OPTIMAL FLEET POLICY OF RENTAL VEHICLES WITH RELOCATION IN NEW ZEALAND: AGENT-BASED SIMULATION

John-Carlo Favier   Subhamoy Ganguly

Department of Informations Systems and   Department of Informations Systems and
Operations Management   Operations Management
University of Auckland   University of Auckland
12 Grafton Rd, Auckland, 1010, NEW ZEALAND   12 Grafton Rd, Auckland, 1010, NEW ZEALAND

Timofey Shalpegin

Department of Informations Systems and
Operations Management
University of Auckland
12 Grafton Rd, Auckland, 1010, NEW ZEALAND

ABSTRACT

An important strategic decision for rental car operators is whether to implement a single-fleet or multi-fleet model. The single-fleet model allows the movement of vehicles between regions, whereas the multi-fleet model does not. In practice, different rental car operators use different models. To address this problem, we have developed two simulation models and compared them in terms of fleet utilization, branch service level, relocations, and, ultimately, operating profit. We have taken the New Zealand rental car industry as an example as the country consists of two well-defined regions, and one-way southbound travel is a preferred option for many customers. The results indicate that a multi-fleet model has a higher service level at key centers and higher utilization. At the same time, the single-fleet model is relatively more profitable at the expense of a lower service level in key centers due to vehicles accumulating in the South Island.

1   INTRODUCTION

International tourism is a major industry for New Zealand, accounting for 8% of GDP (Jaforullah 2015). The largest number of visitors arrive in Auckland (Warren and Taylor 2003), the country's most populous city with its busiest international airport and located in the northern part of the North Island. A large fraction of these visitors rent vehicles to drive around the country and then drop off at another location. Therefore, when it comes to one-way rentals in New Zealand, Auckland is the foremost source, posing significant relocation challenges for the RCOs. The problem is further exacerbated by the fact that many of these tourists who set off from Auckland in the North Island finish their trip somewhere in the South Island (Lohmann and Zahra 2010).

This creates a dilemma for the RCOs operating in New Zealand—whether or not to allow the multi-island rentals that allow customers to pick up in one island and drop off in another. On the one hand, it is understandable that international tourists value multi-island rentals, and following basic principles of fleet utilization, multi-island rentals allow an RCO to pool their fleet across both islands and employ a single-fleet model, possibly improving vehicle availability. On the other hand, multi-island rentals create the need for a significant number of inter-island vehicle relocations, which can increase the logistics costs of the

RCO and reduce vehicle availability due to the long duration of the relocation. It is interesting to note that among RCOs operating in New Zealand, some allow multi-island rentals while others do not.

2   METHODOLOGY

The simulation models for both single-fleet and multi-fleet options include key components of customer demand and vehicle supply. Customer demand is modelled as an open network, i.e., demand enters the network and, whether fulfilled or not, eventually leaves the network. In contrast, vehicle supply is modelled as a closed network, i.e., vehicles never leave the network. They can be paired with demand to form a reservation entity and move from node to node within the network. Following Guillen et al. (2019), we use SIMIO as the simulation software for our models.

3   FINDINGS AND CONCLUDING REMARKS

Our study shows that the single fleet, or pooling strategy, provides a higher level of operating profit for a single high season. At the same time, a multi-fleet model (i.e., not pooling) has two significant advantages over the single-fleet model. First, it provides a higher service level in the major demand centers. Second, it has substantially lower costs of relocating vehicles at the end of the season to restore the original inventory level in each location.

The importance of providing a high service level in major demand centers depends on the general strategy of the RCO. Service level has a profound effect on customer loyalty (Mascarenhas et al. 2006). For this reason, RCOs seeking to establish long-term relationships with customers will more likely prioritize the service level. This factor may be more relevant to large international RCOs or those targeting business customers. At the same time, RCOs serving budget or non-returning customers, such as tourists, may not require an exceptionally high service level in major demand centers. This logic explains why first-tier RCOs tend to use the dual-fleet strategy in New Zealand while many second-tier RCOs operate a single fleet of vehicles.

REFERENCES

Guillen, J., P. Ruiz, U. Dellepiane, L. Maccarrone, R. Maccioni, A. Pinzuti, and E. Procacci. 2019. "Europcar Integrates Forecasting, Simulation, and Optimization Techniques in a Capacity and Revenue Management System". *INFORMS Journal on Applied Analytics* 49(1):40–51.

Jaforullah, M. 2015. "International Tourism and Economic Growth in New Zealand". *Tourism Analysis* 20(4):413–418.

Lohmann, G., and A. Zahra. 2010. "The Influence of International Tourists' Travel Patterns on Rental Car Fleet Management in New Zealand". In *Drive Tourism: Trends and Emerging Markets*, 159–171.

Mascarenhas, O. A., R. Kesavan, and M. Bernacchi. 2006. "Lasting Customer Loyalty: A Total Customer Experience Approach". *Journal of Consumer Marketing* 23(7):397–405.

Warren, J. A., and C. N. Taylor. 2003. Developing Urban Tourism in New Zealand. *Centre for Research, Evaluation and Social Assessment*.