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Optimization of Pricing and Service Location Decisions for Do-It-Yourself Products

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Abstract

This study is motivated by a real-world case in China. Affected by the geopolitical tensions in the Middle East, a Chinese mechanical watch component manufacturer has suffered a sales decline of nearly 50% since 2024, largely due to its reliance on a single B2B channel. To address this, the study proposes a dual distribution strategy integrating the B2B channel with online B2C sales supported by offline services. The online product range mainly features Do-It-Yourself (DIY) mechanical watch kits, designed with modularity and personalization to boost enthusiasts' engagement and enjoyment. To match customers' varying assembly abilities, products are categorized as loose-part kits, semi-finished kits, and fully assembled watches. This study focuses on four decisions for the new B2C channel: (1) optimal pricing across product types; (2) evaluation of offline service models, comparing in-house and outsourced centers; (3) service network location planning; and (4) determining who bears the service fee in outsourced centers. A mixed-integer nonlinear programming (MINLP) model is developed by simulating demographic and geographic data from all 297 cities at the prefecture level and above in China. A decomposition-coordination strategy is employed to decompose the complex problem into three interrelated subproblems: pricing, service network design, and payment allocation, which is solved by CPLEX. The study is expected to provide guidance on these decisions, enhancing customer experience while maximizing corporate profitability. The proposed methods can also be applied to other situations, such as IKEA's furniture supply chains.

Keywords
Multi-product pricing, Service network optimization, Decomposition-coordination strategy

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Bofei Li is an M.A.Sc. Candidate in the Department of Mechanical, Automotive and Materials Engineering at the University of Windsor. Her research focuses on operations research and optimization, particularly in modeling and solving complex industrial problems. Bofei Li received a Bachelor of Applied Science in Industrial Engineering from the University of Windsor in 2023. Her work aims to advance modeling and optimization methods for industrial and service systems.

Guoqing Zhang, PhD, PEng, is a Professor of Industrial Engineering in the Supply Chain and Logistics Optimization Research Lab at the Department of Mechanical, Automotive & Materials Engineering, University of Windsor. His research interests include supply chain management and optimization, operations research, manufacturing modeling,

e-commerce, warehouse management, data-driven optimization, machine learning, and intelligent decision support systems. He has published over 100 articles in these areas. Dr. Zhang's research is supported by NSERC, MITACS, and CFI. He has provided consulting services to several world-leading companies in the automotive, energy, airline, and food industries. In 2015, his team received the CORS Practice Prize. Additionally, he developed a solver for large-scale linear programming based on the interior point method.