Public Abstract
First Name:Esma
Middle Name:
Last Name:Birisci
Adviser's First Name:Ronald
Adviser's Last Name:McGarvey
Co-Adviser's First Name:Christine
Co-Adviser's Last Name:Costello
Graduation Term:FS 2016
Department:Industrial Engineering
Degree:PhD
Title:OPTIMIZING PRODUCTION AND INVENTORY DECISIONS AT ALL-YOU-CARE-TO-EAT FACILITIES

Food service, feeding people outside of their home, is one of the largest industries in the world (Hartel and Klawitter, 2008). Restaurants, hospitals, military services, schools and universities are among those organizations providing these services. Management of a food service system requires operations management skill to operate successfully. A key element of food service is food production. Forecasting, demand, managing inventory and preparing menu items are key tasks in the food production process. In this research a series of three studies are presented to improve the food production system policies at an all you care to eat (AYCTE) facility.

The first study examines two objectives, limiting its focus to foods for which all overproduction must be discarded (that is, leftovers cannot be saved and used in future periods). The first objective of this research is to present a novel method for estimating shortfall cost in a setting with no marginal revenue per satisfied unit of demand. Our methodology for estimating shortfall cost obtains results that are consistent with CDS management's stated aversion to shortfall, we estimate shortfall values are between 1.6 and 2.7 times larger than the procurement cost and between 30 and over 100 times larger than disposal costs. The second objective is to identify how optimal food production policies at an AYCTE facility would change were life cycle cost estimates of embodied greenhouse gas (GHG) emissions, including carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O), included in the disposal costs associated with overproduction. We found that optimal production levels are decreased significantly (18–25%) for food items with high environmental impacts (such as beef), and reduced less for foods with less embodied CO2.

The second study considers a broader set of food types, including both foods that cannot be saved and stored as leftovers (as in the first study), and also foods for which overproduction can potentially be saved and served in the future as leftovers. Food service operations in an AYCTE environment need to consider two conflicting objectives: a desire to reduce overproduction food waste (and its corresponding environmental impacts), and an aversion to shortfalls. This research presents optimal production adjustments relative to demand forecasts, demand thresholds for utilization of leftovers, and percentages of demand to be satisfied by leftovers, considering two alternative metrics for overproduction waste: mass; and GHG emissions. A statistical analysis of the changes in decision variable values across each of the efficient frontiers can then be performed to identify the key variables that could be modified to reduce the amount of wasted food at minimal increase in shortfalls.

The last study's aim is to minimize overproduction and unmet demand under the situation where demand is unknown. It also addresses correlations across demands for certain item (e.g., hamburgers are often demanded with french fries). As in the second study, we again utilize a Hooke-Jeeves optimization method to solve this production planning problem. In order to model a more realistic representation of this problem, demand uncertainty is incorporated in this study's optimization model, using a kernel density estimation approach. We illustrate our approach in all three studies with an application to empirical data from Campus Dining Services operations at the University of Missouri.