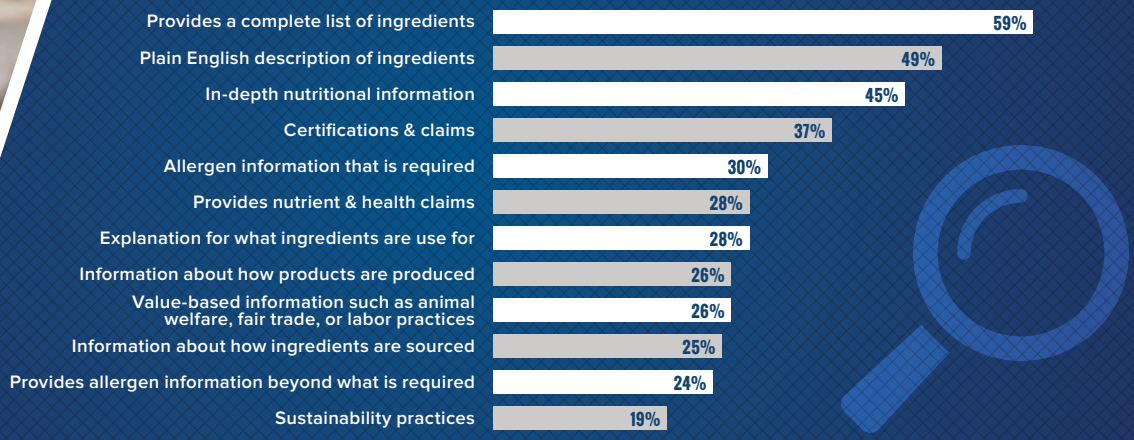
72% OF RESPONDENTS SAID TRANSPARENCY WAS EITHER IMPORTANT OR *extremely important* WHEN DECIDING WHICH FOOD BRANDS & RETAILERS TO SUPPORT.



Consumers want transparency for diverse reasons, including nutrition, animal welfare, and environmental impact.



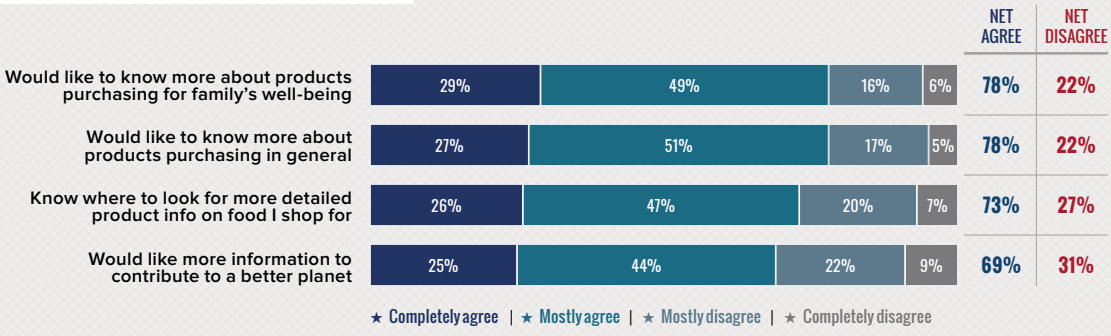
Indicators of Transparency



diverse reasons



Attitudes Toward Transparency



What are the benefits of food traceability?

Enhancing your traceability program can provide consumers the visibility they desire — and it makes sense from a business standpoint, too. Upgrading your technology and practices can provide these benefits:

1 Minimize waste and rework

Process equipment can be automated to detect if a wrong ingredient has been added in real-time, minimizing bad batches and saving time and raw materials.



2 Improve the efficiency of supplier restocking

Certain traceability software automatically monitors inventory and plans new orders.

3 Better tracking of movement up and down the supply chain

Detailed record-keeping allows plant managers to track the quantities and locations of ingredients and batches, regardless of where they are in production and throughout the supply chain. Upgrade your process by transitioning from analog to digital record-keeping methods.

4 Improve product quality

Improving the quality of your products can reduce the impact of potential recalls and increase customer satisfaction and brand loyalty. It's essential to address the root cause of potential issues proactively. This practice can help you prevent future problems and consistently deliver high-quality products. You can leverage technology and data analysis to streamline tracking and tracing products throughout the supply chain. This approach can help you save time, money and resources while ensuring the safety and satisfaction of your customers.



5 Accurate predictability and issue diagnoses

The granularity of the information collected for traceability can be repurposed to help owners better understand their operations and forecast future needs.

6 Reputation management

By quickly identifying where a potential issue originated — whether in production or at the hands of a distributor — food companies can quickly alert customers of product issues. This helps companies both contain a recall and preserve customer trust and loyalty.

7 Ensure compliance with government regulations

Local, state, and federal governments may have different rules regarding food traceability. Maintaining thorough records and visibility over your product's supply chain can aid compliance, especially during an audit.

How can your business do it?

Upgrade your technology

Identify areas where your facility could improve traceability. Then, compare different traceability software, platforms, and systems in the market and select the one that best fits your needs. You can even integrate artificial intelligence technology to expedite your process, which is better than performing audits manually.

Invest in automation

Automation offers many benefits, including automatic identification of harmful ingredients and products and improved data collection and management.

Replace barcodes with RFID tags

Optimize your product identification process using Radio Frequency Identification (RFID) tags instead of barcodes. RFID chips allow you to automatically track items from production to the final destination, while barcodes often rely on human interaction to scan each item.

Maintain a strict quality program

To reduce finished product inventories, companies conduct more changeovers on process and packaging systems. Having and executing a quality program is essential to reduce rework and ensure quality.



MES software will help conduct genealogy in MINUTES instead of days

Establish a product genealogy program

Product genealogy involves recording and tracking every component that goes into a product. Establishing a forward and backward genealogy program supports companies in ensuring that quality products are delivered to consumers, minimizing product recalls and reducing the product recall window from days to hours. Research and development (R&D) teams can also leverage the data to reduce consumer complaints. Implementing manufacturing execution system (MES) software will help to conduct genealogy in minutes instead of days with physical records.

5: AUTOMATION AND DATA

The food processing industry is experiencing a transformative shift because of the integration of automation controls, robotics, and cutting-edge digital technologies such as the Industrial Internet of Things (IIoT). These innovative solutions provide food processing facilities with a competitive edge by enabling them to optimize efficiency, minimize costs, and ensure the highest food safety and quality standards.



AUTOMATION

These are some of the critical components of a state-of-the-art digital system:

- **Human-machine interface (HMI)** — HMI systems provide operators with a visual interface that makes it easy to control and monitor processing equipment. This means that operators can interact with the equipment more intuitively and efficiently, reducing the risk of errors and making the food manufacturing process smoother.

- **IIoT sensors** — IIoT sensors measure and collect data on variables like temperature, pressure, and humidity to detect deviations from normal operating conditions that may indicate potential issues with food processing equipment. By catching these discrepancies early, operators can proactively schedule maintenance to keep the equipment in good working order, reducing downtime, lowering maintenance costs, and extending the lifespan of the equipment.

- **Manufacturing execution system (MES)** — MES software is a powerful tool used to control and monitor all stages of the production lifecycle through extensive data analysis. MES has different modules, but its key benefits include capturing OEE data to improve maintenance times and prevent critical failures, supporting supplier collaboration, and enabling lot traceability, line-to-line performance comparisons, and facility-to-facility equipment comparisons. The real-time information may also help plant owners identify opportunities to reduce energy usage by tracking energy metering.

- **Supervisory Control and Data Acquisition (SCADA) systems** — SCADA systems capture real-time data about the status of equipment and related systems, including motors, pumps, and valves. This information can give operators the necessary insight to make informed decisions about optimizing production. SCADA can also be leveraged to access critical data to minimize downtime quickly. For example, equipment manuals and drawings can be uploaded to the system and made accessible via QR code so team members can scan a code to locate relevant information rather than spending valuable minutes finding physical documents.



- **Artificial intelligence (AI)** — The integration of AI in manufacturing processes has been demonstrated to reduce manufacturing costs and improve product quality, ultimately enhancing a facility's competitiveness in the market. In the food industry, for example, AI technologies in Automated Guided Vehicles (AGVs) have been increasingly adopted in various plant operations, such as sorting, processing and packing. These AGVs use robotics with the application of AI to carry out tedious and repetitive tasks in a dynamic environment. With the aid of lasers, vision systems and AI algorithms, AGVs can create a map of their pathways within a facility; this allows them to navigate and identify landscapes and determine the safest and most effective way to move, even in the tightest of spaces. Some AGVs can incorporate AI to program specific behavior models that respond to human behavior in shared spaces where both robots and workers operate. With the increasing use of AI, the food and beverage industry is undergoing significant transformation, offering the potential to revolutionize manufacturing processes and improve overall efficiency.

- **Augmented reality (AR) glasses** — When equipment experiences issues, an original equipment manufacturer (OEM) may need to travel to the site to diagnose and repair the machine. Paying for an OEM representative to travel can be very expensive, and additional revenue is lost if the equipment is down for multiple days while the technician travels to the site.

- **5G wireless network** — Good network connectivity is important for companies with integrated cloud-based systems, such as a cloud-based MES solution. While a cable connection can be more stable and reliable, 5G wireless capabilities enable systems to continue running during a power outage.

ROBOTICS

By using food-grade industrial robots to handle repetitive tasks, companies can more easily adjust production processes to cater to shifts in market demand and evolving consumer preferences.

Robots are used to lower the cost of production, maximize floor space, and improve hygienic standards in processing and packaging areas. Their ability to work in sub-zero temperatures has also made them popular in cold storage applications. The specific type of robot used will depend on the individual facility's needs, including production volumes, product specifications, and facility layout.

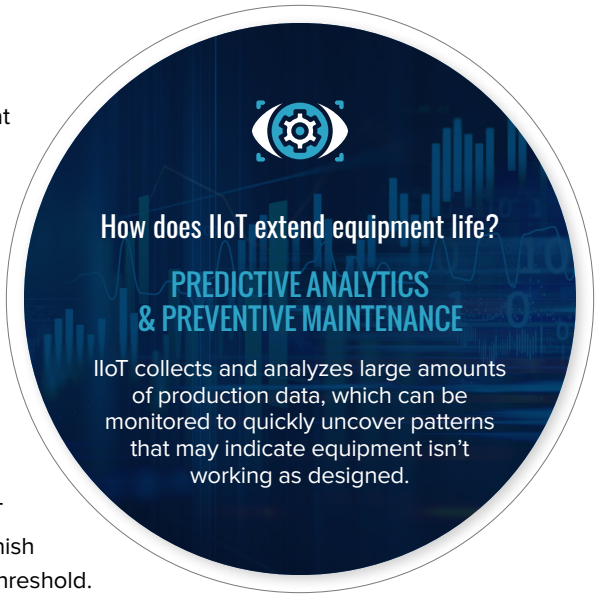
These are some of the most common types of robots used in food processing:

- **Collaborative robots (Cobots)** — These robots are designed to work alongside human workers and are ideal for tasks that require human-like dexterity, such as labeling, packaging, and quality control.
- **Automated storage and retrieval systems (AS/RS)** — These computer-controlled systems are commonly used in warehouses to maximize a facility's vertical storage capacity. AS/RS systems can be designed to handle a wide range of products, from small items to oversized pallets, and offer a higher degree of precision and efficiency than human operators.
- **Automated guided vehicles (AGVs)** — These self-guided vehicles are equipped with sensors, cameras, and other technologies to avoid obstacles while transporting items throughout the facility. AGVs follow physical or virtual guides like magnetic tape or Wi-Fi signals. These robots can reduce the risk of human error while improving employee safety and the overall efficiency of material handling processes.

INDUSTRIAL INTERNET OF THINGS (IIoT)

The industrial Internet of Things (IIoT) is a network of interconnected physical devices, machines, and sensors that collect, analyze, and exchange data across a system.

With IIoT, plant personnel can access real-time data on every aspect of production, including temperature, energy consumption, equipment performance, and equipment maintenance status. This information provides actionable insights into areas where improvements can be made, allowing food processors to enhance efficiency, lower costs, and increase production speed.



For example, a plant manager can install IIoT sensors that monitor the inventory levels of packaging materials. The IIoT system automatically triggers a reordering process to replenish the supply when the inventory level drops below a pre-set threshold.

actionable insights

THE FUTURE IS NOW

As technology advances, it presents exciting new opportunities for plant owners to upgrade operations, cut expenses, and provide better customer service. By using technology to its fullest extent, food processors can keep up with the latest industry trends, adjust to ever-changing market conditions, and maintain their competitiveness in the highly competitive food industry.

THE ROLE OF AUTOMATION IN TODAY'S WORLD

The advancement of technology has provided a solution and a challenge for businesses. While automation has made work more accessible and efficient, freeing up employees for higher-level jobs by automating repetitive and mundane tasks with minimal human intervention, **companies also face a new challenge:**



...SOPHISTICATED TECHNOLOGY
requires a more elevated skillset
TO MAINTAIN & REPAIR.

To eliminate their need to rely on external technicians, companies should invest in providing their staff with the technical knowledge required to manage and rectify issues in automated systems. Doing so will reduce costly downtime and save time and resources in the long run.



invest!

Today's employees possess a greater understanding of technology and are often eager to improve their performance through additional training. Facilities will need to implement automation to sharpen their competitive edge, but with the proper personnel training, companies can also navigate basic troubleshooting and repairs more efficiently.

6: COLD STORAGE SUPPLY CHAIN MANAGEMENT

Food and beverage companies are increasingly using cold storage supply chain solutions to tackle the challenges associated with modern logistics. This type of supply chain involves refrigerated warehouses and transportation to ensure that perishable goods, such as fresh produce, dairy and meat, are kept at a specific temperature throughout the supply chain.

Cold storage supply chain solutions help maintain food products' quality and safety and offer several other benefits:

Reduced food waste as perishable goods are less likely to spoil during transportation and storage.

Improved supply chain efficiency, allowing for better coordination between suppliers, manufacturers, and distributors.

Streamlined logistics, from optimized delivery routes to real-time inventory monitoring, enabling smarter decision-making.

Companies leverage advanced analytics, cloud-based software, and other tools to gather and analyze data, optimize routes, and monitor inventory levels in real-time. This enables them to make better decisions and respond quickly to changes in demand and supply. Food and beverage companies have tweaked, shifted, and even rewritten their business models in recent years in response to these market changes. While some changes are gradual, such as the transition to automated facilities, the logistics sector has been rapidly and drastically influenced by the coronavirus pandemic and the subsequent e-commerce explosion.



Rapid fulfillment and distribution are top of mind for food companies wanting to keep consumers happy and loyal. However, achieving the perfect balance between running a profitable model and meeting higher delivery expectations can take time and effort.

Food companies use cold storage supply chain solutions and technology to improve logistics operations. Cold storage keeps food products at a specific temperature throughout the supply chain, reducing food waste and improving supply chain efficiency. New technologies, such as advanced analytics and cloud-based software, enable companies to gather and analyze data, optimize routes, and monitor inventory levels in real-time, making better decisions and responding quickly to changes in demand and supply.

Micro-fulfillment centers

The 21st-century distribution chain is marked by its response to the e-commerce boom — pre- and post-COVID. After online grocery sales jumped 300% in the early months of the pandemic, giant retailers like Walmart explored expanding distribution using micro-fulfillment centers (MFCs) to increase availability and expedite order fulfillment.

The MFC model uses small warehouses equipped with automation technology in densely populated areas. Employees pack online orders in these centers instead of in the neighborhood store, allowing them to be picked up or shipped directly to the customer. Of course, convenience is essential to consumers; not every person wants to drive out of their way to pick up groceries. For this reason, MFCs can also be added to existing stores to support local store fulfillment and pickups.

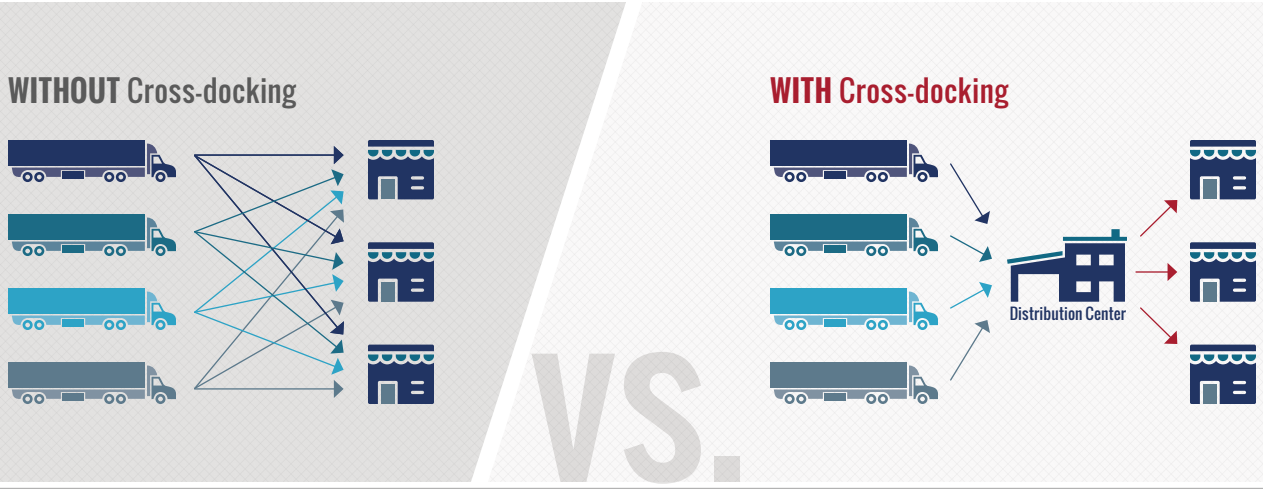


keeping happy & loyal customers



Cross-docking

Cross-docking is a logistics strategy that aims to boost supply chain efficiency by minimizing handling and the amount of time products spend in storage. Using this shipping model, manufacturers send loaded trucks to a specialized distribution dock where pallets and freights are immediately sorted and transferred onto outgoing vehicles to continue their journey.



The cross-docking strategy is increasing as distributors explore cost-, time- and space-saving measures for popular items requiring frequent shelf replenishment, but cross-docking isn't a catch-all solution. Consider the following when deciding whether cross-docking is the proper logistics solution for your business:

- While cross-docking can reduce expenditures on inventory space and transportation, the process requires an advanced level of coordination to ensure that each product **arrives at its intended destination promptly**. Software solutions help manage and track inventory as products move from one location to another.
- Since items don't need to be stored in a warehouse between distribution points, cross-docking can yield **labor savings and decrease the risk of damage** during manual handling. Using a dock equipped with automation technology can further optimize the process.
- While the approach can pay off in **cost savings in the long run,** building a cross-docking warehouse or terminal and equipping it with transport trucks requires a significant initial capital investment.



strategy

The last-mile delivery conundrum

When a customer places an online order for grocery delivery to their home, the product's journey to their doorstep is, from a high level, relatively straightforward. The final step of getting the package from a local distributor to the final destination is the "last mile of delivery." From a manufacturer's standpoint, this seemingly minor step in the process can cause many headaches and eat away at overall profits. The reason is that delivering goods isn't like a traditional mail service where one postal worker delivers correspondence at each house along a designated route. Instead, order distances can be miles apart, especially for facilities and warehouses located in more rural areas. However, a good strategy is vital to keeping consumers happy.

Consider the following to improve your last-mile delivery approach:

- **Reduce the run length** — Implementing a system to increase proximity between pickup and delivery points can help companies meet consumer demand cost-effectively. Especially in densely populated areas, building or leasing small warehouses or cold storage that can serve as holding areas for popular items can help minimize distance and cost.

- **Optimize delivery routes** — Several different methods can be used to optimize last-mile transportation routes for faster deliveries. Route optimization software assists with route planning to ensure traffic congestion and closures don't delay the deliveries or consume more fuel than necessary.

ALSO, CONSIDER COLLECTING AND ANALYZING HISTORICAL DATA ABOUT THE SHIPPING PROCESS, AS IT MAY REVEAL TRENDS & OPPORTUNITIES TO *enhance route efficiency.*

- **Prioritize transparency** — Nobody likes receiving the "delayed package" notification, but it's better than wondering where your order is. Could it have been lost in the mail or sent to the wrong address? Real-time delivery updates can help manage customer expectations and improve their experience, especially when issues arise.

- **Partner with last-mile delivery vendors** — There are companies solely dedicated to providing last-mile delivery services that can help shoulder the responsibility of fast shipping. Outsourcing this part of the shipping process can be beneficial, especially for small- to mid-size companies.

2024: A YEAR OF **SHIFTING** CONSUMER PREFERENCES AND TRENDS

Industry observers expect a noteworthy shift in consumer preferences in 2024, influenced by key trends that will shape the market. Consumers will likely display a heightened interest in specific ingredients and foods, positively responding to key ingredients highlighted on product labels. Secondly, there will be a marked emphasis on environmental consciousness, with consumers engaging more deeply with climate issues, carbon footprints, and sustainability efforts. Thirdly, the trend towards plant-based foods, particularly protein, will continue rising.

In addition, consumers are faced with an information overload on product packaging, which makes clear and straightforward messages more critical than ever before. Consumers are likely to prefer authenticity in distinguishing marketing claims from actual product qualities, with minimal ingredient labeling and authenticity being some of the top preferences. Companies should carefully consider these trends when marketing their products, ensuring their packaging and labeling align with these values and preferences.

rise to the challenge



CHANGE IS ~~COMING~~ HERE. ARE YOU READY?

Undoubtedly, the food and beverage industry will look and operate differently ten years from now, but that momentum has already begun. Growth opportunities and product lines are already heavily influenced by an urgency for more food options at a faster delivery pace.

As companies rise to the challenge of meeting evolving consumer demand, they'll need to consider the best path to future-proof their facilities while remaining nimble to respond to changing preferences quickly. If you haven't already realized it, you'll soon find that technology is at the heart of the next era of strategic business planning, whether that means automation or tools that enable data-driven decision-making.

Building and running a food plant is a balancing act, requiring the ability to juggle a variety of factors, from supply chain disruptions to changing consumer preferences. To stay ahead of the curve, manufacturers should regularly assess their procedures to guarantee that their facilities can thrive as the industry evolves. Partnering with experts who keep their pulse on the latest trends, technologies, and innovations can simplify the process as you prepare for the next decade in food and beverage processing.

IF YOU ARE INTERESTED IN RECEIVING OUR EXTENDED EDITION E-BOOK, SIGN UP TODAY!

Contact us at **1-800-488-2900** to schedule a complimentary, no-obligation consultation.

ABOUT STELLAR

Stellar is a fully integrated design, engineering, construction, refrigeration, and mechanical services firm serving commercial, industrial, and public sector markets across the United States. More than 750 Stellar employees throughout the country create award-winning food processing plants, refrigerated warehouses, distribution centers, commercial buildings, and military facilities. In addition to its headquarters in Jacksonville, Florida, Stellar operates support locations throughout the United States. For more information, visit **stellar.net**.

2900 Hartley Road
Jacksonville, FL 32257

Phone: **904-260-2900**
Toll-free: **800-488-2900**
Email: **info@stellar.net**

stellar.net

stellar
TAKING SOLUTIONS FURTHER®