**Switch or Stay: service-based and goal-based motivators for switching from yearly transit ticket to Mobility-as-a-Service (MAAS)**

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## Problem statement

In an era of digitization and automation, urban mobility faces major future challenges. To attain sustainable mobility, integration of transport modes are key to increase environmental friendly trips and reduce car dependency. Recently, the concept of Mobility as a Service (MaaS) has emerged, described by Hietanen (2014) as "a mobility distribution model in which a customer's major transportation needs are met over one interface and are offered by a service provider". MaaS is based on three elements: ticket and payment integration, mobility bundles and ICT integration (Kamarigianni et al., 2016). Beyond travel information apps, MaaS brings all together all the transport modes into a single mobility plan (Ho et al., 2018). MaaS aims to fulfil mobility needs without the need to own a private car or travel cards from various service providers (Utainen and Pöllanen, 2019).

Multi-modal travel are no longer a theoretical concept as several pilot projects have been conducted such as *Ubigo* (Stockholm), *Smile* (Vienna), and *SL!M* (Nijmegen). *Whim* is currently operating in three cities (Helsinki, Birmingham, and Antwerp) in collaboration with more than 2500 taxis, rental cars and local public transport authority (Goodall, 2017; Whim limitless travel,2017). Other ongoing operational schemes are *Tuup* (Finland), *Hannovermobil* (Germany), *Moovel* (Germany) and *MyCicero* (Italy) (Kamargianni et al., 2016). The Maas initiative offers great potential to replace car-ownership with personalised mobility packages accessing various modes (Nikitas et al, 2017). The pilot projects show that the flexibility of having multiple alternatives played a significant role in the choice of mode for individual trips, resulting in lower private car usage and higher car-sharing and transit usage (Karlsson et al., 2016). Apart from representing similar results about modal change like *Ubigo*, *Smile* pilot in Vienna also shows that more than half of the participants combined different means of transport and used alternatives routes, which were faster than their previously used routes (SMILE, 2015).

This study explores the motivation of young transit users and multi-modal travelers to switch to MaaS from current from the current transit yearly subscription. As MaaS is not widely adopted yet, therefore the role of end-users is based on observations from smaller trials. Experts suggest that Gen Z and millennials who use transit as their main mode will be the MaaS early adopter of MaaS. PT operators are expected to play as the main integrator of the service, collaborating with private sectors in a Public Private Partnership to ensure a reasonable level of service (Hensher, 2017; Smith et al., 2019).

## Research objectives

Fully encompassing switching behavior to MaaS solutions necessitates the consideration of external service factors of the new versus the existing system as well as internal psychological motivators (Whittl et al. 2019). FIGURE 1 presents the proposed behavioral Framework. The framework draws on two relevant models from consumer-research.

The first model is the service bundle switching (SBS), developed d'Allesandro et al (2012) for access-based services. Because MaaS is rather an evolutionary continuation of transport integration (Lyons et al., 2019), the role of the perceived satisfaction from the current alternative may be significant for explaining switching intentions. The SBS model accounts for push-pull factors for the current service, switching costs and expectations related to the new service. Service-based factors associated with transit use include general level-of-service (LOS) satisfaction, pricing satisfaction and system underutilization in the case of fixed price

subscription (e.g., monthly or yearly travel card). In addition to the satisfaction from the existing service, switching costs play an important role in the propensity to switch. High switching costs forms a barrier to switching from the exiting to the new service, regardless of its appeal (d'Allesandro et al., 2012). Switching costs from transit to MaaS subscription include the price difference between the two service bundle, deviation from inertia and expected decision effort associated with complex multi-modal environments. We add perceived pricing efficiency as the main motivator for access-based service bundles versus product-base purchases.

The second model encompasses the internal motivation of the traveler to switch from the current service to the new service considering the expected functional and emotional benefits. Lindenberg and Steg (2007) introduced the goal-framing model, which shapes actions through three motivational perspectives: normative, gain and hedonic. The normative goal "be better" accounts for the need to behave in accordance with one's values and beliefs and to stay true to one own self-concepts: green, healthy or active lifestyles. The gain goal "do better" implies the pursuit of utilitarian values such as better efficiency and time saving. The hedonic goal "feel better" encapsulate the desire to derive pleasure and enjoyment associated with the car, variety seeking and higher flexibility.

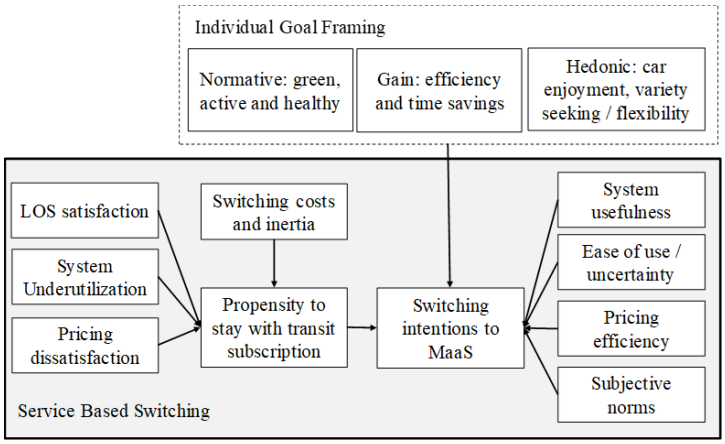


FIGURE 1 Behavioral framework for switching from transit use to MaaS

## Methodological approach

*Case study*

Innsbruck, Tyrol capital, is the fifth largest city in Austria with approximately 135,000 inhabitants. The transit authority IVB-GmbH operates in Innsbruck with an integrated ticketing system. The total length of the IVB route network is approx. 341 km with 24 bus and 3 tram lines. Verkehrsverbund Tirol (VVT), the regional operator, collaborates with IVB and operates 253 regional buses and commuter trains, with a network of 4530 km. Annual transit subsrcription, costing 490 Euro and covering the whole region is the most popular ticket option. IVB Ticketshop app allows online ticket purchase. Both operators have mobile and web trip planner (IVB Scout and VVT SmartRide) with real-time information and dynamic updating system. A recent survey shows that 77% of the transit users were satisfied with the transit system, 90% were satisfied with the network coverage, and 80% considered the vehicles as clean and comfortable, and 62% are satisfied with the system reliability (Sarker et al., 2019). These values coincide with the IVB (Innsbruck Transport Authority) 2016 official customer survey, showing generally high satisfaction with the PT system.

Apart from transit service, additional mobility options such as bike-sharing and car-sharing are available. The bike-sharing (Stadtrad) includes 41 stations and 350 bicycles, is available with IVB annual ticket which provides a 60 % complementary discount on the annual bike-sharing fee. Registration and booking of the *Stadtrad* system is available via nextbike-App. *Carsharing 24/7* and *Drivy* are the two car-sharing providers in Innsbruck. Beecar, floMOBIL and WEEZL are the electric carsharing providers in Tyrol. The 2050 Tyrol Energy Autonomy Programme aims at generating positive attitudes towards electromobility and inducing sustainable mobility choices in a long run. A 6% decrease in privately owned vehicles by 2020 one of the program goals.

Considering the strategies of the Tyrol region to achieve sustainability and energy efficiency by 2050, there is a scope to understand the demand for MaaS to close the gaps in the PT network. In order to adjust temporal and local gaps in PT, regions need more flexible mobility services that are integrated into the overall offer and permanently financed. Based on a recent empirical study, a reasonable share of multimodal usage (annual PT ticket users with weekly 30% additional car use and 21% additional bike use) and mobile apps usage (56%) for trip planning also exists in Innsbruck (Sarker et al.,2019), which initiates the need to evaluate the service aspects of MaaS in comparison to the existing solutions.

*Survey administration*

The onboard and online tailor made survey is expected to be administered during April 2019 through the official websites of the regional transit operators. The estimated survey completion time is 10-15 minutes, considering 21 questions. Participants will be asked to choose one of two options: yearly transit subscription (490 Euros) and various MaaS Scheme based on real-world solutions. An example of a MaaS scheme with a total yearly fee of 590 Euros includes: unlimited transit, unlimited bike rides (up to 30 min), taxi (10 euros for 5 kilometer coverage) and car-sharing with a fee of 0.2 euros per kilometer for short trips, and car rental for 60 Euros per day. The recruited sample size has a minimum of 500 responses. The public transport lines to board for surveying will be randomly chosen by the surveyors using the "first vehicle" strategy, which takes into account stratification by line frequency. Transit riders will be approached in four main locations: the city center, the main bus hub, the central rail station and the regional bus station.

**Expected Results**

The statistical analysis of the survey will include the estimation of a hybrid choice model for switching intentions from yearly transit subscription to MaaS. The model allows simultaneously identifying personal latent characteristics (i.e. level of satisfaction and individual goals) and their effects on the switching intention by incorporating a latent variable model into a discrete choice model. The latent variable model is based on an exploratory factor analysis that identifies the underlying structures among the measured variables. Following the exploratory factor analysis, confirmatory measurement equations linking the underlying latent individual goals and their observed indicators are estimated (Kim et al., 2017). The discrete choice model part estimates the effect of these latent constructs and the observed attributes of the considered transit and MaaS alternatives on the intention of switching to MaaS. The estimated model is expected to empirically support the proposed theoretical model. Namely, greater transit LOS satisfaction and higher switching costs negatively relates to switching intentions, transit system underutilization and pricing dissatisfaction positively relates to switching intentions. Higher perceived MaaS usefulness, ease of use and pricing efficiency

positively relates to switching intentions. Normative, gain and hedonic goal framing positively relates to switching from transit to MaaS.

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