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Workforce Strategic Productivity Analysis and Optimization in a Retail Company

Labor costs account for a significant portion of operational expenses in the food retail sector, making workforce optimization a strategic priority. This work develops a data-driven methodology to determine the optimal number of Full-Time Equivalents (FTEs) needed per store, function, and week, balancing operational efficiency with service level. The proposed framework consists of two complementary components. The first is an efficiency model based on Mixed-Integer Linear Programming (MILP), which estimates the minimum FTEs required based on a store's operational characteristics. The second component is a service level model that utilizes second-degree regression to predict the additional FTEs required to maintain historical service standards. Both models are applied independently by function and within store clusters sharing similar operational profiles. The methodology was implemented in a real-world setting across more than 350 stores of a major Portuguese food retailer, using large-scale datasets processed with PySpark and optimized with Gurobi. Results demonstrate the ability to decompose observed labor usage into efficiency, service, and inefficiency, offering actionable insights for strategic workforce planning. In addition to retrospective evaluation, the framework supports forward-looking simulations under varying service level targets and store scenarios. This work contributes a scalable, interpretable, and robust approach to labor productivity management in complex retail environments.

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