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ECOLOGICAL & PROFITABLE CARSHARING BUSINESS: EMISSION LIMITS & HETEROGENEOUS FLEETS

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Research paper

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Abstract

Carsharing is a mobility concept that addresses the world's growing interest in sustainability. It reduces CO₂ emissions, traffic congestion, and noise in cities. Including electric and hybrid vehicles in the carsharing fleet supports these aspects even more. For a station-based carsharing organization (CSO), the distribution and availability of vehicles play a crucial role to satisfy the customers' needs as well as to obtain profits. We developed a tactical optimization model to determine the size and composition of a heterogeneous carsharing fleet while considering different emission limits with time-dependent demand profiles. Different propulsion modes and vehicle classes represent the heterogeneity of the fleet. Using the application example of the city of San Francisco, results are presented, discussed, and analyzed. Our benchmarks for two different demand scenarios reveal the strong influence of a preset maximum level of CO₂ emissions on fleet composition and monthly net profit. The optimization model allows CSOs to provide a sustainable and profitable mobility concept; city planners are supported to evaluate influences of CO₂ emission thresholds on CSOs. The model thereby represents a Green IS approach, as it contributes to supporting a society's path towards a low emission and noise-reduced environment in urban areas where carsharing is feasible.

Keywords: Carsharing, Emission Limits, Decision Support, Green IS.

1 Introduction and Motivation

A growing level of eco-consciousness in both public and business sectors, combined with an increasing percentage of the world living in cities, evokes a rethinking of car usage and personal vehicle ownership (Dedrick, 2010; Shaheen and Cohen, 2013). According to estimates for the year 2030, it is expected that approximately 60 % of the world's population is living in cities (Shaheen and Cohen, 2013). Besides these factors, economic uncertainty, rising energy costs, and the wish to reduce CO₂ emissions are reasons why the means of transportation are being widely reconsidered. A comparatively new mobility concept that addresses this question is carsharing (Shaheen and Cohen, 2013). Carsharing means that individuals gain access to a fleet of shared-use vehicles in an urban area and pay on an as-needed basis (Shaheen et al., 2005). The development of the mobility market in general seems to be faster than ever before, which is reasonable especially due to technological progress and modern information and communication technologies. These facts also apply to the carsharing development. The availability, location, and status of each carsharing vehicle can be checked online at any time and any place. This greatly simplified carsharing services in recent years. Today a high service level can be offered to the customers (Hayashi et al., 2014; Kaspi et al., 2014). Owing to these circumstances, the number of people using carsharing is rising rapidly, which is observable all over the world. For example *zipcar*, which is one of