Order Picking Optimization in O2O Supermarkets with Customer Interference

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Abstract

The advancement of Omni-Channel Retailing brings opportunities and challenges to traditional supermarkets. It is becoming more and more popular for omni-channel retailers to make use of local establishments to complete online customer orders. However, the complex store operational environment has brought huge challenges for online order fulfilment, which hinders the use of order picking optimization models of traditional warehouses in O2O supermarkets. Pickers responsible for online customer orders may encounter interference from in-store customers. One of the main interference situations is that pickers responsible for online customer orders may have to wait in queue with in-store customers during the peak period. This study, in particular, incorporates pickers' waiting in queues during order fulfilment operations. We first analyze the similarities and differences in order picking processes between the traditional warehouse and O2O supermarkets, emphasizing the complex store operational features. We construct an order picking optimization model to minimize the total due time of online customer orders, with particular consideration of pickers' possible queuing time. An efficient heuristic is proposed to resolve the optimization model. Furthermore, this paper discusses the effect of various factors, i.e., the quantity of order, the calculation method of queuing length and order picking methods, on order fulfilment performance in different computational environments. Numerical experiments were carried out and experimental results were statistically analyzed. The computational experiments evidence the effect of order batching, order quantity, and possible waiting time in queues on online order fulfilment performance. The lack of consideration of customer interference may significantly impair order fulfilment performance. Lastly, managerial suggestions were put forward for O2O supermarket operations.

Keywords
O2O Supermarkets, Omni-Channel Retailing, Customer Interference and Business Analytics.

Biographies
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