Mobility as a Service: Different Directions and Perspectives

Soora Rasouli

Urban Planning Group, Eindhoven University of Technology
Mobility as a service is an **technology-enabled mobility management** concept.

Mobility as a service is a **subscription** to a **bundle** of various transport modes which are offered to users on an **integrated platform**.

The mobility management concept goes back to 1991 by US department of transportation. Inability of technology halted the jump to the mainstream delivery.
MaaS – Topology

Sochor et al (2017)
MaaS – Promises

The promises include:

- increasing convenience and flexibility
- improving accessibility
- a step toward more sustainable transport

Soora Rasouli
The promises include:

- *increasing convenience and flexibility*

*if all transport providers agree to have one single ticketing and payment method and share their data*
MaaS – Promises/ challenges

Convincing successful global service providers Uber, ecab, etc to join MaaS.

Convincing private providers to share their data

MaaS platform should have simple open API (Application programming Interface) to let other providers easily join MaaS.

In many countries public transport tickets are heavily regulated. Third parties are not allowed to sell tickets, marginal revenue for platform operators.
MaaS – Promises

The promises include:

• improving accessibility

if options include first and last mile, acceptable walking distance to available car/bike sharing stations. Deserves attention in rural areas.

To tackle low demand in rural areas a special business model may be needed
MaaS – Promises

The promises include:

• a step toward more sustainable transport

What would be the overall shifting process; from private car toward shared mobility, from public transport toward on demand transport such as car sharing or taxi!

In reality it needs proper business models, involvement of city authorities, government

Soora Rasouli
MaaS – Application

A pre evaluation of the area/ city is recommended before composing an action plan.

Legislation

(ICT) Infrastructures

Citizens’ willingness

. 

. 

. 

Soora Rasouli
Maas maturity index

Goulding & Kamargianni, 2017

Soora Rasouli
MaaS – Prospects

• *Extension to rural areas where accessibility problem is more serious*

• *More focus on demand responsive collective services (Uberpool, etc)*

• *Systematically study the substitution effect with special focus on “postponing the purchase of the first car” or “skipping the purchase of the second car”*
MaaS – Prospects

- Inclusion of MaaS (subscription decision, extra mode, information acquisition) in Activity based models

- Improvement in optimization of vehicle fleet and routing algorithm for demand responsive (collective) transport options
Two critical questions:

1) what would be the demand for such mobility option as a function of characteristics of the MaaS (bundle options), price but also social influence and attitudinal characteristics
2) How do people use the different options within their subscription once they subscribe?
MaaS – Empirical study 1

MaaS subscription decision, considering service attributes and social influence

Bundling and pricing scheme choice

Choice and willingness to pay for extra features of the service

Soora Rasouli
MaaS – Empirical study 1

Sequential Portfolio Choice Experiment

Mimic real world decision processes
Maintain experimental control

a. Choice about **subscribe or not** to the service

b. Choice about **pricing schemes** and **transport modes composition** of bundles

1st step

c. Choice for adding sets of **extra features** to the basic service at an additional price

Soora Rasouli
MaaS – Empirical study 1

Platform
- Price of monthly subscription (4 levels)
- Data required for the registration (4 levels)
- Time commitment (4 levels)

Transport modes
- Pricing schemes (4 levels) for each of the following choice alternatives:
  - Public Transport
  - E-bike sharing
  - Car-sharing
  - Taxi
  - Car rental
  - Ride-sharing
  - On demand bus

Social influence
- General reviews of the service (4 levels)
- Market share among:
  - Relatives (4 levels)
  - Friends (4 levels)
  - Colleagues (4 levels)

14 variables with 4 levels $\rightarrow 4^{14}$ FF
$\rightarrow$ 128 possible choice sets from orthogonal fractional factorial design blocked in 16 orthogonal subsets

Soora Rasouli
MaaS – Empirical study 1

De acceptatie van een Mobilititeit als een dienst (MaaS)

Voorkeur voor dienst

Fietser

<table>
<thead>
<tr>
<th>Vervoerwijzen</th>
<th>Prijs:</th>
<th>200 €/maand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openbaar vervoer (inclusief bus, metro, tram):</td>
<td>Betaal per rit</td>
<td>3 maanden</td>
</tr>
<tr>
<td>Standardtarief: 0.89 €/km; ingetrokken = 0.15 km</td>
<td>Gegevens die nodig zijn voor registratie:</td>
<td>Volledige naam, email adres, telefoon nummer</td>
</tr>
<tr>
<td>− Delen van een elektrische fiets:</td>
<td>Ongelimiteerd aantal reizen</td>
<td>Hoofdzakelijk negatief maar soms positief</td>
</tr>
<tr>
<td>Standardtarief: 2 €/uur</td>
<td>Algemeen ontvangen service recenties:</td>
<td>Familieleden</td>
</tr>
<tr>
<td>− Delen van een elektrische fiets:</td>
<td>Inclusief 120 min; daarna</td>
<td>25%</td>
</tr>
<tr>
<td>Standardtarief: 0.31 €/min</td>
<td>betaal per rit</td>
<td>Vrienden</td>
</tr>
<tr>
<td>− Taxi:</td>
<td>Inclusief 30 km; daarna betaal per rit</td>
<td>75%</td>
</tr>
<tr>
<td>Standardtarief: 3 €/instap tarief = 2 €/km</td>
<td>Betaal per rit met 20% korting op het basistarief</td>
<td>Collega's</td>
</tr>
<tr>
<td>− Autohuur:</td>
<td>Betaal per rit</td>
<td>50%</td>
</tr>
<tr>
<td>Gemiddeld standardtarief: 49 € per dag, inclusief onbeperkt aantal km</td>
<td>Betaal per rit</td>
<td>Onbeperkt aantal ritten</td>
</tr>
</tbody>
</table>
MaaS – Empirical study 1

De acceptatie van een Mobiliteit als een dienst (MaaS)
Voorkeur voor dienst

Voorbeeld keuze set
In aanmerking nemende dat de dienst tegen de tarieven alleen een basis functionaliteit heeft (reisplanning, reserveren, kaartje kopen, betalen en rekening sturen), welke aanvullende opties zijn u dan willen kopen tegen de genoemde extra prijzen?

Prijs van het basisabonnement: 150 €/maand

<table>
<thead>
<tr>
<th></th>
<th>Optie 1</th>
<th>Optie 2</th>
<th>Geen van beide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ontvang real time alarmen en aankondigingen van gebeurtenissen zoals vertragingen, onderbrekingen en een aanbeveling voor een alternatieve route</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>App synchroïnatie met uw agenda</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Betalen voor parkeren</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Vastleggen van uw reis zodat de CO2 en emissies van de rij bepaald kunnen worden</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Met uw abonnement kunt u de dienst gebruiken</td>
<td>In heel Nederland</td>
<td>In heel uw regio</td>
<td></td>
</tr>
<tr>
<td>Gratis niet-verlengbare proefperiode van</td>
<td>1 week</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U kunt gratis uw abonnement opzeggen:</td>
<td>2 dagen voordat het afloopt</td>
<td>2de helft van uw abonnementsperiode</td>
<td></td>
</tr>
<tr>
<td>anders is de boete:</td>
<td>25% van de abonnementsprijs</td>
<td>50% van de abonnementsprijs</td>
<td></td>
</tr>
<tr>
<td>Er is geen boete als u cancelled:</td>
<td>Een geplande rit 1 uur voor de aanvangstijd</td>
<td>Een geplande rit 3 uur voor de aanvangstijd</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Een rit met onmiddellijke ingang 4 minuten voor de aanvangstijd van de reservering anders moet u 75% van de prijs voor de rit betalen</td>
<td>Een rit met onmiddellijke ingang 2 minuten voor de aanvangstijd van de reservering anders moet u 25% van de prijs voor de rit betalen</td>
<td></td>
</tr>
<tr>
<td>De extra kosten voor het total van deze opties is:</td>
<td>9 €/maand</td>
<td>7,5 €/maand</td>
<td></td>
</tr>
</tbody>
</table>

Uw keuze:

Soora Rasouli
MaaS – Empirical study 1

**Completed questionnaires:** 687 in August 2017, and 755 in March 2018.

**Step 1**
Decision to subscribe
- No: 80%
- Yes: 20%

**Step 2**
Decision to add extra features
- Add extra features: 16%
- Keep the basic service: 4%

**Step 1**
% of frequencies of transport mode choice in bundle composition observed among all the respondents that decided to subscribe

- Public Transport: 60%
- E-Bike Sharing: 30%
- E-Car Sharing: 20%
- Taxi: 40%
- Car Rental: 50%
- Ride Sharing: 50%
- On Demand Bus: 10%
MaaS – Empirical study 1

2-stage process of subscription decision

Traditional choice experiment
with a Binomial Choice (1 from a set of 2)

Portfolio choice experiment
with a Multivariate Binary Choice (1 or up to 4 from a set of 7)

Utility of the subscription is a function of:
• constant
• transport modes pricing schemes
• subscription price
• social influence attributes
• socio-demographics and travel related characteristics
• error term

Utility of the bundle is a function of:
• transport modes pricing schemes
• transport modes main effects
• pair-wise interactions between transport modes
• Interaction effects with socio-demographics and travel-related characteristics
• error term
MaaS – Empirical study 1

- **Taxi**
  - 50 km included and then pay per ride
  - 30 km included and then pay per ride
  - Pay per ride with 40% of discount on standard fare
  - Pay per ride

- **Car rental**
  - 4 days included and then pay per use
  - 2 days included and then pay per use
  - Pay per use with 20% of discount on standard fare
  - Pay per ride

- **Ride sharing**
  - Unlimited rides
  - 100 km included and then pay per ride
  - Pay per ride with 20% of discount on standard fare
  - Pay per ride

- **On demand bus**
  - Unlimited rides
  - Unlimited rides in one zone and for the others pay per ride
  - Pay per ride with 20% of discount on standard fare
  - Pay per ride

Soora Rasouli
MaaS – Empirical study 1

General public review of the service

Share among Relatives

Share among Friends

Share among Colleagues

Soora Rasouli
MaaS – Empirical study 1

- Social demographic effects:

  Male and younger age group higher tendency to subscribe

  Single households with child show the highest positive effect and single without child least interested group

  The middle level income are more interested compared to the lowest and highest level income

  Households with more than one car have the lowest interest to subscribe, followed by the household without car. Households with one car are the ones with highest interest.
MaaS – Empirical study 1

Additional analysis:

- Technology acceptance (Adapted from UTAUT2, Venkatesh et al. 2012)
  - Using MaaS app would help me to organize and execute my trips more efficiently
  - I think the use of MaaS app would be clear and understandable

- Innovation adoption (Adapted from Diffusion of Innovation Theory, Rogers 1962)
  - If I will become a MaaS users, it will be noticed by people close to me
  - By using MaaS, I think that I will encourage my relatives and friends to use it for their trips

- Trust in a web-based service (Adapted from McKnight et al., 2001)
  - I think that the service offered with MaaS would be reliable
  - I think using MaaS app for payment would be safe
MaaS – Empirical study 1

**Additional analysis:**

- **Privacy concerns (Adapted from Smith et al. 1996)**
  - I usually get annoyed when mobile apps ask for personal information
  - I’m concerned that mobile apps collect too much personal information about me.

- **Tariff choice biases (Adapted from Lambrecht and Skiera 2006)**
  - If I pay a flat rate, I feel much more free and more relaxed about travelling than when I have to pay a price per km
  - Traveling is less pleasant if I have to think that the costs increase every minute or kilometer
MaaS – Empirical study 2

MaaS personalized package characteristics
- Type/number of modes included
- Pre-trip information
- Travel cost
- Number of transits
- Waiting time
- Access time
- Uncertainty

DECISION CONTEXT
- Daily Travel Agenda (needs; travel party; location; trip purpose; time pressure;..)
- Other (weather)..

INDIVIDUAL characteristics
- Socio-demographics (Car ownership; household type;..)
- Attitudes (Habits; Lifestyle; Preferences)

DECISION OUTCOME
(MaaS versus alternative transp. mode)
- Mode choice

Perceived value
- Satisfaction (Flexibility; comfort; frequency; reliability; Value for money)
- Experience
- Social Network effects

User’s Subscription

Soora Rasouli
Hybrid Choice Modeling

- Integrated modeling framework
- Combines both observable and latent factors
- Unobserved heterogeneity
- Time effects
MaaS – Empirical study 2

**Longitudinal data**

✓ Same sample of households/individuals

✓ Data collection before, during and after MaaS pilot introduction

✓ Measuring within sample travel behavior change over time