Chapter 8
Food Safety Meets Automation:
Smart Kitchens of the Future

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ABSTRACT

The rapid advancement of technology is reshaping the food and hospitality industry, with automation and intelligent systems driving efficiency, safety, and sustainability. Smart kitchens integrate artificial intelligence (AI), robotics, the Internet of Things (IoT), and real-time analytics to manage food preparation, storage, and service with precision. These systems ensure compliance with hygiene standards, control temperatures, prevent cross-contamination, and manage allergens, thereby reduc-

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ing human error while meeting regulatory requirements. Predictive analytics and machine learning enable proactive risk detection, while resource optimization and energy efficiency reduce waste and support sustainability. Yet challenges remain, including high costs, workforce adaptation, reliance on digital systems, and ethical issues concerning transparency and accountability. The future of food safety will depend on human–machine collaboration, where automation secures consistency and chefs provide creativity and cultural value, together redefining trust and guest satisfaction.

INTRODUCTION

Global food industry meets growing complexity in supply network, heightened safety expectations, evolving consumer demands, the integration of automation in food safety has emerged as a key factor in comparison to futuristic luxury. The ongoing evolution of kitchen technology driven by artificial intelligence (AI), Internet of Things (IoT), robotics, and data analytics has revolutionized how safety, hygiene, and quality are maintained in professional food environments. Commercial hotel chains institutional kitchens to airline catering and hospital food services, automation is transforming every food lifecycle (Ding, 2023; Balakrishnan, Zhang, & Tang, 2025). Traditional food safety monitoring relies heavily on manual record keeping, and periodic audits. These methods are increasingly insufficient for modern operations. Human error, inconsistent practices, and the lack of alerts for contamination or temperature frequently compromise outcomes (Iftekhar, Cui, & Kim, 2020). In contrast, automation technologies offer precision, forecast intervention, and increase consistency, enabling food businesses to detect, respond to, and prevent risks more efficiently. Global regulatory bodies such as the Food Safety and Standards Authority of India (FSSAI) and the U.S. FDA embracing digital compliance models, automation is also becoming central to regulatory conformance and certification (Ellahi, Iftekhar, & Kim, 2024).

It explores how real-time monitoring tools particularly IoT devices and smart sensors enhance visibility into kitchen environments by continuously tracking temperatures, humidity levels, and surface cleanliness (Chen, 2021). These tools not only send automated alerts but also trigger sanitation protocols, offering proactive control over contamination risks. A focus on robotic systems illustrates how culinary consistency and quality assurance are achieved at scale, ensuring that taste, texture, and hygiene remain standardized across different shifts, branches, or geographies (Dakhia, 2025). The research examines automation in action, featuring successful implementation in hotels, cloud kitchens, hospitals, and airline catering highlighting ROI, training models, and operational lessons learned. Particular emphasis is