Sustainable Mobility & Mobility as a Service in Ljubljana
Urban mobility: On the cusp of transformation

Urban mobility is facing exciting and turbulent times. It seems that the era of complete dominance of privately owned cars is coming to an end. And this is happening for very good reasons. A privately owned car promises the freedom of mobility but with congestion and pollution in urban environments its value is diminished and the negative effects are increased. When bicycle becomes the fastest means of transportation on the streets, when people need to squeeze at the edge of the roads while our mobility infrastructure takes up almost all of the available space between buildings and when hundreds of people are dying prematurely each day because of transportation-related city pollution, it is time to rethink the future direction of urban mobility. This leads to the understanding and acceptance that the current transportation model is no longer sustainable and needs to be replaced with a model that is more efficient, cost-effective and environmentally friendly.

On the other hand, digitization is delivering new user experiences and new business models that can solve many of these pain points very efficiently and effectively. After 100 years, cars are very ripe for a business model disruption. This was exactly the starting point for EdIT – the student summer school that Comtrade has been organizing for the past 19 years.

The objective of the summer school was to create an urban mobility system that would work with the complete absence of privately owned vehicles. The objective was to use only technology that is already available today, which means that technologies, like autonomous vehicles were not considered. The exercise targeted the city of Ljubljana that is already making some very successful steps to take back the city for the people and reduce the dominance of mobility infrastructure.

Essentially, the objective of the exercise was to dream about the city of Ljubljana in which all residents and people just travelling through would recognize that a collaborative approach to solving mobility issues can increase the quality of city life substantially in addition to having tremendous financial benefits. The objective of the exercise was to dream up a city that could exist today but does not. Our hope is that through this exercise we made a small step towards improving urban life in Ljubljana.
Ljubljana today

Some key facts about Ljubljana, Slovenia’s capital:

• 250,000 people living in the city; 350,000 people including people living in the suburbs and 500,000 in the region
• 140,000 cars in the city
• 100,000 cars from daily commuters that arrive to the city with privately owned cars; about 12,000 people come to Ljubljana daily by train
• Current taxi system: about 360 taxi vehicles
• Current bus system: about 210 buses; about 60M trips made per year
• Bike sharing system in place with 35 stations and about 2,000 daily users on average
• 7 Park and Ride stations on the outskirts of Ljubljana
• Over 1M trips are made daily within the city; approximately 85% of the trips are made with privately owned cars

In recent years, Ljubljana made an important step toward sustainable mobility by introducing several measures – closing the city center to privately owned cars to only allow the electric vehicle Kavalir or public transport to run; expanding existing and opening new Park and Ride facilities; introduction of the Urbana card that can be used for bike-sharing, public transport and even the funicular; the introduction of new bus lines connecting the cities and towns in the region; etc.
Mobility as a Service: The new model for urban mobility

The idea behind this exercise was to remove the inefficient business model under which cars are used today and which is seen as the single biggest pain point of urban mobility. Statistics are very simple -

**car is used less than 5% of the day**

which means that for about 23 hours every day, a car is mainly causing problems. Since private vehicles are not used only for city trips they are not optimized for this purpose. People are buying fossil fuel cars because they need the car for the occasional long distance trip, even though the vast majority of drives are using their cars for short trips for which an electric vehicle would be perfectly adequate. And when a trip is started with a private car, it will probably also be finished in the same way - it is not very convenient to mix it with other means of transportation.

If we embrace the Mobility-as-a-Service (MaaS) concept, the situation changes significantly. First of all, efficiency increases dramatically. On average,

**one shared car replaces about 10 privately owned cars.**

The shared cars can be optimized for a single purpose, which means cars in cities can be more compact with lower carbon footprint. They can also be larger, if that is what is needed. And along every step, users can change the mode of transportation to increase efficiency and flexibility.
User experience at the center of urban mobility

The idea behind Mobility-as-a-Service is that mobility starts in the digital world. A multi-modal mobility app can be used to route people using all the transportation services that are available. Every single trip can make use of different modes of transportation, depending on individual preferences, current weather situation or available time. Urban mobility is based on a single identification and payment system (Urbana), which plays a significant role in simplifying the user experience.

* Users can select which mobility option they prefer and the system shows them a map with stations, schedule and prices.
Imagining the possibilities: Design thinking

In order to conceptualize the new mobility system, we used the Design Thinking approach. We carefully selected 10 different types of commuters (based on real-life situations) who have specific mobility needs within the city. The following types of commuters were used:

- Student
- Retired person with limited mobility
- Family
- Business person
- Persons living outside of the city who travel daily to the city for work

If we ignore the car as a status symbol, privately owned cars essentially have two main purposes:

a) Providing the means to move from point A to point B

b) Ensuring that mobility is available when we need it

Mobility-as-a-Service can optimize both parameters. On one hand, it can optimize the actual mobility part by selecting more appropriate vehicles and optimizing their use. However, the main advantage of this concept is that the vehicle no longer needs to sit idle in order to ensure that mobility will be available when the user needs it. This “mobility guarantee” is an information problem and we should solve it with information technology. In addition to significant economic benefits of having “mobility guarantee” done by a digital platform, the guarantee itself is also better because it can give us the following mobility option:

a) the most appropriate transportation that best fits your needs;
b) transportation that is available to you at the time you need it;
c) transportation that is available at the most convenient location for you.

We modeled different transportation option so that we can eliminate the need for a privately owned car within the city for each of them. MaaS concept does not mean that everybody uses the same set of services. There can be a significant difference depending on the commuter’s needs and financial abilities. However, everybody benefits from the fact that there are less vehicles and that more appropriate means of transportation are used within the city.
Envisioning the future: Ljubljana without privately owned cars

Model and statistics

On a busy weekday in Ljubljana, there are about 240,000 privately owned cars making more than 600,000 trips.

The concept of Mobility-as-a-Service would replace the travel by privately owned cars with the following transportation modes:

- About 40% of all trips made with privately owned cars are taken over by the existing transportation modes (public transportation, shared bicycles, walking).
- Most of the cars (80-90%) are used as part of a car-sharing model where users can use mobile application and remote access to share vehicles.
- The remaining cars are used as a shuttle service/taxi.

All cars are equipped with telematics and offer simplified ride-sharing options. If the driver allows ride-sharing, the car automatically enters the ride-sharing marketplace with the benefit of reduced car-sharing price.

It is assumed that the existing public transportation is expanded and modernized. It is also assumed that bicycle sharing is extended to the whole city and that electric bikes are offered as an additional part of this service.

- The remaining 60% of the total number of trips are made by approximately 20,000 electric cars that are used in a service model:
The financial and business model

All mobility options would be used in a service model and a pay-per-use model would be applied in general. The pricing model would prioritize transport modes in the following way:

- 1st priority: Walking (free)
- 2nd priority: Shared traditional bike (free with a yearly subscription to cover all infrastructure costs)
- 3rd priority: Public transportation (pay-per-use with volume discounts; flat fee for monthly and yearly use)
- 4th priority: Shared car and shuttle/service (pay per use with volume discounts; reduced price for ride-sharing option)

Specific financial calculations depend on several factors which go beyond the research project that was completed as part of this assignment. However, it is clear that there are significant economic savings arising through better and more appropriate utilization of the infrastructure. Additionally, the pay-per-use business model allows people to individually and constantly adapt their use of mobility services to their need and economic constraints.
The benefits of Mobility as a Service concept

The MaaS model has obvious economic benefits for the end users. However, it also has significant benefits for the community at large, such as:

- **Significant reduction of space required for transportation infrastructure.** Just in terms of parking space in Ljubljana, it is estimated that about 300 soccer fields of surface would become available if we transitioned to the MaaS concept without any negative impact on our parking space availability.

- By using electric shared cars the pollution from the road transport within the city would be drastically reduced.
- Using electric cars would also significantly reduce the noise level within the city.
- A multi-modal mobility approach can be used very effectively to promote healthy forms of mobility (such as walking and biking).
On the road to change: Abandoning the old and embracing new commuter habits

There are many ways to change people’s behavior - prohibitions, law, information, persuasive communication, social marketing campaigns, incentives for desirable behavior, etc. However, the best way is when people recognize the benefits of a different behavior for themselves.

The mobility system in the city is a very complex problem where individual optimization does not lead us to a desirable result. In fact, it’s quite the opposite - when each person wants to solve his mobility needs with a privately owned car, the result is that everyone is stuck in traffic, there are always insufficient parking spaces and everyone is exposed to pollution.

In order to make changes it is essential that people are educated and that sustainable mobility is seen as a very important value for them. Additionally, a shared vision between the government, companies and all citizens needs to be put in place that gives direction for activities of every stakeholder.

Digital mobility platforms will benefit from increased use and will have their own positive dynamic. As more people start embracing this, the platforms will yield more value and even

more people will use them. However, the speed of adoption is largely correlated to the awareness and education regarding all key aspects of our mobility, such as financial, environmental and health aspect.

One good way to raise awareness in a fun way is gamification. By choosing Mobility-as-a-Service over car ownership, we normally decrease CO₂ emissions and if we enable people to see how much CO₂ emissions they saved and help them share the information or even compete with their friends, we can make the usage of Mobility-as-a-Service even more attractive.
About EdIT and Comtrade

EdIT - Education for Innovative Thinkers

EdIT (Education for Innovative Thinkers) summer school started in 1996 as a small project with only 10 participants and since then has become a traditional regional event. Over two decades, EdIT has built a reputation for offering a high quality program and educational activities for young generations of IT enthusiasts. The summer school takes place in several locations across Slovenia, Bosnia and Herzegovina and Serbia and gathers the best students from technology high-schools and faculties. The goal of EdIT is to provide young software developers and future IT professionals with the opportunity to develop practical skills through hands-on work and prepare them for future career challenges. Working on actual projects under the supervision of experienced mentors, students can use the acquired knowledge and adapt to real-life conditions in a high-tech company and gain valuable experiences that can be used in future career endeavors.

Comtrade (Automotive/Mobility)

Comtrade is the largest software development and IT solutions company in the Adriatic region. Among other business activities, Comtrade is working on research and development of advanced transportation solutions. Comtrade recognizes that technology can profoundly change the way we deal with transportation, especially in the cities. We can create a significantly improved commuter experience at a lower cost and with a huge benefit to the environment.

Together with its partners, Comtrade is working on an advanced set of solutions that can eliminate the need for privately owned cars in the cities and replace them with a set of Mobility-as-a-Service solutions, including public transportation, car sharing, ride sharing and shuttle services.