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Trends & Insights Report:

Optimizing Food and Beverage Manufacturing Facilities

Report Introduction

It's a tough time to be a manufacturer. Between workforce shortages, technology adoption, consumer expectations, energy costs, and global competition, the challenges facing manufacturers are abundant.

For food and beverage companies, the playing field is even harder. These organizations have an additional slew of considerations including strict regulation, increased supply chain complexity, perishable products, and quality control concerns.

To keep up with these issues, more food and beverage manufacturers are optimizing their facilities. However, optimization is a daunting task that spans plant enhancements, operational excellence strategies, and food safety and quality initiatives.

In this report, we highlight the optimization trends we're seeing at food and beverage manufacturers and why the human element is the most crucial component of all.

SECTION 1

On the Manufacturing Floor

Food and beverage manufacturing floors are complex, fast-paced environments.

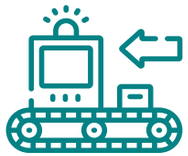
It's easy for something to go wrong in a plant due to the sheer volume of continuous action. The good news, however, is this creates numerous opportunities for improvement.

In this section, we focus on three topics we're seeing food and beverage companies prioritize when enhancing plant environments: automation and robotics, maintenance strategies, and production efficiency.

Automation & Robotics

Food and beverage companies are spending heavily on automation and robotics. Research from McKinsey's Global Industrial Robotics Survey shows automation will account for nearly 25% of food and beverage companies' capital spending from 2022-2027.[1] The areas where automation's set to have the biggest impact include production capacity, production delivery and speed, quality, safety, cost per unit, and operational uptime.

Automation Technology to Know



Vision Systems

These advanced systems use cameras, sensors, and image processing algorithms for automated visual inspections of products. Vision systems can ensure products are labeled and packaged properly, measure the size and shape of products, and, most importantly, detect defects, deviations, or inconsistencies. Because they're not impacted by the fatigue, eye strain, and lack of focus that human inspections face, vision systems are extremely accurate and highly valuable to food and beverage processors.

Growth projection: The global market growth forecast is $12.9 billion in 2023 to $18.4 billion in 2028, a CAGR of 7.3%.[2]

Robotic Arms

Robotic arms automate numerous aspects of production including dispensing, cutting, picking, packing, sorting, and packaging. Benefits of implementing these technologies include increased efficiency, greater production output, improved safety conditions, better quality control, and greater cost savings. Additionally, robotic arms reduce downtime and human error, which is especially important for manufacturing: Research shows 23% of unplanned downtime in manufacturing is the result of human error.[3]

Growth projection: The global market growth forecast is $7.7 billion in 2022 to $13.5 billion in 2030, a CAGR of 7.2%.[4]

Automated Guided Vehicles (AGVs)

AGVs are mobile robots that move items around a manufacturing facility. The main benefit of AGVs is they can operate without human intervention, following predefined paths or routes using guidance systems. AGVs are especially helpful in transporting raw materials, ingredients, and products between production areas in a manufacturing environment. AGVs not only decrease time and labor costs but also reduce accidents and injuries. Additionally, because AGVs follow repetitive tasks, the margin for error is reduced and machine operator time is freed up for more advanced tasks.

Growth projection: The global market growth forecast is $5.6 billion in 2024 to $8.3 billion in 2029, a CAGR of 8.2%.[5]

Special Automation Focus: Repack Operations

At Catena Solutions, we work with companies that are investing in automation equipment to bring repack operations in-house.

Many food and beverage manufacturers repack products, which means transferring products from original commercial packaging to packaging suitable for consumer consumption or retail. Repacking is labor intensive, which is why some manufacturers outsource repacking to a contract packer (co-packer). A co-packer packages and labels products for the client, saving time and labor.

However, using a co-packer means less control. The manufacturer must abide by the co-packer's production schedule and costs. With food and beverage products, quality control can also become more complex.

That's why our team is seeing more manufacturers implement automation and robotics to handle repack operations on their own. In fact, Catena Solutions led a global snack food company through a repack transformation, which will save the company $2.3 million annually, increase capacity, and streamline operations. *Learn more about this project.*

> "While automation can be incredibly helpful, it's critical to understand ROI with these initiatives, including the investment in people. Companies need to ensure the high investment of these technologies is worth what they're going to get out of it in terms of eventual cost savings and production efficiency. Otherwise, organizations are transforming for the sake of getting the shiniest and newest product."
>
> ***Geoff Olsen, Leader of the Supply Chain Practice at Catena Solutions***

Maintenance Strategies

Manufacturing downtime is extremely pricey, costing an average of $260,000 per hour.[6] Additionally, research has found poor maintenance strategies can reduce a facility's overall production capacity by 5-20%.[7] With the amount of varied machinery in a food and beverage manufacturing plant, maintenance strategies can't be compromised.

Preventative or Predictive? How About Both

Preventative Maintenance

Perhaps the most important maintenance function in a facility is preventative maintenance. Many outdated food and beverage manufacturing plants approach maintenance in a reactive manner—when something breaks, technicians are called in to fix it, and companies pay the price of that downtime.

Proper preventative maintenance strategies boost a common facility KPI: mean time between failures (MTBF). A higher MTBF means lower costs and a lengthened asset lifespan. Tracking MTBF allows facility leaders to better plan preventative maintenance and prevent breakdowns, and 78% of companies that track and implement preventative maintenance see an increase in equipment lifespan.[8]

Predictive Maintenance

The next evolution of an elevated maintenance strategy, predictive maintenance utilizes data and technology to optimize maintenance tasks in real-time. Equipment is outfitted with sensors, programmable logic controllers, and ERP systems to monitor performance and send alerts prior to failure. Highly optimized facilities have advanced analytics, AI, and IoT technology systems that use data-driven insights to alert technicians of potential issues. A strong predictive maintenance program[7] can lead to:

- 5–10% material cost savings
- 5–20% reduced inventory carrying costs
- 10–20% increased equipment uptime and availability
- 20–50% reduced maintenance planning time
- 5–10% reduced overall maintenance costs

Maintenance Considerations in the Food and Beverage Industry

Food and beverage facilities have unique needs, making a proper maintenance strategy nonnegotiable. This includes:

- **Stricter regulations:** Equipment needs to be running properly to avoid illness, outbreaks, and lawsuits.
- **Product loss:** Perishable items can be lost quicker when machines fail.
- **Sanitation:** Frequent cleanings of machinery can wear down equipment faster.
- **Complexity:** Food processing equipment is highly complex and may require specialized maintenance personnel.
- **Connectedness:** A production line contains various connected equipment, so a machine failure impacts an entire line.

> "One of our clients, a multinational food processor, is working on automating preventative maintenance. Essentially, they're deploying robots to go around to each machine and check critical parts to ensure the equipment is running as it should and isn't headed towards failure."
>
> ***Lexi Addison, Consultant Engagement Director, Supply Chain Practice at Catena Solutions***

Production Efficiency

While the automation, robotics, and maintenance strategies covered above should lead to greater production efficiency, we want to highlight three more areas we're seeing food manufacturers focus: technology integration, workspace design, and continuous improvement.

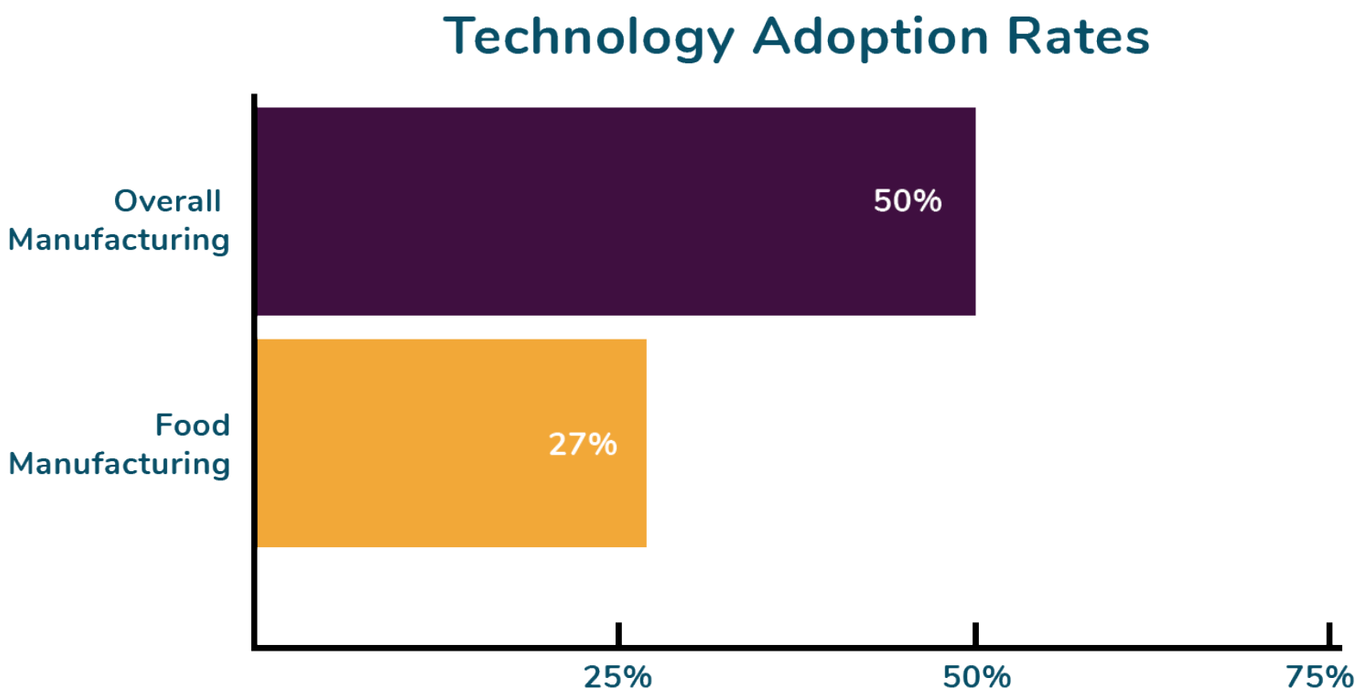
Production Efficiency Focuses

Technology Integration

Integrating the right technology into production has countless benefits. However, technology integration must be done carefully and correctly. Employees may be skeptical of the initiative, or, at the very least, will require training to work with new systems and machines. Companies need to bring in the right resources experienced with change management and adoption to properly implement technology.

While manufacturing has seen an 80% increase in Industry 4.0 adoption since 2019,[9] it's generally larger manufacturers that are keeping up. The same research shows 72% of all manufacturers have yet to implement efficiency-boosting tech. For the food and beverage industry specifically, only 27% of manufacturers are using smart manufacturing, compared to 50% of the overall manufacturing industry.[10]

> "At the end of the day, people are willing to work with new machines if it makes their lives better and they're not putting themselves or their friends at risk. However, it's important that companies ensure employees know their job is secure and that the new technology will help them gain new skills and advance their career."
>
> ***David Kaissling, Supply Chain & Manufacturing Consultant***
>
> *(Read our Q&A with David here)*



Workspace & Workflow Design

For optimized production, manufacturers should work with professionals to design the workspace to support greater efficiency. This includes developing the layout and flow of lines to reduce unnecessary movements that impede production processes and time.

In addition to workspace design, organizations can leverage outside resources for an optimized workflow. Workflow design details the different aspects of making a product, who's responsible for each, and the steps required. Having a workflow design in place creates a systematic and streamlined process and leaves minimal room for error. Implementing workflow management software will also help manufacturers automate tasks and improve communication and collaboration.

Continuous Improvement

Continuous improvement is highly regarded in manufacturing environments. Some companies use these methodologies in a turnaround context; others simply want to move from good to great. Additionally, following a continuous improvement method helps streamline operations, provides greater employee autonomy, and encourages innovation.

Here are methods you're likely to see in food and beverage manufacturing:

- **Lean:** Focuses on reducing waste and maximizing productivity to drive value.
- **Six Sigma:** Aims to minimize defects and inconsistencies within the end product.
- **Total Quality Management:** An organization-wide methodology that emphasizes customer satisfaction.
- **Kaizen:** Focuses on small, incremental changes that add up to bigger improvements over time.
- **5S:** Consisting of Sort, Set in Order, Shine, Standardize, and Sustain, 5S is the system for maintaining a clean, efficient, and safe workplace.
- **Theory of Constraints:** Addresses and alleviates the most significant constraints in a process.
- **Agile:** Focuses on flexibility, collaboration, and rapid feedback to maximize the value of resources in the shortest amount of time.
- **Kanban:** A visual workflow technique to optimize workflows and reduce waste in processes.
- **5 Whys:** Uncovers the root cause of a problem through digging into the reasons for failure.

SECTION 2

Achieving Operational Excellence

Though the opportunities for improvement within a facility are abundant, companies can't ignore the critical task of assessing and improving internal processes to achieve optimization goals.

In this section, we feature strategies for operational excellence, specifically around cost optimization and planning techniques, and why these efforts are just as vital as physical upgrades.

Cost Optimization

Cost optimization for food and beverage companies involves considering raw materials, seasonal demand, equipment investments, energy expenses, consumer preferences, and more. Additionally, a close working relationship between manufacturing leaders and corporate finance and planning departments is required, so communication and data sharing are key.

Focus Areas for Cost Optimization

Lowering Cost of Goods Sold (COGS)

Also referred to the "cost of sales," COGS are the direct expenses of producing goods such as the cost of materials and direct labor. COGS excludes indirect expenses like distribution costs, software, and shipping. Lowering COGS not only improves profit margins but helps companies price products and get taxed appropriately.

Tips for lowering COGS: Focus on eliminating waste, reducing deadstock, negotiating better prices, and implementing automation technology. This may involve outsourcing aspects of production to third parties for companies that can't manage it in-house.

> "Finance plays a crucial role in driving cost optimization efforts in food and beverage manufacturing facilities by providing financial insights, guiding investment decisions, ensuring efficient use of resources, and offering the strategies necessary to identify, prioritize, and implement cost-saving initiatives."
>
> ***Rich Medrano, Leader of the Revenue Growth Practice at Catena Solutions***

Total Cost of Ownership (TCO) Analyses

Total cost of ownership is a metric used to assess the long-term value of an asset, such as a piece of machinery. Purchase price alone is not an accurate way for companies to determine if an asset is a good investment. TCO in a manufacturing environment considers the additional cost of daily operation expenses, maintenance, and skilled labor needed to operate machinery.

Since the leading cause of unscheduled downtime in U.S. manufacturing is aging equipment,[11] companies need to conduct TCO analyses to ensure their equipment is providing an acceptable ROI and supporting business growth.

Tips for a TCO analysis: Data is crucial for an accurate TCO analysis. Working with expert resources can ensure food and beverage manufacturers are collecting the right data and evaluating the metrics needed for a TCO analysis to be useful.

Negotiation & Strategic Sourcing

Negotiation and strategic sourcing are about more than getting the best price. Procurement leaders in a food and beverage manufacturing environment can use negotiation to improve supplier performance, relationships, and costs within their processes. Organizations we're working with are focusing on regularly reviewing contracts, exploring bulk purchasing options, and proactively analyzing manufacturing expenses to identify opportunity areas.

Tips for thoughtful negotiation and sourcing:

- Focus on a strategy that fits with your overall business vision
- Ensure you're aligned with your partners' mission and strategy
- Approach negotiation with authenticity
- Focus on win-win negotiations where both parties gain value
- Develop ground rules, communication frameworks, and KPIs for ongoing relationships

Energy Efficiency

The amount of energy used in U.S. food production is astounding: The U.S. consumes as much energy preparing and transporting food as France uses to power the entire country for a year.[12] Food production accounts for 16% of that energy as manufacturers use resources for electricity, cooling, and heating plants. Improving energy efficiency is not only good for sustainability purposes but also reduces costs.

Tips for optimizing energy use:

- Invest in energy-efficient production equipment and operational systems
- Use automation technology and energy management systems to track energy use
- Conduct regular energy audits to identify areas of improvement
- Consider renewable energy sources like solar and wind power

A Note About Transportation & Distribution Expenses

Indirect expenses, specifically shipping and transportation costs, can be overlooked during an initiative to optimize a facility. However, these costs are closely tied to facility optimization as insufficient distribution processes are a major profitability hindrance to even the most well-run facilities. Catena Solutions recently worked with a seafood manufacturer that was struggling with its transportation and logistics approach. By creating a strategy to optimize the overall carrier base, we enabled the company to achieve 30-40% transportation cost savings depending on the shipping lane. *Learn more about the project here.*

Prioritizing Planning & Efficiency

When it comes to facility optimization, it's not always about getting the newest and best technology or products out there. Evaluating and improving current processes and planning goes a long way in improving operations and saving money at the plant level. Here are planning methodologies we're seeing food and beverage companies prioritize the most.

Planning & Operational Efficiency Methods to Consider

Material Requirements Planning (MRP)

MRP identifies what's needed, how much, and when to ensure materials are available for production while minimizing inventory costs. Companies that utilize MRP can better match supply to demand and improve inventory control. A survey of manufacturing firms also revealed those utilizing MRP experienced an average reduction of 25% in lead times and a decrease of 40% in excess inventory levels.[13]

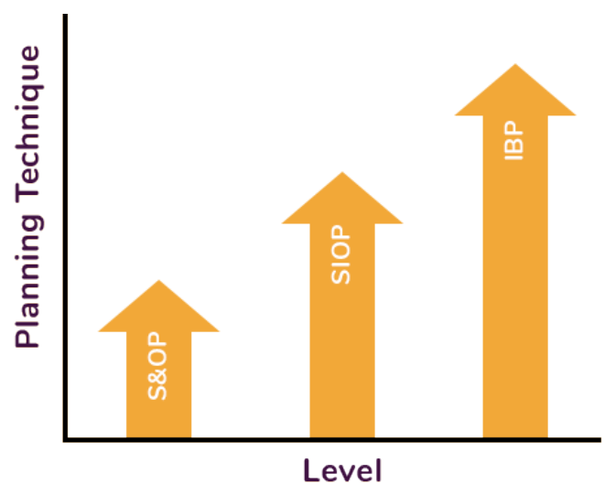
However, accurate data is crucial for MRP to be successful. MRP systems calculate the quantities of materials needed for production based on the master production schedule, bill of materials, sales forecasts, customer orders, and inventory levels. Without real-time and reliable data tracking these metrics, companies are unable to use MRP for planning.

Advanced Planning Techniques

Moving from basic supply and demand planning to advanced techniques provides companies with the insights and collaboration needed to optimize manufacturing operations. Planning techniques food and beverage companies implement for sustained success include:

- **Sales & Operations Planning (S&OP):** S&OP focuses on aligning sales forecasts with production plans and resources to meet customer demand.
- **Sales, Inventory & Operations Planning (SIOP):** The next iteration of S&OP, SIOP brings inventory management and additional production and planning considerations to the S&OP process to achieve supply chain goals.
- **Integrated Business Planning (IBP):** IBP integrates functions and processes across an entire organization, including sales, operations, finance, marketing, and supply chain. IBP is more comprehensive than SIOP and S&OP because it encompasses strategic, financial, and operational planning activities.

Looking for help with your company's IBP development? Catena Solutions revamped a Fortune 500 food manufacturer's IBP process, establishing a foundation for continuous improvement and implementing streamlined solutions. *Learn more about the project here.*

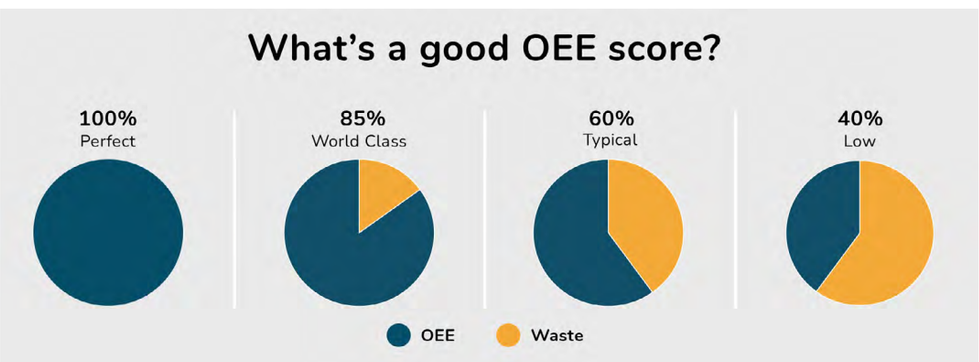


Compared with companies that don't utilize IBP, the average mature IBP practitioner experiences service levels 5-20% higher.[14]

Improving Overall Equipment Effectiveness (OEE)

A manufacturing best practice, OEE is the metric for measuring planned production time that is truly productive. Measuring OEE is essential for companies to compare the performance of an asset to industry standards or the results of different shifts working on the same asset. OEE is also used to track progress over time in eliminating waste from a given production asset.

In manufacturing facilities today, sensors on equipment capture run time, down time, and cycle times. This allows manufacturers to gain insight into issues with production lines so they can improve systems and plant efficiency. OEE software is especially valuable to the food and beverage industry because it alerts to issues in real time so manufacturers can react quickly, wasting less product.



Inventory Accuracy

Inventory management and accuracy must be highly prioritized in the food and beverage industry. Organizations need to balance having the stock to meet customer demand while also avoiding excess inventory levels and product waste.

Best practices we're seeing at our customers include:

- **First In, First Out (FIFO):** With FIFO systems, the oldest inventory items are used first. FIFO is helpful for preventing spoilage and ensuring products with shorter shelf lives are distributed first.
- **Just-in-Time (JIT):** JIT inventory management synchronizes inventory levels with production schedules, reducing excess inventory and storage costs.
- **Lot Tracking:** With lot tracking, a manufacturer assigns a unique identifier to batches of raw materials, ingredients, or finished products so they can trace its movement. Lot tracking is especially helpful in the event of recalls or quality issues.
- **ABC Analysis:** An ABC analysis categorizes inventory items into three categories (A, B, or C) based on their value. The classification system helps prioritize ordering, storage, and replenishment activities.

> "I want to call attention to the importance of data in inventory management. Food and beverage organizations need to leverage data analytics modeling technologies to gain insight into a company's inventory data and create a plan to reduce carrying costs and minimize stockouts. Additionally, inventory planning needs to be integrated with S&OP, SIOP, and IBP processes to make sure it's properly managed to reduce inventory waste."
> ***Dave Minor, Vice President of Delivery at Catena Solutions***

SECTION 3

Ensuring Safety & Quality

The most critical aspect of food and beverage manufacturing can also be the most challenging.

Many issues stand in the way of seamless quality and safety programs including complex supply chains, increased regulatory controls, contamination risks, shelf-life management, consumer expectations, and lack of skilled labor.

In this section, we highlight ways we're seeing food and beverage companies address growing challenges with food safety and quality. Plus get insight into the FSMA 204 ruling and strategies for dealing with recalls and audits.

Food Safety & Quality

All industries have set regulations to follow for manufacturing. However, the food and beverage industry's safety and quality considerations are growing faster than ever. In 2022, the U.S. Food & Drug Administration (FDA) saw a 700% increase in recall units compared to 2021.[15] While this sounds alarming, food and beverage manufacturers understand increased recalls are linked to stricter regulations as regulatory bodies work to prioritize consumer safety.

FSQ Trends to Know

Food Safety Modernization Act (FSMA) Section 204

In late 2022, the FDA published Section 204 of the Food Safety Modernization Act (FSMA), also known as the Food Traceability Rule.

The rule governs that by January 2026, businesses that manufacture, process, pack, or hold foods on the FDA's Food Traceability List (FTL)[16] must adhere to traceability requirements for those items. The list includes products like non-pasteurized cheeses, nut butters, fresh produce, fresh seafood, and ready-to-eat salads.

The biggest challenges[17] for companies reaching FSMA 204 compliance:

- **Data:** Companies need advanced data governance, privacy, architecture, capture, processing, and standardization processes to be able to accurately track items throughout the supply chain.
- **Processes:** Many producers don't have standardized processes around lot-level traceability or labeling, which can hinder compliance with the ruling.
- **Stakeholders:** Suppliers may not follow the same standards that manufacturers are implementing, and supply chain employees and partners will likely need training on FSMA 204 compliance.
- **Technology:** Many producers rely on legacy technology systems that aren't set up to trace ingredients and products throughout their lifecycle.

> "Although all companies follow current FDA regulation and guidelines, few have started the process to become compliant with FSMA 204 by the deadline because many don't have the supply chain visibility needed for this regulation. It takes highly accurate data to be able to identify the journey of an ingredient. This is an area where outside experts can be incredibly helpful to prepare for compliance."
>
> ***Geoff Coltman, Senior Vice President at Catena Solutions***

The Top 5 Issues at Processing Plants

Source: Food Processing's 2024 Manufacturing Outlook Survey[18]

Recalls & Audits

What we're seeing at more food and beverage manufacturers are recalls that have been strategically thought out. Rather than companies announcing recalls and causing panic, manufacturers are taking more time to work with the FDA and USDA to truly understand the recall process and how to navigate it. That way, when a recall is announced, the company already has a solution in place and can work on rectifying the issue and gaining public trust back, which is crucial: 18% of consumers would abandon a brand if a recall was issued due to consumer sickness and 43% would leave a brand for months before coming back.[19]

Manufacturers also undergo various audits to ensure their facilities are up to food safety standards and avoid the costly and reputation-damaging impact of recalls. As regulatory bodies increase standards, manufacturers need to identify criteria for the partners they work with, including co-manufacturers and suppliers. This may entail creating a supplier code of conduct to ensure partners are adhering to the same standards and safety protocols that manufacturers have.

"I think the biggest obstacle to implementing FSQ solutions is a lack of training," said Esther Levy, Food Scientist, MBA. "Organizations need to allocate enough budget for continuous education for FSQ departments. Companies should work on creating an FSQ culture, which is difficult sometimes. Creating that culture can get a bit neglected, especially in fast-paced environments. A company may have comprehensive, well-documented procedures, but if they don't have the right training in place, they can't ensure employees are following them."
(Read our Q&A with Esther here)

> "Food safety and quality compliance is an area where humans are more important than ever. While technology is helpful for FSQ initiatives, this is an area of food and beverage manufacturing that requires more critical thinking. Human expertise is essential to ensure absolute accuracy with safety standards."
>
> ***Stacy Johnson, Consultant Engagement Director, Supply Chain Practice at Catena Solutions***

SECTION 4

In Conclusion: Harness the Human Element

Your employees are the most important investment you'll ever make, but the manufacturing industry is struggling to retain that investment: 85% of businesses in manufacturing report feeling the strains of the talent gap[20] and 71% of manufacturers cite the inability to attract and retain employees as their primary challenge.[21]

"The most important method is engaging people," said David Kaissling, Supply Chain & Manufacturing Consultant. "Create a clear vision and strategy, make sure everybody understands it, and keep measuring yourself and reporting on it so everyone can see what's important. Providing recognition, encouraging wins, and teaching employees what to do to solve their problems can go a long way." *(Read our Q&A with David here)*

On the following page, we provide insight on what employees need in order to accept new initiatives with an open and committed mind.

Build a Stronger Workforce

The manufacturing optimization focuses covered so far in this report can be rendered useless without one crucial element: employee buy-in. At the end of the day, manufacturing facilities are a people-first operation. Without engaged and committed workers, other initiatives are bound to fall flat.

Build your workforce of the future with these focuses:

Employee Engagement

Engaged employees are 70% more productive and experience 70% lower turnover than non-engaged ones

Trust & Authenticity

Workers at high-trust companies report 74% less stress and 29% more satisfaction with their lives

Change Management

73% of change-affected employees experience moderate to high stress levels

Upskilling

80% of manufacturing workers want to upskill, but the biggest roadblock is having enough time

Valuable Benefits

Flexibility, work-life balance, better pay, career advancement, and mentorship are most desired

Improving Processes

Efficient ways of working and ease of use of systems are highly impactful in creating a positive workplace

Sources: Employee Engagement,[22] Trust & Authenticity,[23] Change Management,[24] Upskilling,[25] Improving Processes[26]

"When you think about all the elements of optimizing a food or beverage manufacturing facility—whether it's technology, equipment, or processes—there's always a people element. For any of these transformations to be successful, the focus needs to be on people first and foremost. At Catena Solutions, we have the expertise needed to empower employees to embrace transformation initiatives, putting your company on a path towards optimized, successful operations."

Matt Wessels, Leader of the Human Capital Practice at Catena Solutions

Optimizing manufacturing is a major undertaking.

Catena Solutions is here to help. We support food and beverage organizations, leveraging our expertise to drive growth, optimize operations, and navigate industry challenges.

With our network of industry experienced consultants, we advise and execute on client initiatives in the areas of strategy, optimization, people, and regulation.

For more information, visit us at **catenasolutions.com**

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