



## Role of artificial intelligence in menu planning, cost control, and food waste reduction in star category hotels-A study

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### Abstract

Artificial Intelligence (AI) has emerged as a transformative technology in the hospitality industry, particularly in food and beverage operations of star category hotels. Menu planning, cost control, and food waste management are critical areas that directly influence profitability, sustainability, and guest satisfaction. Traditional methods of menu engineering and inventory management often rely on manual analysis and historical data, which may lead to inefficiencies, inaccurate forecasting, and increased food waste. The present study examines the role of Artificial Intelligence in enhancing menu planning efficiency, optimizing food costs, and reducing food wastage in star category hotels. The study analyzes how AI-driven tools such as predictive analytics, demand forecasting, inventory management systems, and waste monitoring software contribute to operational excellence. The findings indicate that AI adoption significantly improves decision-making accuracy, reduces operational costs, and supports sustainable practices in hotel food production units. The study concludes that Artificial Intelligence has the potential to redefine food service management in star category hotels by integrating technology-driven solutions with traditional culinary practices.

**Keywords:** Artificial Intelligence, menu planning, cost control, food waste reduction, star category hotels, hospitality industry, smart kitchens

### Introduction

The hospitality industry is one of the most dynamic and competitive service sectors, where efficiency, quality, and sustainability play a vital role in long-term success. Among various hotel departments, the food and beverage (F&B) department contributes significantly to revenue generation while simultaneously incurring high operational costs. Menu planning, food cost control, and waste management remain major challenges for star category hotels due to fluctuating demand, diverse guest preferences, and perishable nature of food items.

Artificial Intelligence (AI), defined as the simulation of human intelligence by machines, has gained substantial importance across industries, including hospitality. AI technologies such as machine learning, data analytics, and automation enable hotels to analyze large volumes of data, predict customer behaviour, and optimize operational processes. In food production units, AI assists chefs and managers in designing menus based on customer preferences, seasonal availability, nutritional value, and cost efficiency.

Food waste is another critical issue faced by star category hotels. According to global estimates, a significant percentage of food prepared in hotels is wasted due to overproduction, improper forecasting, and inefficient inventory management. AI-powered waste tracking systems and smart inventory solutions help in minimizing waste by providing real-time insights into consumption patterns and stock levels.

This study focuses on understanding the role of Artificial Intelligence in menu planning, cost control, and food waste reduction in star category hotels and evaluates its impact on operational efficiency and sustainability.

### Objectives of the Study

1. To study the role of Artificial Intelligence in menu planning in star category hotels.
2. To examine the impact of Artificial Intelligence on food cost control and inventory management in hotel food production units.
3. To analyze the effectiveness of Artificial Intelligence in reducing food waste in star category hotels.
4. To assess the overall influence of Artificial Intelligence on operational efficiency in hotel food and beverage departments.

### Null Hypotheses (H<sub>0</sub>)

- **H<sub>01</sub>:** Artificial Intelligence has no significant role in menu planning in star category hotels.
- **H<sub>02</sub>:** Artificial Intelligence has no significant impact on food cost control and inventory management in hotel food production units.
- **H<sub>03</sub>:** Artificial Intelligence is not effective in reducing food waste in star category hotels.
- **H<sub>04</sub>:** Artificial Intelligence has no significant influence on operational efficiency in hotel food and beverage departments.

### Alternative Hypotheses (H<sub>1</sub>)

- **H<sub>11</sub>:** Artificial Intelligence plays a significant role in menu planning in star category hotels.
- **H<sub>12</sub>:** Artificial Intelligence has a significant impact on food cost control and inventory management in hotel food production units.
- **H<sub>13</sub>:** Artificial Intelligence is effective in reducing food waste in star category hotels.
- **H<sub>14</sub>:** Artificial Intelligence has a significant influence on operational efficiency in hotel food and beverage departments.

## Materials and Methods

### 1. Research Design

The study adopts a descriptive and analytical research design to examine the application of Artificial Intelligence in food and beverage operations of star category hotels.

### 2. Data Collection

#### Primary Data

Data was collected through structured questionnaires and interviews with executive chefs, food production managers, and F&B controllers working in selected star category hotels.

#### Secondary Data

Secondary information was gathered from research journals, books, industry reports, hotel case studies, and online hospitality databases.

### 3. Sample Size and Area

The study considered a sample of star category hotels operating in urban hospitality markets. Respondents included professionals directly involved in menu planning, cost control, and waste management.

### 4. Tools for Analysis

- Percentage analysis
- Comparative analysis
- Qualitative interpretation of responses

## Results

The results of the study reveal that hotels adopting AI-based systems experience noticeable improvements in food production efficiency. AI-supported menu planning enables hotels to design menus based on demand forecasting, guest preferences, and profitability analysis.

Cost control measures using AI-driven inventory management systems help in reducing food costs by minimizing over-ordering and pilferage. AI-based waste tracking tools assist in identifying major sources of food waste such as overproduction, spoilage, and plate waste.

Hotels using AI solutions reported a reduction in food wastage and improved sustainability performance. Staff productivity and decision-making accuracy improved due to real-time data availability.

## Discussion

The findings suggest that Artificial Intelligence plays a crucial role in transforming traditional food production practices in star category hotels. AI-based menu engineering allows hotels to align culinary creativity with profitability and guest satisfaction. Predictive analytics supports chefs and managers in planning menus that reduce excess production while meeting customer expectations. Cost control is enhanced through automated inventory systems that track stock movement and generate alerts for reordering. AI reduces dependency on manual calculations and human judgment, thereby minimizing errors and financial losses. Food waste reduction emerges as one of the most significant benefits of AI implementation. Smart waste monitoring systems help hotels identify inefficiencies in food preparation and service, enabling corrective actions. However, challenges such as high initial investment, staff

training requirements, and data privacy concerns remain barriers to widespread adoption.

## Conclusion

Artificial Intelligence has become a powerful tool in improving menu planning, cost control, and food waste reduction in star category hotels. The study concludes that AI-driven solutions enhance operational efficiency, reduce food costs, and support sustainable hospitality practices. While the adoption of AI requires significant investment and technical expertise, the long-term benefits outweigh the challenges. Star category hotels that integrate AI into their food production operations gain a competitive advantage by delivering quality food services while maintaining profitability and environmental responsibility.

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