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WHITE PAPER

Food & Beverage Processing Trends: Emerging Priorities for Equipment and Operations



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About This Report

This publication is adapted from PMMI Business Intelligence's 2026 State of the Industry: Processing Equipment report, developed in collaboration with Interact Analysis and the Food Processing Suppliers Association (FPSA). It presents selected findings from industry research, including interviews with processing equipment suppliers, to provide insights into trends and developments shaping the U.S. food and beverage processing machinery market.

Figure and table numbering has been retained from the original report for consistency. The full report, 2026 Processing State of the Industry, including additional findings and market forecasts, is available through PMMI Business Intelligence.

Food & Beverage Processing Trends

HEALTH • WORKFORCE • MACHINE DESIGN • SANITATION
AI & BIG DATA • SUSTAINABILITY

KEY TRENDS SHAPING FOOD & BEVERAGE PROCESSING

Industry perspectives on evolving market dynamics

The food and beverage processing industry is being shaped by changing consumer preferences, ongoing workforce challenges, evolving equipment requirements, and growing interest in automation and data-enabled technologies. Sanitation requirements and sustainability priorities are also influencing how processors approach equipment selection, operational efficiency, and future investments.

Drawing on interviews with processing equipment suppliers and other industry research, this report examines the trends influencing food and beverage processing operations, equipment needs, and investment priorities. The following pages explore key developments across the industry and their implications for processors.



Health-Driven Consumption Shifts

Consumer preferences are shifting toward simplified ingredients, higher protein density, and perceived nutritional quality, reinforcing a clean-label phase in US food consumption. Emerging factors such as GLP-1 adoption may further influence portion size and nutrient prioritization, introducing potential volume headwinds while reinforcing demand for protein - and vegetable-forward products. Rather than triggering broad capacity expansion, these dynamics are reshaping formulation strategy and increasing operational complexity through more frequent changeovers and heightened sanitation and inspection requirements.



Workforce

Persistent labor shortages remain a defining structural constraint across the processing landscape. While conditions have moderated from peak disruption levels, skilled-technician gaps, high turnover, and hiring volatility continue to influence capital planning and operating models. Processors are prioritizing automation that stabilizes throughput with fewer operators, while OEMs are expanding aftermarket services, strengthening technician retention efforts, and designing equipment that reduces manual intervention and maintenance complexity.



Machinery Design & Functionality

Equipment design is increasingly shaped by workforce constraints and integration demands. Processors are prioritizing intuitive controls, reduced manual intervention, and systems that require less internal engineering oversight. At the same time, demand for turnkey, fully integrated solutions is rising as companies seek suppliers capable of delivering coordinated, ready-for-production systems.

Sanitation

Sanitation has moved from a secondary consideration to a core investment driver. Rising recall visibility, higher SKU complexity, and formulation changes are elevating the importance of hygienic design, cleanability, and repeatable sanitation workflows.

AI and Big Data

AI adoption in processing remains gradual and risk-weighted, with current use focused on data monitoring, inspection enhancement, and decision support rather than autonomous control. Reliability, accountability, cybersecurity, and ROI discipline continue to govern deployment pace as processors prioritize validated, repeatable performance.

Sustainability

Sustainability efforts are increasingly framed around cost reduction and efficiency. Water use, energy consumption, and waste minimization are influencing equipment upgrades, sanitation practices, and system design decisions.

THE CHANGING US HEALTH NARRATIVE

Health consciousness

In recent years, the United States has seen a shift in consumer preferences toward ingredient simplification, higher protein density, and perceived nutritional quality. While "health" has long affected food demand, the current cycle is notable for its impact on formulation decisions and its cultural visibility.

Public discourse around food quality has increased, driven by a combination of mainstream media coverage, evolving public health conversations, and the amplification effects of social platforms. Health-oriented initiatives and messaging, including the use of "Make America Healthy Again," reflect how food and nutrition have entered broader public dialogue, reinforcing growing skepticism toward 'highly processed' foods and increasing attention on how foods are formulated. Alongside this, influencers have further accelerated the shift by promoting recognizable ingredient lists, transparency, and minimal processing, reinforcing the perception that simpler formulations are healthier.

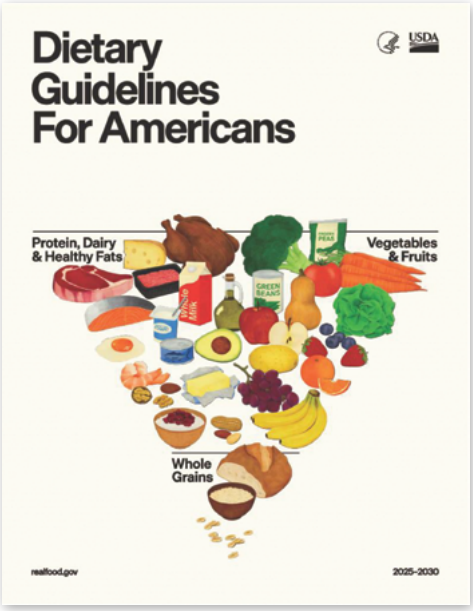
This transition fits within a recurring five- to ten-year pattern of evolving US health priorities. Earlier phases emphasized low-fat diets, followed by organic and non-GMO ingredients. The current phase is defined by clean-label positioning, shaped by heightened skepticism around food processing and a preference for simplified formulations. Consumers are increasingly responding to visible cues such



as recognizable ingredients, "real ingredient" messaging, and protein-forward labeling as shorthand indicators of health and quality.

Federal nutrition guidance has also reinforced this clean-label phase. The 2025–2030 Dietary Guidelines for Americans place renewed emphasis on "real food," prioritizing protein, dairy, fruits, vegetables, healthy fats, and whole grains while explicitly calling for a reduction in highly processed foods. While these guidelines are not prescriptive for the broader consumer market, they directly inform school meal standards and other federally funded food programs. As a result, ingredient simplification and protein-forward positioning are being reinforced within large-volume institutional channels, adding durability to trends already visible across retail and foodservice.

Interview insights strongly align with these broader cultural trends. Processing-equipment suppliers reported sustained growth in categories consumers associate with health, including nutraceuticals, perceived healthier beverages, and fruits and vegetables. These segments were reported as expanding faster, indicating that wellness-oriented formulations are influencing portfolio shifts across the industry.





GLP-1 adoption as an accelerant

Alongside these broader clean-label and protein-forward shifts, pharmaceutical appetite regulators are emerging as an additional factor reshaping food consumption patterns. According to the Gallup National Health and Well-Being Index, roughly one in eight US adults now report using a GLP-1 drug, a share that has increased sharply over a short period. With oral GLP-1 formulations entering the market, penetration is expected to continue expanding.

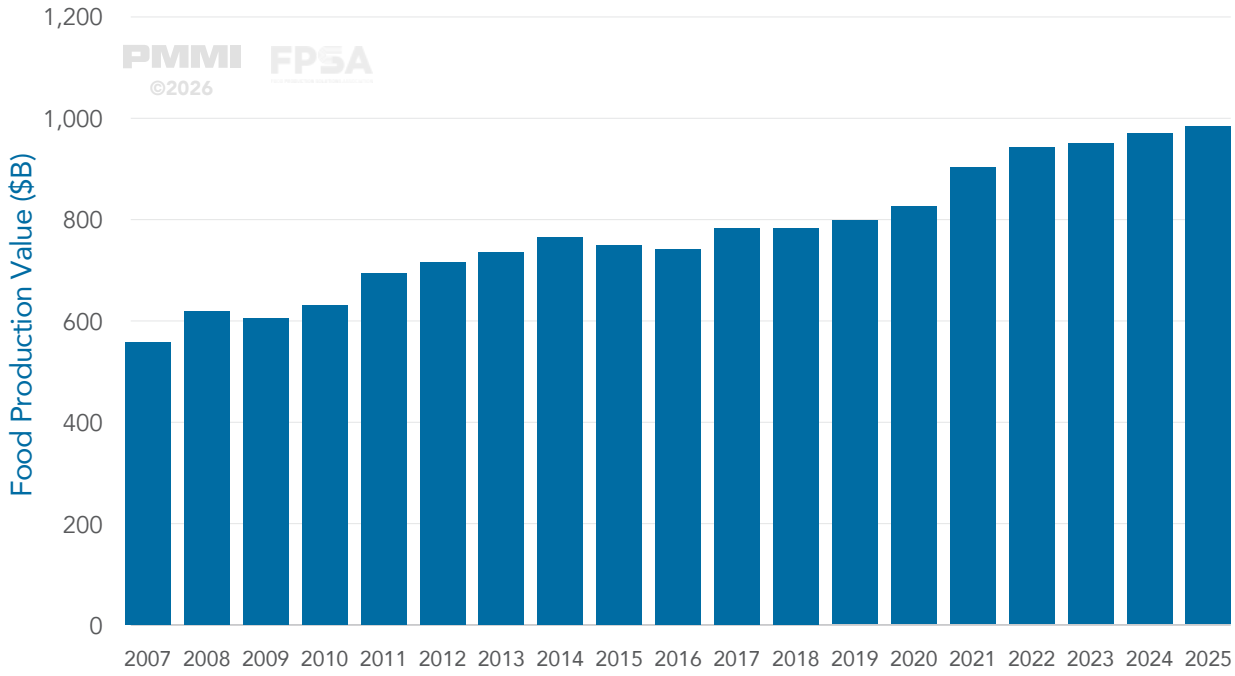
While there is still debate around the ultimate ceiling for GLP-1 adoption, their impact on eating behavior is already evident. These medications primarily influence consumption through volume reduction, as users report smaller portions and lower overall caloric intake. If adoption continues to scale, this dynamic has the potential to weigh on aggregate food consumption, introducing a structural headwind to categories that have historically benefited from steady volume growth. This is particularly notable given that US food production has trended upward for decades (as illustrated in Figure 8), a pattern that could face pressure if a meaningful share of consumers consistently eat less.

At the same time, GLP-1 use is shaping how remaining calories are allocated. Patients are commonly advised to prioritize protein and vegetables to maintain muscle mass and nutritional balance while eating fewer total calories. As a result, GLP-1s are reinforcing demand for foods that deliver higher nutrient density per calorie rather than simply lower calories, aligning closely with the broader clean-label and protein-forward messaging now visible across the market.

Approximately 1 in 8  US Adults Report GLP-1 Use

Source: Gallup National Health and Well-Being Index

Fig. 8 US Food Manufacturing Output Has Trended Upward Over the Long Term



Source: Interact Analysis: Manufacturing Industry Output Tracker

How food companies are responding

Food companies are responding to these shifts through a combination of product reformulation, portfolio reframing, and marketing emphasis rather than wholesale category reinvention. One of the clearest signals of how far health-oriented messaging has penetrated the market is the extent to which traditionally indulgent brands are now adopting protein-forward positioning.

In packaged foods, this is evident in Kellogg's' introduction of higher-protein Pop-Tarts variants. Historically positioned as a convenience treat, Pop-Tarts are not a category consumers associate with functional nutrition. The decision to elevate protein content in this product underscores how broadly protein signaling is now being applied, even in formats where incremental nutritional improvements are unlikely to fundamentally change consumption behavior. From an industry standpoint, this reflects an effort to retain relevance and shelf space as consumers reassess everyday food choices through a health-oriented lens rather than eliminate indulgent products entirely.

In foodservice, similar dynamics are playing out at scale. Starbucks has expanded protein-forward offerings across both beverages and food items, while increasingly highlighting protein content in its marketing. Given Starbucks' role as a high-frequency, convenience-driven chain, these moves signal that health and protein messaging are no longer confined to specialty or performance-focused consumers. Instead, they are being integrated into mainstream consumption occasions, including snacks and beverages traditionally chosen for convenience rather than nutrition.



Implications for food and beverage processing machinery

Despite the evolution in consumer preferences, interviews made clear that health-driven trends are not prompting broad greenfield investment. Instead, processors are introducing more health-aligned SKUs by adjusting recipes and parameters on existing processing lines. This approach allows manufacturers to respond to shifting demand without replacing core equipment.

Increased Frequency of Changeovers

As product portfolios expand to include a wider range of health-oriented formulations, facilities are experiencing greater batch-to-batch variability. Interviewees highlighted rising demand for faster sanitation, more efficient line purging, and flexible batching systems, particularly in plants running shorter production runs, multiple flavors, or seasonal SKUs.

Heightened Emphasis on Hygiene and Cleanability

More frequent product switching has elevated the importance of hygienic design and cleanability. Processors are placing greater value on equipment that supports tool-less cleaning, minimizes downtime, and reduces contamination risk, especially when switching between products with different allergen or nutritional profiles. These considerations are increasingly influencing purchasing decisions even in the absence of major capacity expansion.

Greater Sensitivity in Inspection and Quality Control

Health-oriented formulations often differ in density, moisture content, or ingredient composition, placing additional demands on inspection and quality-control systems. Interviewees noted more frequent calibration and adjustment to maintain detection accuracy as formulations evolve, increasing the value of inspection equipment that can perform reliably across a broader range of product characteristics.

WORKFORCE

Machine builder shifts

Persistent labor constraints in US manufacturing have become a structural force in food and beverage processing. Workforce availability influences how processors operate, as well as how OEMs design, service, and commercialize equipment. In the processing machinery market, workforce shortages are reshaping equipment specifications, aftermarket strategies, integration demand, and talent retention priorities. The sections that follow examine these impacts across both machine builders and end users.

Aftermarket Support Expands

Widespread labor shortages, especially among skilled maintenance technicians, are causing processing plants to increasingly rely on machine builders for ongoing service support. Instead of maintaining in-house teams capable of regular troubleshooting and upkeep, many plants now prefer to outsource this work directly to OEMs. This shift has led to a notable rise in requests for OEM-provided service visits, technician support, and maintenance programs.

Across the industry, service programs are expanding in several ways:

More frequent OEM service visits: Plants with shrinking technical staff are increasingly asking OEMs to perform routine maintenance and system checks. They are willing to rely on OEM technicians to prevent downtime and maintain machine health.

Growth in formal service contracts: Some OEMs are offering structured service agreements that include scheduled inspections, performance verification, and documentation support to help customers remain compliant with audit requirements. These programs ensure machines remain in optimal condition without requiring the plant to train or staff specialized maintenance personnel.

Expansion of predictive and preventative maintenance offerings: Several OEMs are developing or promoting advanced maintenance programs aimed at early detection of equipment issues. While customer adoption varies due to ROI uncertainty, OEMs increasingly view these offerings as a strategic aftermarket revenue stream and are piloting them in the field to build credibility.

Aftermarket activity rising when new equipment sales slow: In periods of reduced capital spending, customers often shift investment toward rebuilding or maintaining existing machinery. Some OEMs benefit from this counter-cyclical pattern, especially those whose consumables or service parts are proprietary and therefore consistently in demand.

Overall, aftermarket support is becoming a more important pillar of processing OEM business models. For machine users, it reduces operational risk, ensures regular machine upkeep, and alleviates the need for scarce technical talent. For machine builders, it provides a steady revenue source, strengthens customer relationships, and helps stabilize the business during economic slowdowns or pauses in capital expenditure.

Employee Retention and Technician Constraints

Although the labor disruption experienced in 2020 has partially eased, workforce strain remains a defining challenge for processing OEMs. Interviews with OEMs consistently indicated that competition for skilled labor remains an important factor. Several organizations reported raising wages above local norms to remain competitive in attracting and retaining technical talent. In some cases, employee-ownership structures were noted as contributing to longer-term workforce stability, helping reduce turnover and maintain continuity within production teams.

Retention pressures are especially visible in field-service and commissioning roles. Demand for installation support, troubleshooting assistance, and maintenance expertise has grown as processors struggle to staff these functions internally. Many OEMs described the difficulty of expanding their technician teams in line with customer needs, noting that the same labor shortages affecting processors are also constraining their own hiring pipelines. This is particularly impactful in roles requiring frequent travel, which can contribute to employee fatigue and reduce long-term retention.

Some manufacturers have responded by strengthening their technician-retention strategies—offering more structured work-hour policies, attempting to balance travel schedules, or widening recruitment efforts through training partnerships and technical-school engagement. Others emphasized that broader economic conditions, including a softening labor market, have temporarily improved retention, though structural shortages persist for high-skill roles.

Given the growing reliance on OEM-delivered support, technician recruitment and retention are likely to remain critical differentiators in the processing-machinery sector.

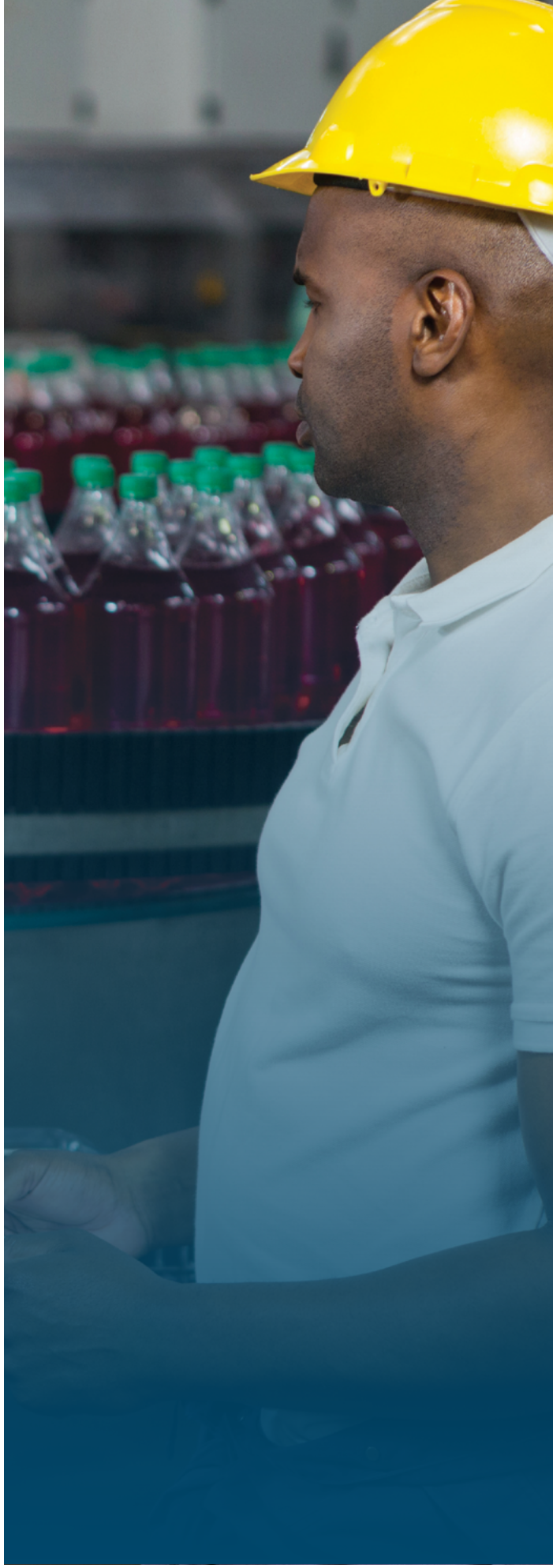
Maximizing Output Per Labor Hour

Across multiple interviews, processors were described as pushing to increase throughput without expanding their labor footprint. In many facilities, adding shifts is no longer feasible due to the difficulty of hiring and retaining workers. As a result, plants are seeking to increase output with existing staffing levels.

For some facilities, this means scaling mechanical capacity. Interviewees cited larger batch sizes, higher-speed lines, and even upgraded components such as larger valves to reduce offload time in production cycles.

Beyond scaling equipment, processors are also targeting labor-intensive transfer points within the line. Rather than relying on operators to manually move product between stages, facilities are investing in automated transfer and repositioning solutions that reduce touchpoints and shorten cycle time. These changes help protect throughput when staffing remains thin.

Higher-capacity equipment, speed-enhancing retrofits, and integration upgrades therefore remain in high demand. Rather than simply pursuing speed, facilities are investing in systems that improve output per labor hour and protect production levels in a constrained workforce environment.



Ergonomics and Assisted Material Handling

Labor shortages are also accelerating automation in physically demanding and repetitive material-handling tasks. Across interviews, processors described reducing ergonomic strain and reallocating limited labor by shifting manual movement to automated systems.

Examples included autonomous mobile robots (AMRs) transporting ingredient combos or bulk materials across facilities, as well as automated guided systems moving vats, totes, or product between upstream and downstream steps. Targeted upgrades—such as redesigned transfer points or automated repositioning devices—are eliminating roles historically dedicated to manual lifting, pushing, or sorting.

Although applications vary by facility, the underlying driver is consistent: reducing repetitive, difficult-to-staff tasks while maintaining steady material flow. Automation in this context is not solely about speed; it is about sustaining operational continuity and a safe enviroment with fewer available workers.

While these deployments are currently more common in larger or highly automated facilities, interviewees suggested that similar solutions may become more prevalent as labor constraints persist and ROI calculations increasingly factor in workforce availability rather than labor cost alone.

For OEMs, this shift presents opportunities to integrate material-handling automation into broader system offerings or provide modular upgrades that reduce ergonomic strain. As workforce pressures continue, solutions that lower physical labor requirements may capture incremental demand, particularly among processors seeking to stabilize operations without expanding headcount.

Worker Safety Design Shifts

Interviews highlighted several ways equipment design is evolving to better protect workers, particularly in environments facing high turnover, reduced operator experience, and increased automation demands.

Reduction of Hazardous Manual Tasks

Machine builders are redesigning equipment to reduce the need for operators to lift, reach into, or physically interact with machinery. Examples include externalized maintenance points—such as seal replacements that can be performed without removing heavy components—as well as simplified mechanisms that limit exposure to moving parts. These changes reflect shrinking maintenance teams and a need to reduce ergonomic strain and injury risk during routine service.

Minimizing Operator Exposure to Confined or Dangerous Spaces

Interviewees noted that many safety incidents occur when workers must enter equipment for cleaning or maintenance. In response, OEMs and sanitation-system partners are collaborating earlier in the design process to ensure machines can be cleaned or serviced with minimal physical entry. Automated or semi-automated cleaning approaches are increasingly used to keep workers out of confined or potentially re-energized areas.

Embedded Safety Controls and Interlocks

Modern machines incorporate more durable, washdown-capable safety switches and interlocks designed to remain functional in demanding environments. Equipment is increasingly configured to stop automatically, or prevent operation altogether, when guards or access panels are opened. While these protections are now standard in many applications, interviewees emphasized that newer generations of equipment offer improved reliability compared to legacy systems, reducing both injury risk and unplanned downtime associated with safety component failure.



MACHINERY DESIGN & FUNCTIONALITY

Simplification and turnkey solutions in high demand

HMI Simplification

A recurring theme across interviews was the need to simplify machine operation for a changing workforce. As roles become harder to fill, plants increasingly rely on teams with varied experience and technical proficiency, elevating the importance of intuitive equipment design. Similar trends were noted in previous PMMI Packaging Machinery State of the Industry reports, interviews for this report indicate that the same workforce-driven design shifts are also prominent in the processing space.

Simplification comes in the forms of:



Simplified User Interfaces
The incorporation of app-like icons and images to reduce training time.



Lockout Systems
Password or key card restrictions to prevent accidental changes.



Mistake Proofing
Restricting recipe changes from exceeding a maximum number.



Multi-language HMIs
Various languages available for the operator to choose from.

We expect continued investment in user-friendly controls and simplified workflows. OEMs that prioritize intuitive design may see advantages in both initial sales and long-term customer retention.

Growing Demand for Turnkey Solutions

A theme across the interviews is the accelerating shift toward turnkey, fully integrated solutions. As staffing constraints persist, processors are seeking suppliers who can deliver systems requiring minimal internal engineering or coordination.

Interviewees reported increasing preference for equipment suppliers who can assume greater responsibility for system-level performance. In particular, some described customers who no longer want to maintain internal technical expertise and instead want their equipment to arrive largely ready for production, with limited need for onsite integration or engineering oversight. This has driven a noticeable rise in demand for packages that include installation, configuration, and broader operational support, rather than isolated machine purchases. This trend places advantages on OEMs with broader product portfolios or established integration capabilities, including those who can deliver complete process cells, coordinated line sections, or end-to-end mechanical and automation solutions.

The move toward turnkey solutions has implications across the supplier landscape. OEMs already positioned with strong integration capabilities may benefit from a greater share of wallet as customers shift spending toward bundled offerings. Conversely, more specialized or single-machine vendors may experience pressure to expand into system-level offerings or form partnerships with complementary suppliers to remain competitive as customers consolidate their vendor interactions.

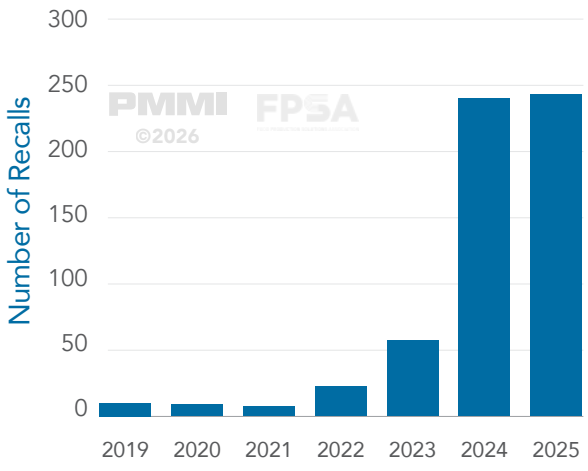
SANITATION

The growing challenges of sanitation as recalls take the spotlight

Throughout our research process, interviewees consistently referenced the rising visibility of product recalls in the United States. Compared to a few years ago, recall activity has become more frequent and more prominent in public exposure. One OEM pointed to the digital environment as an amplifying factor. Incidents that once remained localized can now circulate nationally within hours, increasing companies' reputational risk and intensifying scrutiny of food safety practices.

While digital virality may amplify recall visibility, interviewees emphasized that underlying drivers are operational. In the following sections, we examine the types of recalls being observed, how equipment design influences cleanability, and where sanitation considerations are directly shaping capital investment decisions.

Fig. 9 US FDA Food & Beverage Recalls



Source: US FDA

Recalls surpass 200 in food & beverage

Recalls Reinforce Sanitation as a Systemic Risk

Recent FDA recall data illustrates the scale and persistence of food safety incidents in the current operating environment. Recall activity across 2024 and 2025 remains elevated relative to pre-2020 levels, particularly in categories characterized by high SKU complexity and frequent changeovers, including prepared foods, fruits and vegetables, bakery and confectionery, dairy, and protein-related products. As shown in the accompanying figures, undeclared allergens and pathogen-related contamination continue to account for the majority of recall events. These causes are closely linked to cross-contact control, residue removal, and execution consistency during sanitation cycles.

The persistence of these recall drivers across multiple years suggests that sanitation challenges are structural rather than episodic. For equipment suppliers, this reinforces the importance of machine designs and cleaning architectures that reduce variability, improve cleanability, and support repeatable sanitation workflows under real-world operating conditions.

Fig. 10 US FDA Food & Beverage Recalls - 2025

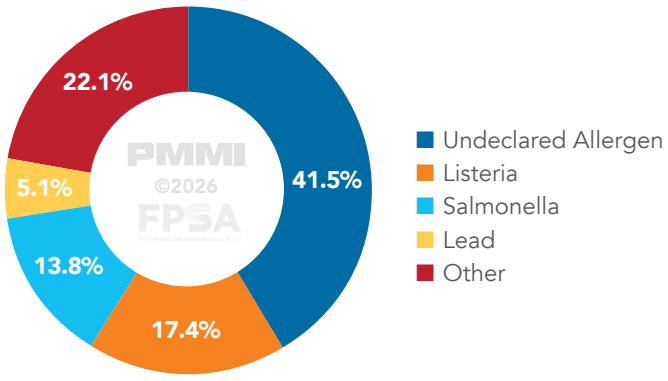
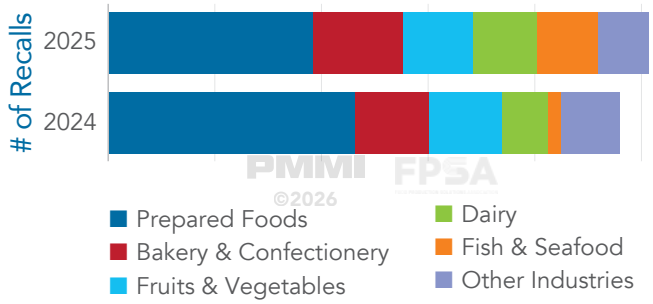


Fig. 11 US FDA Food & Beverage Recalls by Industry



Source: US FDA

Product diversifications creates challenges for producers

Formula Changes Introduce Additional Sanitation Variables

Beyond recall data, interviewees highlighted formulation changes as an emerging sanitation variable. Shifts in ingredient behavior, such as residues that harden, crystallize, or adhere more aggressively during production or cooling, can strain legacy equipment designs that contain hollow structures or inaccessible surfaces. What was once cleanable under prior product specifications may no longer perform to the same level under new formulations.

One example involved a facility that switched to iron-fortified flour. The system included magnets intended to capture metal debris from upstream milling processes. However, once the fortified flour was introduced, the magnets began pulling the fortification iron itself out of the mix, causing unexpected buildup and clogging throughout the system. This required significant troubleshooting and highlighted how seemingly minor formulation changes can disrupt both sanitation practices and mechanical operation.

Such cases highlight the importance of early collaboration between processors and equipment suppliers when formulation changes are under consideration. Even minor ingredient adjustments can have unintended consequences for residue behavior, cleanability, and mechanical interaction. OEMs that engage proactively during product-development or reformulation phases may be better positioned to identify potential sanitation risks before they manifest operationally. As product portfolios continue to evolve, earlier technical alignment between process engineers and machine builders could help mitigate costly troubleshooting and unplanned equipment modifications.

Sanitation demands are increasingly shaped by evolving product characteristics and expanding SKU portfolios. Shorter production runs and more frequent changeovers are compressing production windows, while formulation shifts introduce new residue behaviors that challenge legacy equipment designs.

Integrating sanitation into system design

Coordination Between Sanitation Providers and Machine OEMs

Interviewees noted that some OEMs now coordinate earlier with sanitation-system providers to define cleaning architecture during the equipment purchasing stage. By aligning equipment geometry, spray coverage, drainage, and material compatibility upfront, suppliers can reduce the need for retrofitted cleaning solutions after installation. This early alignment becomes increasingly important as plants seek to limit manual cleaning labor and avoid confined-space entry.

However, Clean-Out-of-Place (COP) remains prevalent when sanitation planning is not fully integrated into equipment selection. In many cases, plants install new machinery and only later determine how it will be cleaned within existing floor-space and time constraints. This creates operational friction, drives aftermarket modification requests, and reinforces the risk of treating sanitation as secondary during capital procurement.

Time Constraints and System Review Gaps

Sanitation time windows vary widely. Some facilities allocate eight hours for cleaning, while others require completion within four. These constraints directly affect Clean-In-Place (CIP) system sizing, chemical dosing strategies, and workflow design. OEMs that understand a customer's sanitation window early in the specification process may reduce the likelihood of post-installation performance gaps or underperforming cleaning cycles.

Interviewees also emphasized that sanitation systems are rarely reassessed once commissioned. As throughput increases or formulations change, previously adequate CIP or COP processes may become strained. Equipment designed with flexibility, serviceability, and reviewability in mind may better accommodate evolving production demands and reduce long-term customer dissatisfaction.

In practice, effective sanitation strategy extends beyond selecting CIP or COP. It requires anticipating how cleaning systems will perform under changing product mixes, production speeds, and labor conditions. OEMs that position sanitation planning as a core element of system design—rather than an afterthought—may reduce long-term customer friction, limit retrofit exposure, and strengthen competitive positioning.

Sanitation considerations driving equipment upgrades

Reducing Variability in Sanitation

In response to persistent reliance on COP and workforce variability, OEMs are engineering sanitation workflows to be faster, simpler, and more repeatable.

Interviewees emphasized reducing part counts, simplifying assemblies, and improving accessibility to product-contact surfaces to minimize sanitation time and reduce the risk of improper reassembly. Examples include tool-less belt removal, tilting hoppers, simplified clamps, and sloped surfaces designed to eliminate harborage points.

Given high turnover and the frequent use of temporary sanitation crews, durability during washdown has also become a priority. OEMs are improving sealing of electronics, increasing ingress protection (IP) ratings, and reinforcing enclosures to tolerate aggressive cleaning environments and inconsistent handling.

Together, these changes reflect a shift from relying on operator precision to embedding repeatability directly into machine architecture. As sanitation frequency increases, engineered repeatability may become a more visible differentiator in equipment selection.

Safety and Sanitation Converge in Equipment Design

Balancing sanitation access with operator safety has emerged as a persistent design challenge. As cleaning frequency increases and manual interaction remains common in COP-driven environments, plants seek solutions that improve cleanability without increasing safety exposure or downtime.

Interviewees highlighted growing demand for guards and access panels that remain attached during cleaning, reducing the risk of dropped or misplaced components. Washdown-rated safety hardware is also becoming more common to ensure protective systems remain functional under aggressive sanitation conditions.

These developments reflect a broader shift toward integrating sanitation efficiency and operator protection within the same design framework, rather than treating them as competing priorities.

When Sanitation Triggers Capital Replacement

In some cases, sanitation limitations are directly driving capital investment decisions. Interviewees cited the replacement of legacy equipment, including older belt conveyors, painted frames, and hollow-frame designs, that could no longer meet modern cleanability expectations.

In certain facilities, aging painted components had begun to degrade, creating contamination risks as coatings flaked into product. As cleaning frequency and regulatory scrutiny increase, these vulnerabilities are accelerating the retirement of outdated assets in favor of stainless-steel, open-channel designs capable of withstanding aggressive washdown regimes.

In these environments, sanitation limitations increasingly influence capital planning decisions rather than being treated solely as maintenance issues.



For additional insight into the sanitation realities facing CPGs and OEMs, from labor and training challenges to chemical durability concerns and the next wave of hygienic machine design, see PMMI's comprehensive **Food Safety and Sanitation Trends** report.

AI & BIG DATA

AI's integration in processing machinery

Across food processing equipment, AI has become a prominent topic of discussion. However, interviews indicate that adoption in processing environments will likely progress more gradually than in adjacent sectors such as packaging. The primary reason is not lack of capability, but risk tolerance. Processing environments carry direct food-safety implications, regulatory oversight, and product liability exposure. As a result, AI systems must meet higher reliability and accountability thresholds before widespread deployment.

Where AI Is Gaining Traction

AI has become a central theme in industry discussions, with increasing interest from processors and equipment suppliers alike. Interviewees noted that the term "AI" is often used broadly, encompassing a range of technologies from advanced analytics and condition monitoring to machine learning–based inspection systems.

What Is Being Used Today?

While full AI autonomy remains limited, data-enabled systems are increasingly embedded in processing environments. Rather than autonomous decision-making, plants are leveraging:

In many current deployments, processing environments are leveraging structured data analytics and rule-enhanced automation rather than fully autonomous learning systems.



Machine Monitoring - Some OEMs have implemented continuous data capture systems that record operating parameters and event footage to identify faults similar to modern-day doorbell camera sensors, which record pre- and post-event footage to identify faults upstream.



Inspection Systems - Traditional rule-based inspection technologies remain the backbone of processing. Metal detectors, X-ray systems, checkweighers, and vision tools continue to operate at high speeds with proven reliability. AI-enhanced vision models are increasingly being tested where product variability or complex defect patterns challenge deterministic algorithms. Early use cases focus on anomaly detection, error classification, and reducing false rejects.



Durability Simulations - Manufacturers also have internal life-cycle testing and durability simulation tools that model wear patterns, loading conditions, and the expected lifespan of components. These systems collect and analyze large volumes of performance data, such as cycle counts, motion frequency, or load profiles, to validate designs and anticipate when components may require attention.



Knowledge Transfer via HMIs - One novel AI integration is the use of LLM-style AIs trained on machine documentation, service logs, and error-code libraries. These systems can translate technical alerts into plain language and provide step-by-step troubleshooting guidance. By simplifying interpretation and reducing reliance on manuals, they enable less-experienced operators to resolve issues more quickly and reduce downtime.

Barriers limiting AI adoption

Despite growing interest, several structural barriers continue to restrict true AI deployment:

Reliability and Accountability

Interviewees noted that while AI-supported quality and machine-adjustment tools are emerging, processors must ensure consistent and predictable outcomes before allowing systems to influence product quality or process parameters. When AI begins to make or recommend adjustments, processors need clarity on who is responsible if outputs deviate — the plant, the OEM, or the AI vendor. This creates a natural incentive for deliberate rollout.

Cybersecurity and IT Governance

Historically, many processors have been cautious about systems requiring cloud connectivity. Internal IT teams often restrict outside data access, slowing adoption of cloud-trained AI models. Interviewees emphasized that interest in AI grows significantly when solutions can be deployed locally or with constrained data pathways, reducing cybersecurity concerns.

Workforce Turnover and Skills Continuity

Successful AI deployment depends on stable, knowledgeable technical teams who can maintain, tune, or retrain models over time. Interviewees repeatedly referenced the broader skills gap in processing environments. Even as OEMs and larger plants move toward machine-learning experimentation, maintaining continuity is harder in high-turnover settings.

ROI Sensitivity

Processing operates on thin margins. Interviewees stressed that AI must deliver clear, measurable gains — whether through quality improvements, labor efficiency, or reduced rework — to justify investment. Even though interest in AI is growing and data-driven tools offer promise, processors are pragmatic: high-cost tools require convincing justification before adoption.



Looking Ahead

While AI adoption in processing is likely to remain phased and risk-weighted, interviews show building momentum. OEMs are actively integrating AI-assisted quality tools, and processors are increasingly exploring where AI can support consistency, quality, and decision-making without compromising reliability. As costs decline, data pipelines mature, and validation frameworks become more clearly defined, AI's role is expected to expand gradually but meaningfully across processing operations.

For readers seeking a deeper understanding of AI in both packaging and processing equipment, PMMI's Building An AI Advantage In Packaging Equipment provides additional analysis and use-case examples relevant to this space.

SUSTAINABILITY

Water reduction, energy and waste reduction take the spotlight for sustainability

Across the interviews, sustainability appeared in many forms, including water and energy reduction, waste minimization, and sanitary design that limits scrap. OEMs noted that although sustainability remains a priority for customers, the motivation has shifted. What was once tied to meeting environmental targets is now more often framed in terms of operational efficiency and cost savings.



Water Reduction

Water use emerged as one of the most significant sustainability concerns. Processors are under growing pressure to reduce both freshwater consumption and wastewater output, which can represent substantial ongoing operating costs.

Interviewees reported a shift toward systems and cleaning methods that significantly reduce water usage. This includes replacing older designs that relied on continuous water flow for cooling with modern systems that eliminate or dramatically reduce water consumption by recirculating or internally cooling fluids.

Cleaning practices are also evolving. Many plants are moving away from traditional high-volume rinsing during sanitation, instead adopting mechanical or dry cleaning methods that reduce the amount of water sent to the drain. Examples include sweeping or mechanically removing product prior to washdown, using dry-ice cleaning methods, and purging residual material with physical devices before rinsing. These approaches limit wastewater volumes, reduce treatment costs, and improve environmental performance.

Sanitation and washdown activities can require significant water use in food processing environments. As wastewater treatment fees escalate, processors are increasingly exploring technologies that reduce the volume of water required for cleaning internal piping and processing equipment.



Cost-driven sustainability in processing

Energy Efficiency

Energy consumption is another central sustainability priority. Modern equipment designs increasingly focus on reducing power draw, improving efficiency during operation, and minimizing energy use during idle periods.

Recent design improvements include systems that significantly reduce hydraulic or motor power requirements, operating only when needed rather than continuously. These optimizations lower overall energy consumption and can provide meaningful cost savings in facilities with large fleets of equipment.

Other sustainability-aligned practices include reducing the energy load during periods when machinery is idle, such as partially staffed or shortened shifts. Automated low-power modes allow machines to remain active for monitoring or readiness while minimizing unnecessary electricity use.

In addition, some processors are evaluating the cumulative impact of motors used in conveying and pumping systems, recognizing that even incremental efficiency improvements can generate significant savings across continuous, line-wide operation.

Waste Reduction and Scrap Minimization

Waste reduction is one of the most consistently emphasized sustainability themes. Rising ingredient costs, shorter production runs, and intensifying cost pressures mean that even small increases in scrap can have a disproportionate financial impact.

Manufacturers and processors are placing greater emphasis on equipment that maintains product integrity, keeps material on the line rather than on the floor, and minimizes losses associated with changeovers or product handling. In many cases, this includes conveyor systems designed with improved containment features, such as guides or sidewalls, to prevent spillage during transfers or high-speed operation. In processes where additives or coatings account for a large share of product cost, equipment is increasingly designed to apply these materials more efficiently, reducing excess use and preventing waste.

Operational shifts with shorter runs and more frequent product changes also heighten the cost impact of defects. As a result, systems that improve accuracy, reduce variability, and prevent mistakes contribute directly to sustainability goals by keeping more product within acceptable specifications.





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