MobilityCoins – First results on social acceptance, system boundaries and individual budgets in a tradeable credit system in Germany

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SHORT SUMMARY

We propose a holistic, budget-based mobility management system that accounts for negative transport externalities and transport equity. Based on research in tradeable credit schemes – a cap and trade system - the concept of MobilityCoins incentivizes sustainable mobility by offering the possibility to earn credits with active mobility and by making resource-intense modes more costly. As the allocation of individual mobility budgets might be socially contested and requires tracking of daily trips, we conducted a qualitative analysis through expert interviews to evaluate acceptance and equity issues. Representing different sectors, the experts assessed that i) the system would contribute mostly to traffic efficiency and climate mitigation, ii) data security and user effort would be the most critical issue for social acceptance, iii) a yearly budget allocation cycle and a regional-to-national enrollment would be suitable and iv) mobility impairment and public transport supply should be high-priority parameters when setting up the budget allocation function.

Keywords: traffic management, tradeable credit schemes, sustainability, transport equity, mobility budget

1. INTRODUCTION

Mobility in the 21st century is marked by a trade-off between, on the one hand, the fight against global warming, air pollution and space efficiency in urban regions, and, on the other hand, the fight against transport inequalities, i.e., regarding the accessibility of disadvantaged groups (Sammer et al. 2021, Martens, 2017, Millonig et al. 2021). There is only a limited effect of single transport management instruments, often not internalizing negative externalities and either focusing only on one mode of transport (fuel taxes, pop-up bike lanes, public transport subsidies) or only a single problem (congestion charging, speed limits, etc.). Single policies might not capture the complexity of a transport system and are usually not designed to account for both climate mitigation and transport equality. Economic instruments such as congestion- or carbon pricing can reduce car-related externalities, but can also raise equity issues (discriminating the poor, rural areas, disabled people, etc.), and require accompanying measures such as the expansion of public transport (PT) (Litman, 2011; Eliasson, 2008). Scholars are therefore working on more holistic traffic management approaches with a focus on Tradeable Credit Schemes (TCS) (e.g., DIT4TraM project, EU Horizon program 2020). An overview of recent advancements in TCS research is given by Lessan & Fu (2019), building upon the essential work from Goddard (1997) and Verhoef et al. (1997). We presented a first multi-modal TCS-approach called 'MobilityCoins' in Bogenberger et al. (2021).

In this paper, we present insights on the system design and social implications of MobilityCoins, which we derive through expert interviews with representatives from various sectors. As a thorough analysis of all system parameters is out of scope of this paper, this contribution will focus on the different target achievements of such a system, the critical factors for acceptance, the spatial and temporal system boundaries, and fair budget allocation. The overall research question is: What are the relevant parameters of the MobilityCoin system and how should they be designed to provide a fair and sustainable mobility management tool?

The idea of MobilityCoins

In the MobilityCoin system, each person receives an initial budget through free allocation with which the external costs of daily trips in the system boundaries must be paid (see Figure 1). The initial budget can either be allocated uniformly, or it can vary, based on individual factors (mobility needs, PT supply, etc.). The economic mechanism is that the person traveling gets charged (polluter pays principle) for using public space and producing external costs. The dynamic price for each trip is defined by the agency and depends on several factors: mode and drive type, time of day, trip distance, external costs, target achievement, etc. A car trip might be more costly than a PT trip, e.g. due to higher emission production and space consumption. The quantity of coins in the market is managed by the agency. Users can trade coins on the market: either to buy new ones if the personal budget is depleted or to monetize surplus coins. At the end of a period, users are eligible to vote on infrastructure measures (e.g., bike lanes instead of parking lots) funded by the generated revenues.

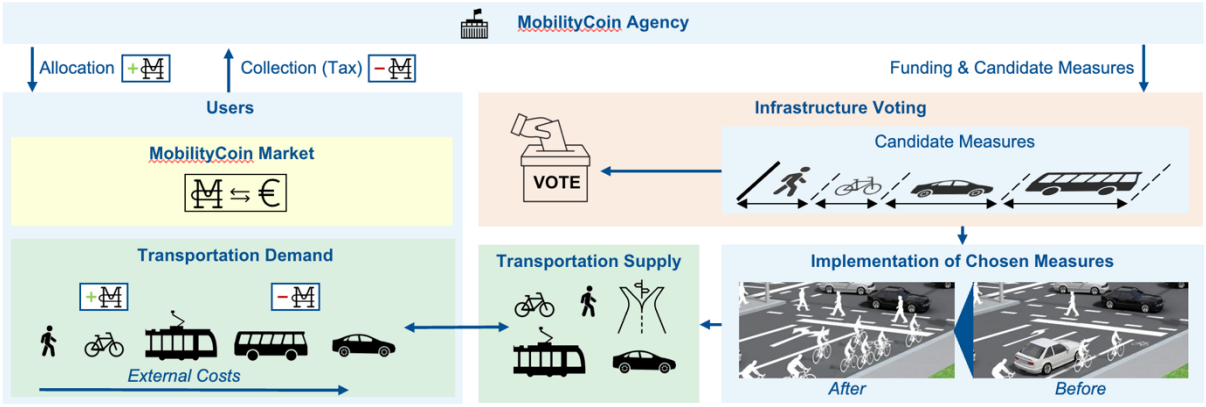

Figure 1: The MobilityCoin system. Credits: Chair of Traffic Engineering and Control (TUM)

2. METHODOLOGY

The method of expert interviews was chosen to build a first broad understanding of acceptance, equity issues and the vast space of system design parameters, that come along when implementing a sustainable, budget-based mobility system. TCS might be highly socially contested when it comes to implementation assuming that the agency must record daily trips, users may need to trade coins and may receive different amounts of initial credits. This requires careful prior evaluation. Therefore, this method enables a deeper understanding of interests and perceived risks and opportunities of different involved institutions regarding the MobilityCoin system. 15 experts (mostly from the city of Munich, Germany) participated in guided interviews of 60 to 80 minutes length. The different expert areas can be summarized as follows:

- local and regional public transport (2, CEOs)
- traffic and mobility science (2, PhD, Professor)
- transport technology companies (2, CEO, Professor)
- disabled people (1, spokesperson)
- environment (1, consultant)
- economy (1, head of institute)
- car and bike clubs, car industry (3, spokesperson, executive)
- administration (3, city level, metropolitan region level, and federal state ministry level)

We contacted the highest position in the institution that was related to the field of mobility (see reached positions in the brackets above). The interviews were conducted either in person or in an online meeting. Additional to open questions, the experts had to fulfill ordering tasks on a virtual board (ranking of parameters for the budget function, ranking of targets according to their possible achievement, ranking of critical aspects for social acceptance). The ranking results are used for this paper's statistical analyses.

To analyze the spoken answers, the audio files were transcribed and encoded with the software MaxQDA 2022. In a next step, we will present the findings of the qualitative content analysis.

3. RESULTS AND DISCUSSION

General Acceptance

Altogether, the interviewees support the idea of a new holistic traffic management system that incentivizes the most efficient and resource-saving means of transport. We asked them which of the different targets the system would contribute most to (see Figure 2). Traffic efficiency (with the subgoals 'reduction of traffic jams' and 'efficient use of network capacity') and climate change mitigation (emission reduction, air quality improvement) were the goals the MobilityCoins system would most likely contribute to. Some experts (administration, economy, traffic technology, disabled people, cycle club) were convinced that the mobility system would also contribute to a more livable city (meaning higher quality of stay, fair space allocation). Few experts expected that the MobilityCoin system would contribute to infrastructure financing and social justice – which would recommend taking a closer look at social issues.

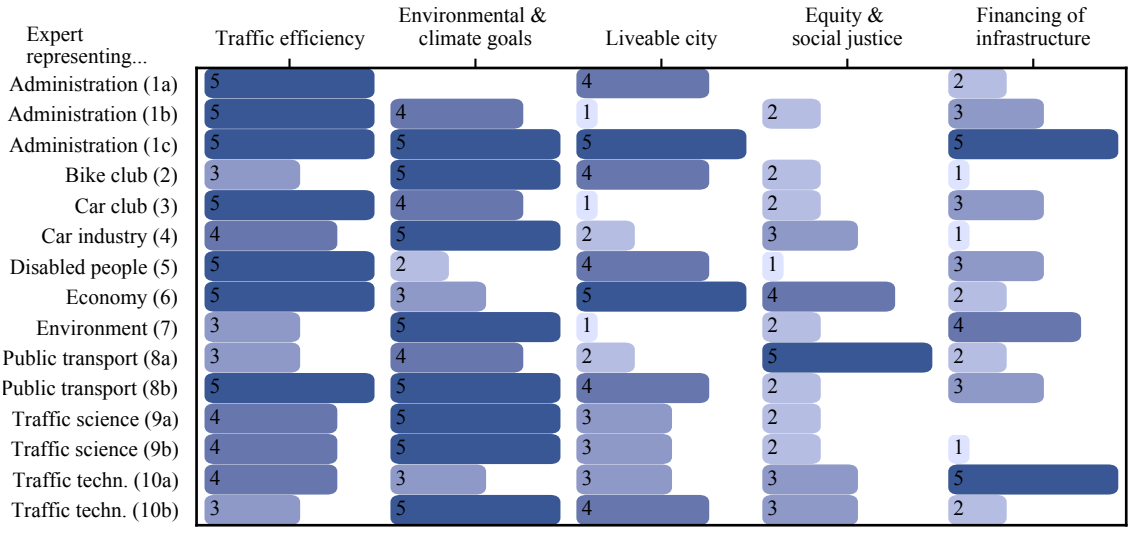

Figure 2: Expected target achievement of the Mobility Coin system. 5= very high expected contribution to target achievement; 1 = very low expected contribution to target achievement

We then asked the interviewees to rate different aspects of the MobilityCoins system according to their criticality for social acceptance (Figure 3). The most pressing issue for the experts was data security and tracking of trips. 13 out of 15 experts rated this topic as highly critical for social acceptance. As problems with this issue, they mention the possible lack of anonymity when traveling, going along with the fear of constant observation, and the missing reward for sharing the data. The second most critical issue expressed was the possible high effort and complexity that a user would face when using the system. New tasks would be to manage budget expenses and trade coins on the market when they are depleted or left over, which would add up to mobility-related tasks such as refueling, buying a PT pass, etc.

The unequal provision of transport services between rural and urban regions is another aspect that the experts saw as rather critical. As a parallel expansion of PT services in rural areas is not guaranteed within the proposed system, some experts (e.g., the regional and metropolitan administration) consider this topic as a demanding issue. They suggest accounting for this problem by adjusting the allocated budget amount and the price ratios between car and PT trips. The allocation of different budget sizes is seen as less critical for social acceptance by the experts – however, the regional and metropolitan administrates express concerns, as varying budget sizes could be problematic in terms of social justice, which is, in turn, critical for political success. The topics of reaching market equilibrium, the financing of traffic infrastructure, and missing incentives to change travel behavior were assessed as less critical. The representative of disabled people, however, considered it very important that the system generates money that can be invested in more safe and accessible mobility – the economics expert, however, stated

that generating funds for public expenditure shall not be the goal, but to improve the space allocation, traffic efficiency, and air quality in the city.

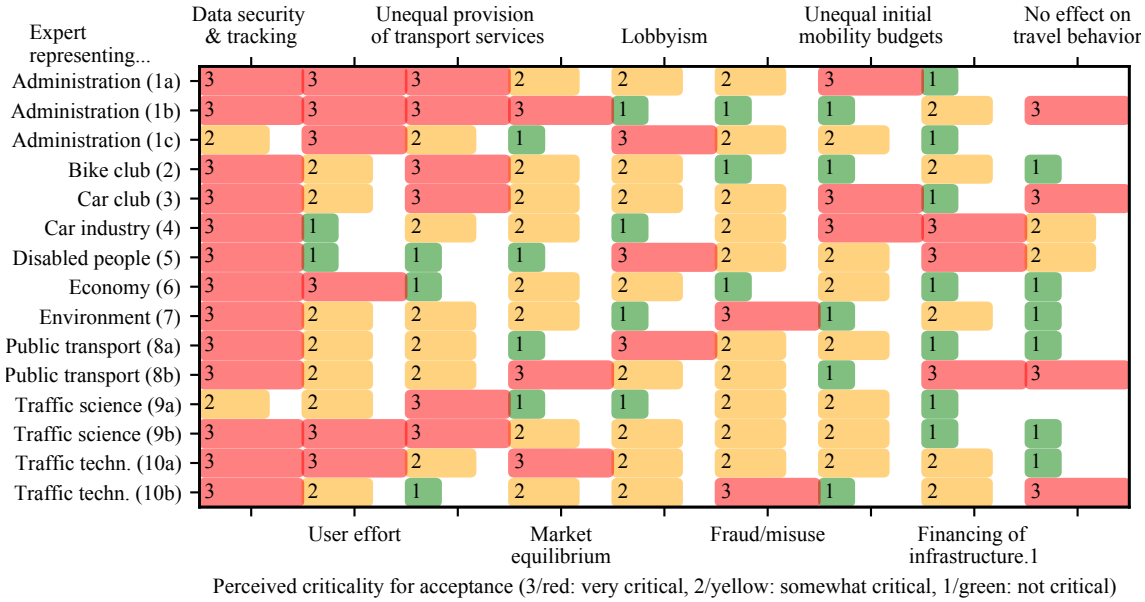

Figure 3: Ranking of critical aspects for social acceptance regarding the MobilityCoin system

System boundaries

In the next section, the experts were asked about the spatial and temporal dimensions of the system. Regarding the spatial dimension, all options, from district level to European level were mentioned. However, most of the experts opted for enrollment on the metropolitan region level or on the national level. There were two main explanations for this decision. 1) On a broader spatial level, the dualism of a holistic mobility system would be better integrated, meaning the system would both account for young and old people, good and deficient transport supply, dense and vast regions, and so on. 2) If the system boundaries would be set too narrow, commuter flows would not be accounted in the system, although they make up for large amounts of daily traffic – for example in Munich. In the same year, 45% of the employees in Munich were commuters who do not live in Munich (LHM, 2019). Regarding the temporal regularity of the budget allocation, most of the experts (75%) opted for the yearly cycle. Two experts opted for a quarterly cycle and one for a monthly cycle. A yearly budget allocation would fit yearly tax returns and the payment of insurance fees, it was stated. Moreover, there would be more leeway to spend and save coins throughout the year and the seasonal differences would be included. As an advantage for the quarterly budget allocation, it was named that individuals could better manage and foresee their coin expenses, as the period is shorter and plannable.

Mobility Budget

Most experts approved the allocation of *individual* mobility budgets, meaning that two persons may not receive the same number of coins at the beginning of a time period. The most stated argument was that an individual initial endowment would be important for social acceptance and equity (e.g., rural/car-dependent vs. urban/well-connected). Only two experts (traffic technology and city administration) favored an equal budget for all residents (see Figure 5), although this is one of the standard assumptions for initial budget endowment in TCS theory (Fan & Jiang, 2013, Grant-Muller & Xu, 2014, Wadud et al., 2008). During the interviews, the experts were asked to rank different user-related parameters according to their importance for the budget allocation function. This importance can then be translated into a weighting factor for each parameter in the budget function.

In Figure 4, we see that the parameter ‘mobility impairment’ was attributed the highest importance. Most experts agreed that mobility-impaired people should be accounted with a higher initial budget. In this context, however, the representative of disabled people did not welcome an unlimited mobility budget for disabled people. The argumentation was that mobility-impaired people should not be treated differently when it comes to the individual effort of everyone to achieve a more sustainable mobility behavior.

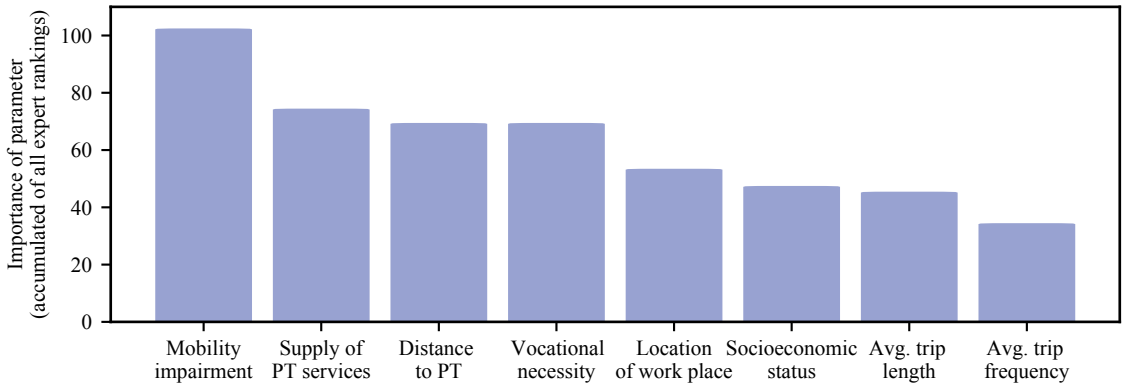

Figure 4: Ranking of parameters for the budget allocation function, according to their importance

The parameters 'PT service supply' and the 'walking distance to PT' went hand in hand and were both perceived as very important for the budget function. The experts agreed that people living in poorly connected areas should be compensated with a higher mobility budget. Their arguments included: a) Residents in these areas must travel larger distances than in the city, which would cost them more coins; b) poor PT supply leads to higher car usage, which would also lead to a fast budget depletion. Some experts suggested parallel PT development, as the budget compensation would otherwise impede behavioral change. With the parameter 'vocational necessity' ranked fourth place, the authors suggest establishing an individual budget for everyday life and a vocational budget that could be partly or completely reimbursed by the employer, to separate the external costs related to business and those related to private travel. The parameter 'location of workplace' has been attributed some importance, but experts also mentioned the location of residence as a useful parameter. One scientist, for example, argued that while the location of work can change fast, the location of residence may stay the same for a long time (e.g., because of family members). On the other hand, the economy expert argued that parameters with spatial dependencies should be completely left out of the function, as decisions about work and residence location should not be influenced by the expected amount of budget.
The other parameters, e.g. 'average trip frequencies' or 'average trip lengths', were considered less important. This is interesting, as some modeling approaches took previous mobility behavior as a basis for the individual budget allocation of a person (see, for example, Brands et al., 2020). The parameter 'socioeconomic status' was considered less important: One scientist argued that the effects of low-income, which could be, e.g., living in more rural areas and therefore possibly relying on a car, or having high travel distances to work, would already be balanced out by the other parameters.

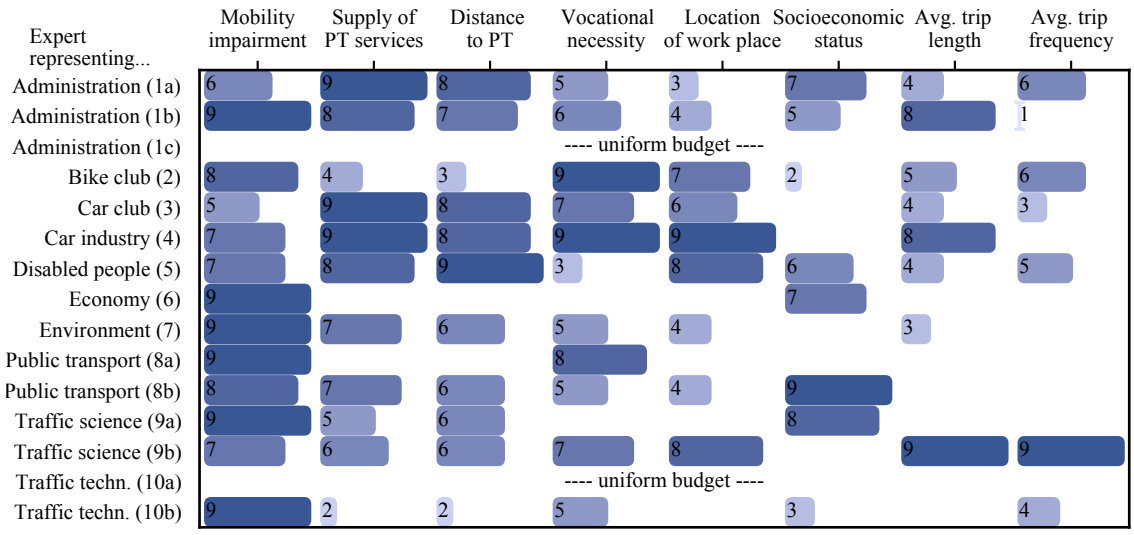

Figure 5: Individual prioritization of parameters for the budget allocation function (listed for each expert). 9 = high importance of parameter; 1= few importance of parameter, no value: parameter shall not be considered in the budget allocation function.

4. CONCLUSIONS

We presented a first overview of the target contribution, risks for social acceptance, and spatial and temporal system boundaries of a holistic mobility management system based on TCS (*MobilityCoins*) in Germany. The findings of the expert interviews provide valuable input for the system design and aim to address risks related to its implementation. Through a first analysis of the closed-question part (ranking part) of 15 expert interviews, we found that the system proposal was well received and is expected to contribute mostly to traffic efficiency and climate mitigation goals. Data security (tracking) and user effort might be the most critical issue for social acceptance. Budget endowment should be conducted on a yearly rhythm. On a spatial dimension, regional-to-national level enrollment is suitable, as restricting the system to city borders excludes commuter flows, leading to the problem of not integrating all external costs.
Furthermore, we had a closer look at individual and fair mobility budgets as a central part of a TCS system: It was possible to identify three important parameters for the budget allocation function: Grade of mobility impairment, PT service supply/ walking distance, and location of work and residence. Further work will focus on willingness-to-pay and mode choice in the MobilityCoin system.

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