

Designing Services for Meal Delivery Platforms

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Meal delivery platforms operate in dynamic environments, facing complex challenges including fluctuating customer demand, deciding where and which restaurants to offer, and efficient rider allocation. This thesis introduces the Restaurant Selection and Rider Dimensioning Problem (RSRDP) by proposing an integrated optimization model that jointly determines the optimal restaurant assortments and rider allocations to maximize the platform's expected profitability, while maintaining high service quality standards. A nested logit model captures customer purchasing behavior on the platform to model how customers choose a restaurant to order from, where customers initially choose a cuisine type and subsequently select a specific restaurant within that type. Rider operations are modeled through a spatial-temporal network, enabling optimized management of rider flows across urban zones. We formulate the problem as a Mixed-Integer Linear Program (MILP) and research advanced solution methods including Benders decomposition, column generation, branch-and-price, and heuristics. Finally, we propose our novel Iterative Assortment Generation (IAG) algorithm to solve the problem, ensuring computational feasibility for large-scale scenarios. Computational experiments based on simulated urban delivery data illustrate that integrating restaurant selection with rider dimensioning consistently increases profitability and maintains high service quality compared to traditional methods that separate these decisions. Furthermore, we explore the impact of two distinct rider compensation policies: commission-based (payment per delivery) and fixed employment (hourly wages). Our findings reveal significant trade-offs between these compensation structures. Commission-based compensation offers greater operational flexibility, adaptability to fluctuating demands, and cost-effectiveness; however, it also leads to increased rider relocations and potentially reduced rider satisfaction due to uncertainty in workload. Conversely, fixed employment provides stable rider availability, promoting better workforce management, but potentially incurs higher operational costs and decreased responsiveness to short-term demand fluctuations. Based on these insights, we recommend meal delivery platforms adopt integrated

optimization models as part of their tactical planning to effectively balance service quality and profitability. Platforms should carefully evaluate their rider compensation policies, recognizing that the ideal choice may depend on the specific context of their operational environment, such as demand variability, competitive landscape, and workforce preferences. Future research could build on this study by investigating dynamic compensation schemes that adapt in real-time to observed demand conditions. Additionally, incorporating hybrid compensation schemes, combining salaried and commission-based riders, and utilizing the strengths of both policies, provides a promising research direction. Developing multi-objective models that balance profitability against service quality measures, such as timely deliveries or rider satisfaction, would further guide operational decisions and customer and rider retention. Furthermore, future research could improve the way service districts are designed. Instead of using fixed boundaries, districts could be adjusted dynamically and tailored more precisely to specific customer segments and changing demand patterns. This approach would mean that restaurant offerings can also change throughout the day to closely match customers' preferences, potentially increasing overall profitability. Furthermore, modeling couriers individually, rather than as aggregated flows, allows more precise scheduling that better accounts for realistic travel times, shift durations, and rider constraints. Although this approach increases modeling complexity and computational demands, it offers more accurate operational insights, leading to better-informed management decisions. Finally, employing heuristic-driven column-generation methods and comparing solution approaches systematically can improve scalability and accuracy.

Link to the thesis: <https://repository.tudelft.nl/record/1ae82030-8182-490c-ac1f-2257675e781a>