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THE HIDDEN COSTS OF HUMAN ERROR IN FOOD MANUFACTURING



EXECUTIVE SUMMARY

The food manufacturing industry operates continuously in a high-stakes environment where human actions are as critical as equipment performance. Despite advancements in technology, human error remains a significant and costly challenge, contributing to product recalls, operational disruptions, and reputational damage. This whitepaper explores the underlying causes of human error, its financial and operational impacts, and actionable strategies to mitigate these risks.

Human error accounts for 23% of unplanned downtime and is responsible for 56% of product recalls, primarily due to mislabeling, contamination, and undeclared ingredients. Errors also contribute to 10.9% of food waste, highlighting their pervasive impact on operational efficiency and cost. Beyond immediate losses, human error undermines brand trust, with over half of consumers avoiding brands linked to recalls, compounding long-term financial consequences.

Errors in food manufacturing stem from ambiguous Standard Operating Procedures (SOPs), reliance on manual tracking, and human tendencies such as fatigue, distractions, or overconfidence. The absence of real-time accountability exacerbates these issues, allowing small oversights to escalate into larger crises.

The Boar's Head Listeria outbreak of 2024 illustrates the devastating consequences of human error. Lapses in sanitation and oversight led to widespread illness, fatalities, and financial losses not uncommon to exceed \$30 million. This case underscores the urgency of addressing systemic gaps in human error management.



EXECUTIVE SUMMARY

To reduce human error, manufacturers must integrate people, processes, and technology.

Key strategies include:

- **Digital SOPs:** Dynamic workflows ensure clarity, eliminate ambiguity, and enhance compliance.
- **Real-Time Monitoring:** Systems validate task completion and provide immediate alerts for missed steps, improving traceability and accountability.
- **Integrated Data Streams:** Merging human action data with machine insights enables predictive analytics and operational improvements.
- **Culture of Accountability:** Continuous training and feedback mechanisms empower employees to adhere to safety and quality standards.

Minimizing human error drives measurable gains, including reduced recall costs, waste elimination, and improved compliance. Operationally, it streamlines processes, enhances productivity, and simplifies audits. Strategically, it builds consumer trust, aligns with sustainability goals, and fosters a competitive edge.

In an era of Industry 4.0, integrating human action data with machine-generated insights is crucial for achieving operational excellence. Solutions like Zendelity's Command Center empower manufacturers to reduce errors, protect their brands, and unlock long-term value.

Addressing human error is no longer optional—it is a necessity for sustainable growth and resilience in food manufacturing. By adopting proactive measures today, organizations can safeguard their future and ensure the highest standards of safety and quality.



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THE SCOPE & IMPACT OF HUMAN ERROR

Food manufacturing is a 24/7/365 complex and high-stakes industry where people, alongside equipment, play a critical role in delivering safe, high-quality products. While manufacturers collect extensive data on equipment performance, human actions often remain a blind spot, even though they are equally vital to ensuring food safety and quality. This disconnect leaves organizations vulnerable to one of the most persistent challenges in the industry: human error.

Human error is a leading cause of food safety issues, contributing significantly to product recalls and reputational damage. It poses a big impact to the bottom line.

- Engineer.com revealed that up to 23% of unplanned downtime are attributed to human error[1].
- Food Safety News highlighted 56% of recalls, resulted from operational mistakes, such as incorrect labelling, the presence of an undeclared ingredient, or contamination during the production process.[2]
- New Food Magazine reports that the daily transgressions made during the food production process account for 10.9% of food waste.[3]



[1] Engineering.com - [Human Error is Worse in Manufacturing Compared to Other Sectors](#)

[2] Food Safety News: [Food safety compromises can carry costly consequences](#)

[3] New Food Magazine: [How human error and bias can jeopardise food safety and quality](#)

THE SCOPE & IMPACT OF HUMAN ERROR

On the flip side, although human actions can introduce errors, people also bring a critical element of observation that machines alone cannot replicate. For instance, an operator might notice a subtle anomaly, such as a change in texture or odor, that equipment sensors are not designed to detect. These insights can provide valuable context to machine-generated data, enhancing the overall understanding of the manufacturing process. However, without systems to capture and integrate these observations, their value is often lost.

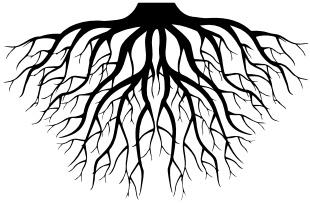
What's also important to consider as you explore the impact of human error, is that the implications can be felt for years to come, according to the recent Gallup poll, 53% of people said they avoid buying specific brands or types of food because of a recall or advisory,[4] making the cost of regaining loyalty steep.

These errors arise from various factors, including distractions, overconfidence, fatigue, or intentional shortcuts. In fast-paced and complex manufacturing environments, such mistakes are inevitable but not insurmountable.



[4] Newsweek: [Food Recalls Affect Millions of Americans in 2024](#)

THE ROOT CAUSE OF HUMAN ERROR



Human error in food manufacturing is both widespread and multifaceted, encompassing missteps in executing SOPs, conducting inspections, and maintaining traceability throughout the production process. These errors arise from a variety of causes, but the common thread is the interplay between human actions and the complex demands of manufacturing environments.

One significant contributor to human error is the complexity or ambiguity of instructions. When SOPs are unclear or excessively detailed, employees can easily misinterpret steps, leading to mistakes. This is exacerbated by reliance on manual tracking systems or unstructured data, which are prone to inconsistencies and create blind spots in the production process. Furthermore, the absence of real-time accountability and visibility means errors often go unnoticed until they escalate into more serious problems.



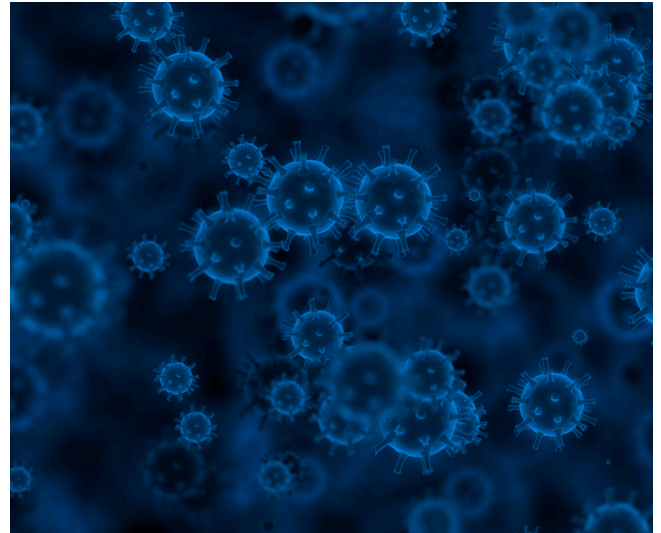
Human nature itself plays a crucial role in the persistence of these errors. Distractions, such as daydreaming or losing focus during repetitive tasks, can lead to missed steps. Overconfidence may cause employees to skip what they perceive as unnecessary procedures, while fatigue or stress increases the likelihood of lapses in judgment. Intentional shortcuts, taken to save time or effort, can also undermine safety and quality standards. These human tendencies, while understandable, pose significant risks in the context of food manufacturing,

Despite the critical nature of these errors, they are relatable on a human level. Everyone has experienced moments of distraction or oversight, from sending an incomplete email to skipping a step in a routine process. While these errors might seem minor in everyday life, their consequences in food manufacturing can be catastrophic. This universally underscores the need for robust systems and strategies to mitigate human error and ensure consistent adherence to safety and quality standards. By addressing these challenges, food manufacturers can protect their operations, brands, and consumers from the far-reaching effects of human error.

REAL-WORLD IMPLICATIONS

Real-world examples illustrate the severe consequences of human error in food manufacturing.

In 2024, Boar's Head faced the deadliest Listeria outbreak in over a decade, resulting in the recall of 7 million pounds of deli meats, including liverwurst, bologna, smoked ham, and pre-packaged bacon and sausages. The outbreak, traced to a specific production process at their Virginia plant, caused at least 57 hospitalizations and 9 deaths across 18 states. Investigations revealed extensive health violations at the plant, including the presence of mold, rust, and insects, which had been flagged as early as 2022 by the USDA Food Safety and Inspection Service (FSIS).[5]



The financial and reputational fallout was catastrophic. Boar's Head permanently closed the Virginia facility, discontinued its liverwurst product, and established a Food Safety Council to address quality assurance gaps. Lawsuits alleging personal injuries, wrongful death, and deceptive marketing practices have continued to mount, adding to the substantial costs of the recall and brand rehabilitation.[6]

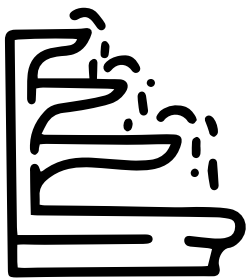
This case underscores how a single breakdown in human processes can lead to widespread public health crises, significant financial losses, and long-term damage to consumer trust.

[5] Food & Wine: [The Deadliest Listeria Outbreak in a Decade Prompts the Permanent Closure of a Boar's Head Plant](#):

[6] New York Post: [Lawsuits piling up for Boar's Head following listeria outbreak that killed 9](#)

QUANTIFYING THE COSTS

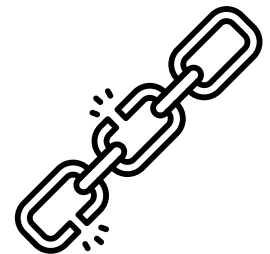
The financial implications of human error are considerable. According to Food Safety News, the financial impacts of a recall can reach \$30 million, with 23% of respondents reporting even higher costs.[7] Additionally, downtime caused by addressing these issues disrupts production and delays orders, further compounding the financial losses. Indirectly, regulatory penalties can add tens of thousands of dollars in fines, while reputational damage leads to a loss of consumer trust.



To put this in perspective take a single oversight, such as missing a simple sanitation task during a routine shift change, and the cascading crisis it can trigger. Imagine a mid-sized food processing plant where contaminants enter the production line due to such an oversight. This seemingly minor lapse results in a widespread recall. These costs include product retrieval, disposal, lost sales, and operational downtime while investigating the issue, halting production, and delaying customer orders.

The ripple effects extend well beyond these direct financial hits. Regulatory fines for non-compliance add tens of thousands of dollars to the burden, while negative media coverage erodes consumer trust. Retailers often react by reducing shelf space for the affected brand, compounding long-term revenue losses. Furthermore, the inefficiencies introduced by managing recalls, retraining staff, and addressing compliance issues divert valuable resources from core operations.

Human error not only disrupts workflows but also exposes the interconnected vulnerabilities of food manufacturing operations. These mistakes—whether caused by distraction, fatigue, or shortcuts—are an inevitable part of human nature. Without systems to catch errors in real time, businesses are left to face the cascading effects unchecked. Addressing human error is no longer just a risk management strategy; it is essential for safeguarding financial health, operational efficiency, and brand reputation. Proactive investments in error-proof systems and processes are crucial for ensuring long-term success in an industry where stakes are increasingly high and the cost of mistakes can be catastrophic.



[7] Food Safety News: [Food safety compromises can carry costly consequences](#)

WHY HUMAN ERROR PERSISTS

Human error is not a new challenge in food manufacturing, yet it remains one of the most persistent and costly issues the industry faces. Understanding why these errors continue to occur is key to addressing their root causes and implementing effective solutions.

Despite advancements in technology, many critical tasks in food manufacturing—such as sanitation checks, ingredient verification, and packaging inspections—still depend heavily on human execution. These tasks are prone to inconsistencies, as employees may deviate from SOPs due to lack of training, unclear instructions, or the pressure to meet production targets. The reliance on manual methods exacerbates the risk of errors and increases the likelihood of non-compliance with regulatory standards.

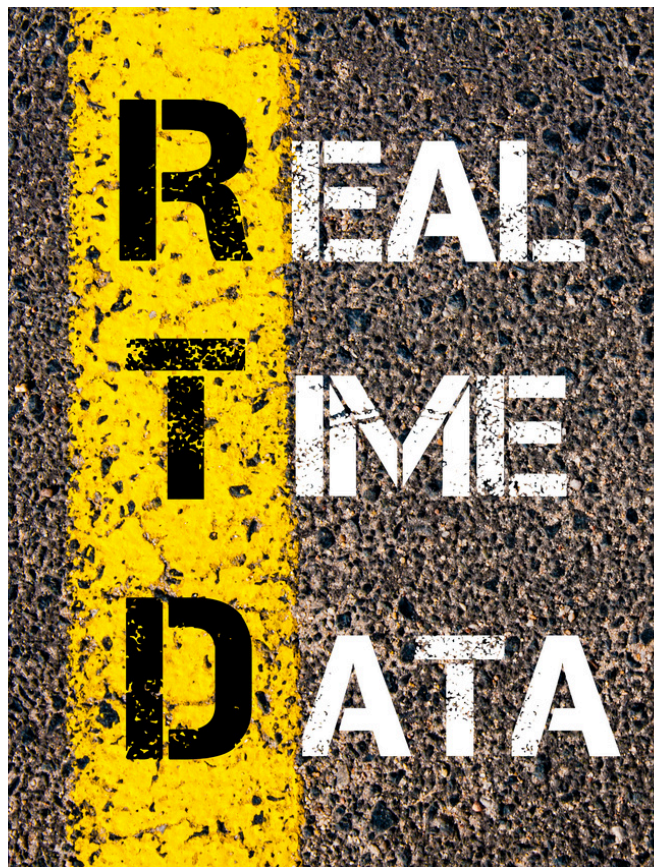


While current technologies may capture basic information, they fail to deliver the consistency, accuracy, and real-time visibility needed to ensure compliance. Even advanced systems like manufacturing execution systems (MES) and quality management systems (QMS) are primarily focused on equipment and process monitoring, leaving human action data siloed and disconnected from broader operational insights.

WHY HUMAN ERROR PERSISTS

This lack of integration creates significant blind spots in accountability, allowing critical errors in human procedures to go unnoticed. Without the ability to unify and analyze human data, these gaps in tracking undermine the ability to proactively address risks, leading to preventable food safety and quality issues.

Modern manufacturing relies heavily on real-time insights for decision-making. Equipment data is readily available, providing metrics on performance, output, and efficiency. However, there is often no equivalent data stream for human actions. Did an employee complete a sanitation task correctly and on time? Did they follow the SOP as intended? Without real-time data capturing these actions, errors are only identified after they have escalated into more severe issues. This reactive environment significantly hampers a company's ability to proactively manage food safety and quality.



By understanding why human error persists, food manufacturers can begin to implement proactive measures to bridge the gaps, integrate data streams, and create a more resilient and effective operation. This requires not just better technology but also a shift in mindset to view human actions as both a challenge and an opportunity for improvement.

PROACTIVE STRATEGIES FOR MITIGATION

Reducing human error in food manufacturing requires a proactive approach that integrates people, processes, and technology. The goal is to ensure that human actions are consistently aligned with operational goals and compliance requirements while addressing gaps in existing systems.

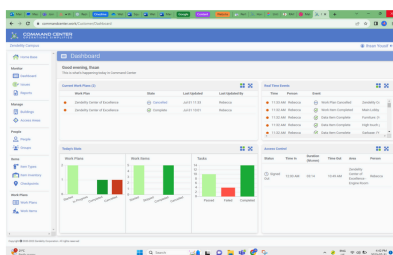
Digital SOPs for Error-Proof Processes

Digital Standard Operating Procedures (SOPs), not just a digital form, are a critical step in minimizing human error. By replacing static, paper-based instructions with interactive and dynamic digital workflows, manufacturers can provide employees with clear, step-by-step guidance tailored to the specific task at hand. This approach eliminates ambiguity and reduces reliance on memory or outdated instructions.



Automated updates ensure that SOPs remain current and accessible, allowing teams to immediately adapt to new regulations or process changes. Additionally, integrating these SOPs into workflows minimizes the risk of deviation, ensuring consistent execution across shifts and locations.

Real-Time Monitoring and Traceability



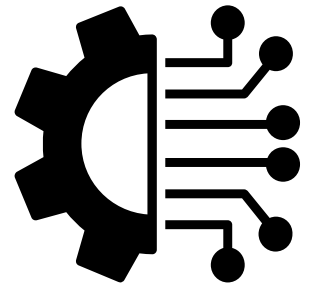
Real-time monitoring and traceability are essential components of a proactive strategy. Systems that validate task completion securely, using methods like near-field communication (NFC), provide greater accountability and trust in the accuracy of data, unlike QR and bar codes that can easily be replicated. Immediate alerts for missed or incorrectly executed tasks allow supervisors to intervene quickly, preventing minor issues from escalating into larger problems.

Effective traceability systems also connect human actions to a product's lifecycle, providing a comprehensive and auditable record. This integration is vital for meeting regulatory standards and maintaining transparency throughout the supply chain.

PROACTIVE STRATEGIES FOR MITIGATION

Integrating Human Procedure Data Alongside Equipment Data

The integration of human procedure data alongside equipment data is another essential element in reducing human error. Therefore, look for a solution that provides structured and normalized human action data out of the box, so it can be seamlessly incorporated into analytics and Industry 4.0 initiatives. This unified approach enhances operational insights, as human observations often provide context that machine-generated data cannot.



Building a Culture of Accountability and Improvement



Building a culture of accountability and continuous improvement ensures that these strategies deliver sustained benefits. Embedding training opportunities into daily workflows allows employees to learn and apply knowledge in real time, bridging the gap between theoretical instruction and practical application. Continuous feedback mechanisms reinforce accountability, providing employees with actionable insights on their performance. Empowering teams with access to data helps them understand the impact of their roles on overall operations, fostering a sense of ownership and encouraging proactive decision-making.

Focusing on Solutions for People, Processes, and Technology

Addressing human error is not about eliminating the human factor but empowering it. By leveraging the right tools, processes, and technology, manufacturers can create an environment where people and machines work in harmony. This holistic approach reduces errors, improves compliance, and unlocks the full potential of operational excellence. Through these proactive strategies, food manufacturers can not only address the challenges of human error but also position themselves for long-term success in an increasingly competitive and regulated industry.

THE ROI OF REDUCING HUMAN ERROR

Investing in strategies to minimize human error is not just about mitigating risk—it's a direct path to measurable financial, operational, and strategic gains. Food manufacturers face staggering costs when errors occur, with recalls often exceeding \$30 million per incident. Yet, proactive measures turn these risks into opportunities for savings and growth. Preventing errors reduces costly recalls, cuts raw material waste and eliminates inefficiencies like overtime and corrective labor. These savings free up resources to drive innovation and growth.

Operationally, addressing human error streamlines processes and boosts productivity. Facilities that reduce disruptions achieve higher efficiency, while real-time monitoring ensures tasks are completed correctly the first time. Automated systems also simplify regulatory audits, saving valuable time and reducing compliance headaches. The result? Smooth-running operations that can scale seamlessly in an increasingly competitive industry.

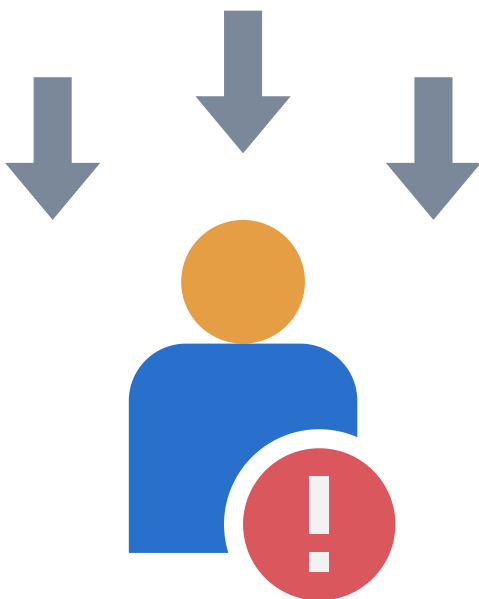


The strategic benefits are just as compelling. By proactively reducing errors, manufacturers enhance brand trust and consumer loyalty in a market where transparency and safety are non-negotiable. Avoiding recalls protects reputations and preserves valuable shelf space, while waste reduction aligns with sustainability goals that appeal to regulators and eco-conscious consumers alike. This positions manufacturers as industry leaders, balancing innovation with accountability.

By adopting these strategies facilities can save millions annually in recall costs, penalties, and waste reduction, all while cutting downtime and reducing errors. More than a risk management strategy, reducing human error is an investment in the future—a key to operational excellence and long-term profitability. Today's actions to integrate human and machine data lay the foundation for tomorrow's industry leaders.

THINK LONG TERM IMPACT

As stated by the GfSi, "At the heart of today's food safety and supply chain challenges is a lack of visibility. Because of paper-based record-keeping and fragmented data systems, achieving real-time supply chain visibility has been difficult. When data is not digitized and accurate, it cannot be easily exchanged among trading partners, creating inefficient supply chains. With continued supply chain shortages, disruptions, and other logistics hurdles, food safety evolution has never been more crucial. Massive shifts in consumer behavior coupled with disjointed and manual food traceability processes means the food industry needs to take action to digitize the supply chain and adopt technology to create a safer and more traceable food system." [8]



The benefits of reducing human error extend beyond immediate savings and operational gains. Addressing human error today prepares manufacturers to scale Industry 4.0 technologies, ensuring seamless integration of human and machine data in the future. Continuous improvement in processes strengthens operational resilience, creating a cost-effective and efficient manufacturing system that supports sustained profitability over the long term.

Reducing human error is more than a risk management strategy—it is an investment in the future of your operations. By implementing proactive measures and prioritizing the integration of human and machine data, food manufacturers can achieve lasting financial savings, operational excellence, and strategic growth. The return on investment is clear: the tools to reduce human error today will shape the competitive advantages of tomorrow.

[8] GfSi: [Advancing Supply Chain Visibility to Reach New Levels of Food Safety](#)

NEXT STEPS



Human error has long been one of the most persistent challenges in the food manufacturing industry, but it does not have to remain an inevitability.

From overlooked sanitation tasks to mislabeled products, the consequences of human error can be devastating—triggering recalls, reputational damage, and regulatory penalties that ripple across operations. However, the solutions are within reach.

This paper has outlined how human error arises, its costs, and the strategies needed to address it. By adopting digital SOPs, implementing real-time monitoring, integrating human procedure data with machine data, and fostering a culture of accountability, manufacturers can bridge critical gaps in their operations. These measures not only mitigate the risks associated with human error but also enhance food safety, improve operational efficiency, and protect brand trust.

The time to act is now. In a world driven by Industry 4.0, data is no longer just a tool—it is a competitive advantage. Yet, while many organizations have embraced machine-generated data, human actions often remain a blind spot. The integration of human action data into broader operational strategies is the key to unlocking greater insights, enabling predictive analytics, and ensuring a truly proactive approach to food safety and quality.



MEET COMMAND CENTER

Command Center is designed to help manufacturers bridge the gap between human actions and machine data. By structuring and normalizing human procedure data, Command Center empowers food manufacturers to reduce errors, gain actionable insights, and align their operations with Industry 4.0. Fast to implement and easy to use, Command Center delivers immediate value while setting the stage for long-term success.



Command Center is SaaS-based grab-and-go technology that combines the flexibility of near-field communications (NFC) technology with the smartphone to cost-effectively ensure adherence to all daily physical operating procedures needed for food safety. It's the only solution to provide a single version of the truth regarding operations and provide access to real-time, accurate operating data that can be used to increase efficiencies, reduce overall risk and help save lives, money, and time.

Let's discuss how Command Center can transform your operations. Schedule a no obligation consultation today to explore tailored solutions that address human error, protect your brand, and drive operational excellence. Together, we can build a foundation for safer, smarter, and more efficient food manufacturing.

Book A Meeting Today!

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