Affordable or exclusive mobility? An applied cost model for Innovative Air Mobility (IAM) in Northern Germany

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In the IAM industry and literature, diverse vehicle configurations and different values for estimated ticket prices per kilometre circulate. At this moment, these numbers are fixed values without any link to a business model, including a fleet assignment and vehicle allocation to demand scenarios. Therefore, this research focuses on an applied cost model to calculate the direct operating cost of potential IAM businesses based on demand scenarios for the metropolitan area of Hamburg. For this purpose, the study considers commuters, business travellers and airport shuttles going to the Hamburg Airport, which contain about 9500 IAM passengers per day in total [1,2,3]. The cost model itself is a derivative of a consisting cost estimation, which is used for initial cost evaluation for different IAM activities [4]. For multicopter configurations, the model uses a fixed fare per kilometre of 5 €/km, for vectored thrust configurations of 1.5 €/km. Existing assumptions of the initial cost estimation will be substituted by various inputs which are generated by an operating IAM business model. An operating platform is needed to serve the demand requests, to estimate the needed fleet size as well as the number of revenue flights and empty flights that in turn influence occurring operating costs. Therefore, this study uses a vehicle allocation model to calculate the required operation inputs [5].

In a first step, the ticket price for an IAM flight scales linearly with the flight distance, similar to a ticket fare in traditional transport systems. The fare per kilometre is derived from the initial direct operating cost estimation [cite]. First results indicate an unbalance of ticket prices for different flight distances. When using fixed fares per kilometre for multicopter configurations on short-haul and vectored thrust configurations on long-haul, the existing model considers two different subsystems with individual fares per km. Whenever the flight distance exceeds the maximum range of the multicopter, the model operates with a vectored thrust configuration, designed for longer ranges. Here, the value for the fare per kilometre changes as well, which could lead to significantly lower total ticket prices on longer flights with the currently used fares when switching from multicopter to vectored thrust configurations. Itineraries with a long flight distance for the multicopter receive an above-average ticket price, which then leads to an underestimation of potential demand. In the same way, short flights with vectored thrust configurations are offered with below-average ticket price that lead to an overestimation of potential demand. Figure 1 shows two different ticket fare structures.

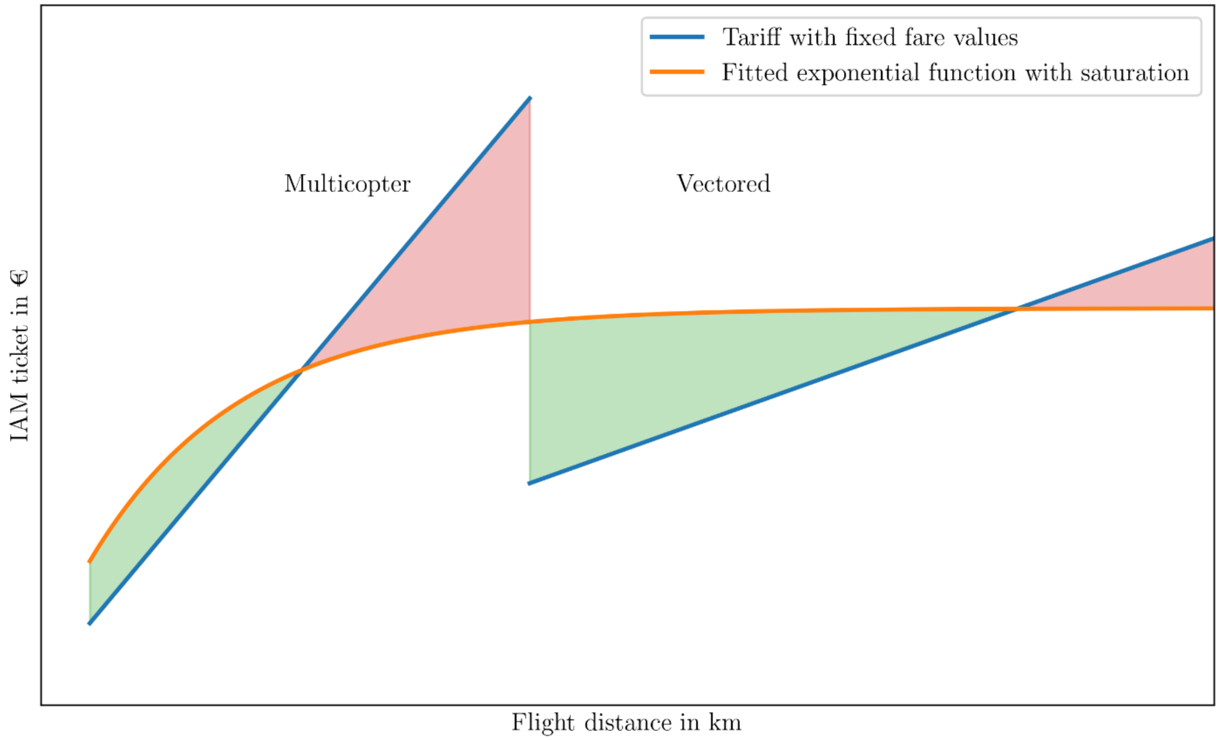

Figure 1 Comparison of different ticket structure for IAM flights

While a fixed fare value leads to a linear function for each configuration, there is a ticket price jump when switching from multicopter to vectored configurations. In comparison, the orange fit shows an exponential function with saturation as an alternative ticket structure. Differences in the total ticket price are marked with green and red areas to illustrate potential over or underestimations of the associated demand of IAM. Parameters of the alternative fare structure must be linked to airlines operations data to achieve a profitable business model. When considering different flight distances, thus varying operating costs, the model has to observe the demand and frequency of the flights on certain flight distances. In the end, an IAM business has to set the parameters for the exponential function to serve a potential demand that leads to a profitable business.

As mentioned above, currently available ticket fares are set universally without any link to a concrete demand scenario, which leads to uncertainty in the available fare forecast. This research provides first insights into an economic ticket fare system for an IAM operation based on demand scenarios in the metropolitan area of Hamburg.

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Biography

Speaker Given Name

After finishing his Master in Mechanical and Process Engineering at the TU Darmstadt, he joined the DLR in 2019. Since then, his focus has been on the operations and business modelling of drone applications. In particular, he investigates potential IAM passenger demand and occurring costs.