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THE USE OF ARTIFICIAL INTELLIGENCE AND AUTOMATION IN THE FOOD INDUSTRY

Information technologies, particularly artificial intelligence (AI) and automation, rapidly transform the modern food industry. They optimize production processes and introduce new approaches to quality control, supply chain management, and product development. Integrating IT solutions enhances efficiency, sustainability, and safety, aligning with global trends toward sustainable development.

Key Areas of AI Application in the Food Industry:

Product Quality Control: AI is actively used to detect defects in food products automatically. Machine learning algorithms analyze images captured by production line cameras to identify damage, foreign substances, or quality deviations [4, p. 337].

Consumer Preference Analysis: AI helps analyze large datasets on consumer preferences, enabling companies to tailor their products for specific markets. Based on collected data, new products are developed, and existing ones are improved [4, p. 338].

Production Optimization: AI systems predict needed, helping to avoid overproduction or shortages. They also optimize the use of raw materials and energy resources.

Supply Chain Management: using predictive analytics, AI enables more efficient management of raw material supplies, considering seasonality, logistics risks, and other factors. All these factors reduce costs and stabilize supply chains [4, p. 337].

New Product Development: AI algorithms analyze consumer dietary habits and preferences, assisting in creating of innovative products, such as items for specific diets or those with enhanced nutritional value.

Food Safety Monitoring: AI systems monitor food safety in real-time, identifying potential hazards such as contamination before products reach the market.

Robotics and Automation: AI controls robotic systems that sort, package, and transport products, reducing manual labor costs and improving operation precision [4, p. 338].

Reducing Food Waste: AI analyzes production and storage processes to suggest ways to reduce raw material, finished product losses and promoting sustainability.

The Role of Automation in the Food Industry: Automation is critical in increasing efficiency and precision in food production processes. It reduces manual labor costs, enhances production speed and quality, and ensures consistent technological operations. Companies optimize packaging, transportation, storage, and food processing through robotic systems, smart sensors, and software. Additionally, automation contributes to waste reduction and strengthens sustainability efforts in response to increasing environmental and efficiency demands [2].

Examples of Successful AI and Automation Implementation:

Coca-Cola: the "Coca-Cola Y3000 Zero Sugar" campaign is a prime example of AI-driven innovation. Consumers scan QR codes on cans to access the Coca-Cola Creations Hub and use the "Y3000 AI Cam" tool to create personalized images of the future. This approach deepens emotional engagement and boosts brand loyalty.

Nike: Nike uses AI in its SNKRS and Training Club apps to personalize customer experiences. By analyzing user behavior, Nike delivers customized offers, significantly increasing customer engagement and sales [1].

Tyson Foods: the company employs automated quality monitoring systems on production lines, using robotics to ensure rapid and accurate packaging.

Negative Impacts of AI Implementation in the Food Industry

Despite numerous advantages, the use of artificial intelligence in the food industry also presents several potential negative consequences:

Job Reductions: mass automation and the adoption of AI can lead decreased employment, particularly among low-skilled workers, potentially causing social unrest and economic problems in regions dependent on food production.

Increased Technology Dependence: excessive automation increases dependence on technology, making companies more vulnerable to technical failures, cyberattacks, or issues with software and equipment supply.

Risk of Production Errors: although AI is a powerful tool, it can make mistakes due to incorrect configuration or insufficient training data, potentially leading to production failures, quality standard violations, or even the release of unsafe products.

Impact on Small Businesses: the high costs of AI technology implementation put small and medium-sized enterprises at a disadvantage compared to large corporations, potentially increasing market monopolization.

Environmental Challenges: the development, training, and deployment of AI systems often require significant energy resources, potentially increasing the industry's carbon footprint [3].

Ethical Issues in Labor Replacement: debates arise regarding the ethicality of replacing human labor with technology in an industry traditionally providing employment opportunities across various occupations.

Artificial intelligence and automation in the food industry opens new opportunities for optimizing production processes, improving product quality, increasing efficiency, and creating innovative solutions. These technologies contribute to significant resource savings, ensure food safety, and enable personalized consumer offerings. However, alongside positive transformations, challenges arise, including job reductions, technology dependence, data privacy risks, and high implementation costs that limit access to technologies for smaller enterprises. Thus, to fully realize the potential of AI and automation, it is necessary to implement these technologies while maintaining a balance between technological advancement and social responsibility, accessibility, and sustainable development in the food industry.

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