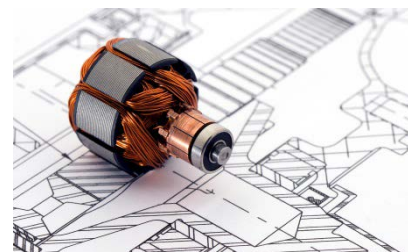# Megatrends in urban mobility and how to get them implemented

Deutsch-Japanisches Wirtschaftsforum – April 2018

Alexander Schmidt

Fraunhofer-Institut für Arbeitswirtschaft und Organisation IAO, Stuttgart

Fraunhofer

IAO

Profile of the Fraunhofer-Gesellschaft

- **Founded:** 1949

- more than **22,000** staff

- **66** institutes and independent research units

- **Fraunhofer Worldwide**

Europe: Brussels (Belgium), Budapest (Hungary), Porto (Portugal), Gothenburg (Sweden), Bolzano (Italy), et al.

USA: East Lansing, Maryland, Plymouth, Boston, Newark, Cambridge

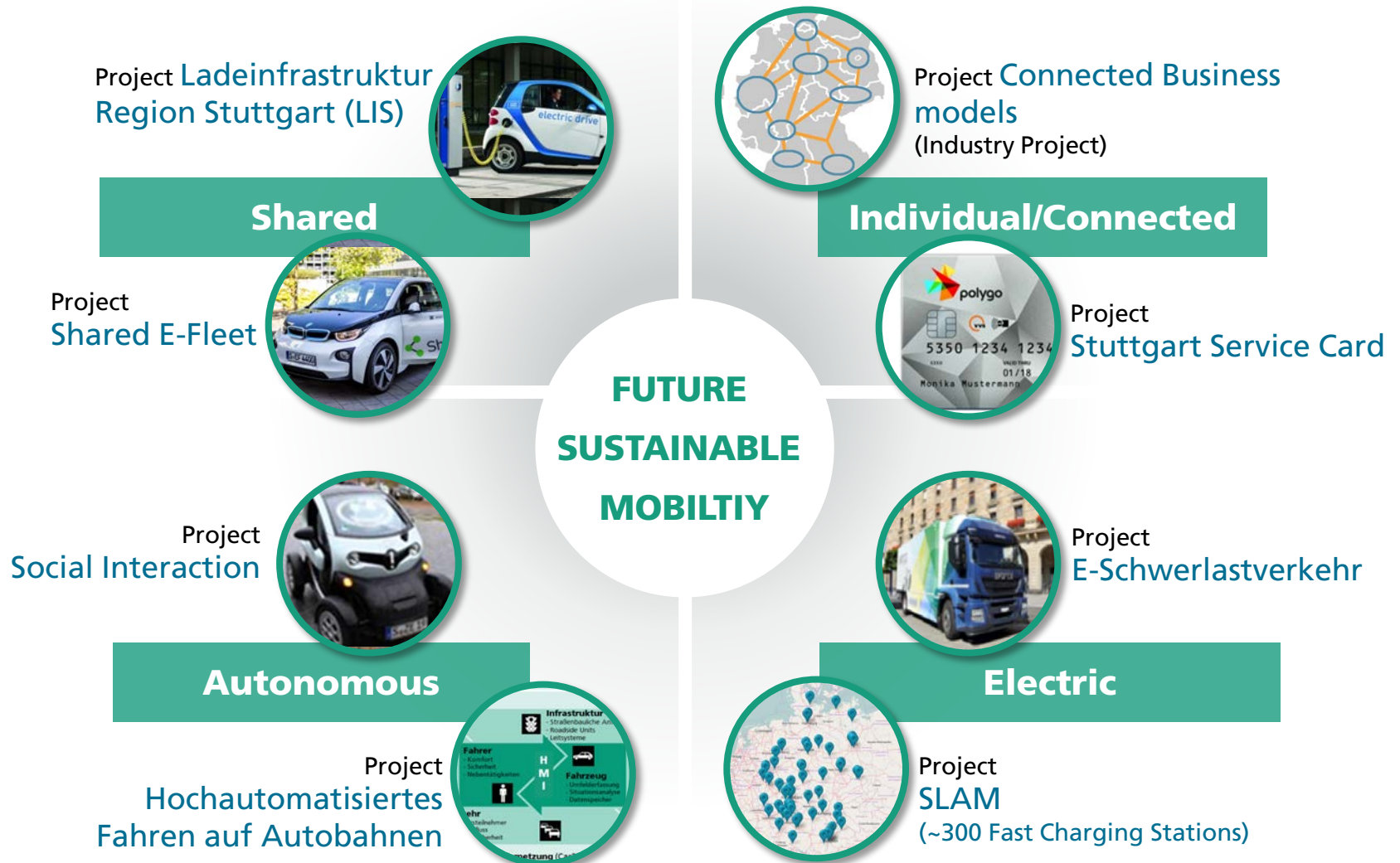**South America:** Santiago (Chile), Salvador (Brazil)

Asia: Ampang (Malaysia), Beijing (China), Jakarta (Indonesia), Koramangala Bangalore (India), Seoul (South Korea), Singapore, Tokyo (Japan)

Middle East: Dubai (United Arab Emirates), Cairo (Egypt)

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MEGATRENDS IN URBAN MOBILITY

The convergence of connectivity, electric, autonomous, shared mobility

Project **Ladeinfrastruktur Region Stuttgart (LIS)**

Project **Connected Business models** (Industry Project)

Shared

Individual/Connected

Project **Shared E-Fleet**

Project **Stuttgart Service Card**

FUTURE

SUSTAINABLE

MOBILTIY

Project **Social Interaction**

Project **E-Schwerlastverkehr**

Autonomous

Electric

Project **Hochautomatisiertes Fahren auf Autobahnen**

Project **SLAM** (~300 Fast Charging Stations)

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shared

DATA ANALYTICS - Project example

HubCab

Exploring New York City taxi trails and sharing our way to a more sustainable urban future

The electric car sharing of the future
A new type of public transportation service

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From car sharing to ride sharing
Special vehicles for urban and shared use cases

Source: ngin-mobility.com

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autonomous

RESEARCH ON VEHICLES

URBAN DRIVEN

Research project to demonstrate and evaluate technologies of future urban vehicles –
They will be electrified, autonomous, connected and can interact with other traffic participants

Source: Fraunhofer IAO

Depending on the degree of automation, needs can be fulfilled in different ways.

f.e. Entertainment

f.e. Basic requirements

6 needs can be distinguished with which the passengers can be addressed.

Wellbeing
- Fitness
- Beauty
- Health
- Wellness

Basic requirements
- Washing / cleaning
- Sleep
- Eating / drinking
- Dressing / changing clothes

Communication
- Social networks / interest groups
- Consultations
- Private Communication

Productivity
- Work
- Organization
- Training
- Shopping for daily requirements

Information
- Surrounding / route information
- Product information
- Online infor-mation search

Entertainment
- Games
- Artistic activities
- Passive entertainment

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Key Findings of the Survey

75 percent of users are prepared to pay for value-added services.

The greatest willingness to pay is demonstrated by users to meet the needs of communication, productivity, and basic requirements.

The countries differ greatly in terms of relevance and ranking of service groups.

Users from California (U.S.) exhibit the greatest willingness to pay for services.

Even in case of a short travel time per day, end customers are prepared to pay for value-added services.

Younger users are prepared to pay more than their older counterparts.

The willingness to pay is largely independent of the vehicle segment.

The willingness to pay a surcharge for an automated vehicle is significant across all vehicle segments (highest in the small car segment).

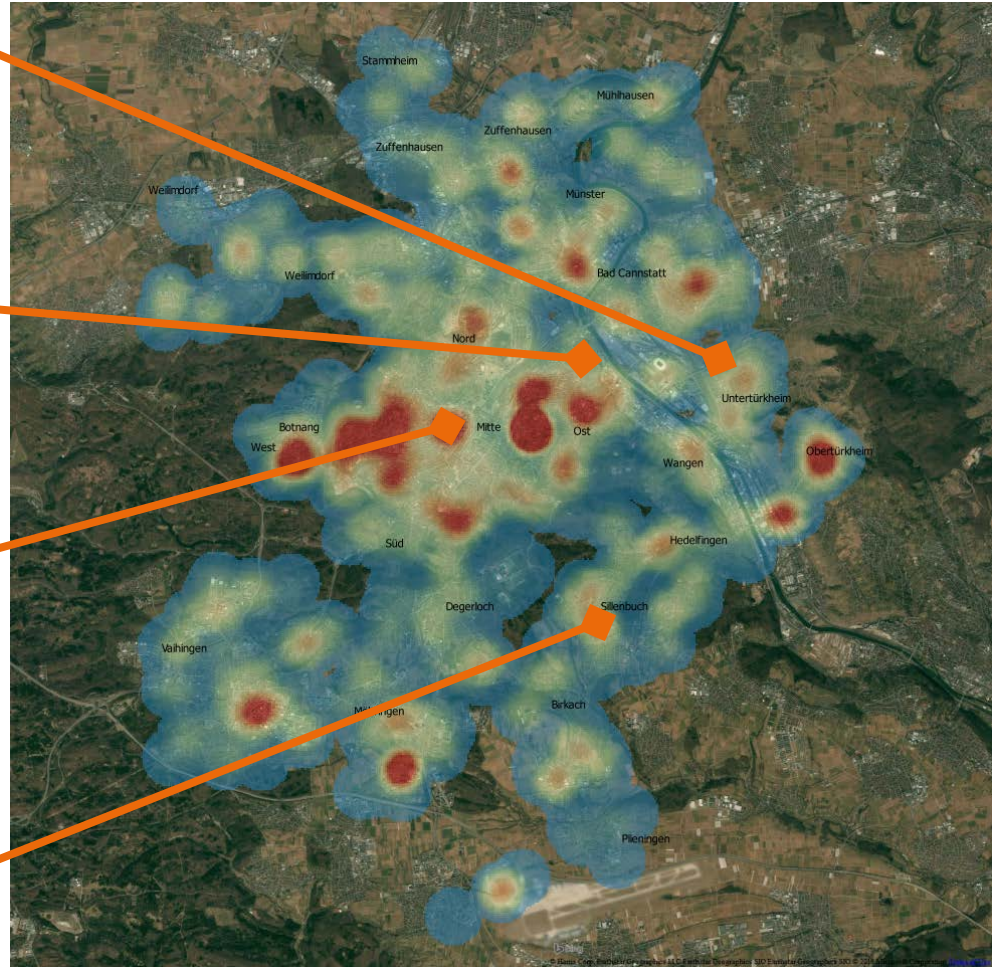The "Value of Time" varies according to country, age, income, and vehicle segment.

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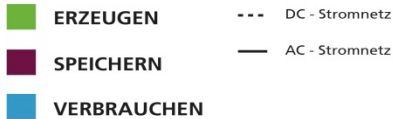# electric

Potential for AC charging in cities
Where are charging stations needed

1. **Residential area Luginsland**

2. **Public bath with direct access to city park**

3. **University of Stuttgart**

4. **Sillenbuch** – rich residential area

Fraunhofer IAO Micro Smart Grid
developing parking facilities to a smart electricity grid

ERZEUGEN

SPEICHERN

VERBRAUCHEN

- - - DC - Stromnetz
——— AC - Stromnetz

① Windkraftanlage - vorbereitet
- Anlage mit vertikaler Achse ist für den Standort aufgrund der Windverhältnisse besonders geeignet

③ Photovoltaik
- CO_2-arme Stromerzeugung auf 190m²
- Überschüssiger Strom im Sommer kann zur Nutzung im Winter im LOHC-Speicher gespeichert werden

② LOHC-Wasserstoffspeicher
- Erster Speicher seiner Art im Regelbetrieb speichert Wasserstoff sicher in einem Trägeröl
- 2.000 kWh Speicherkapazität, womit ein 2-Personenhaushalt bis zu 8 Monate versorgt werden kann
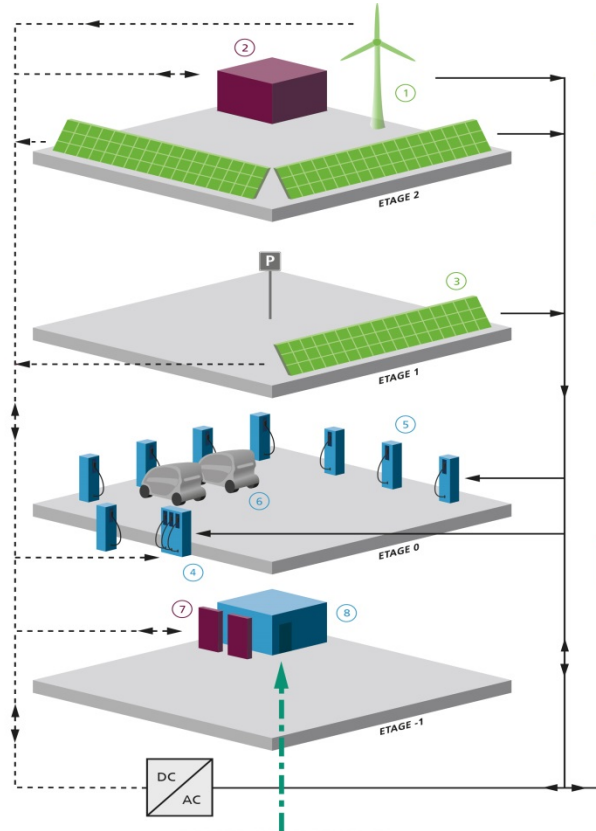
⑥ Elektrofahrzeuge
- Ca. 30 Elektrofahrzeuge verschiedener Hersteller inkl. Plug-in Hybriden
- Teilweise mit Telematikeinheiten zur Erfassung der Livedaten während der Fahrt ausgestattet

⑤ AC-Ladestationen
- Ca. 30 Wechselstromladestationen in der unteren Ebene des Parkhauses
- Ladeleistungen bis zu 22kW (entspricht der Leistung von 6 Haushaltsteckdosen)

④ DC-Schnellladestationen
- Zwei Schnellladestationen (50 und 150 kW)
- Eine Schnellladestation am Fraunhofer IZS ist die erste 150kW-DC-Lademöglichkeit der EU (entspricht der Leistung von rund 40 Haushaltsteckdosen)

⑧ Leistungselektronik
- Physischer Teil des übergreifenden Steuerungssystems zur Optimierung des Energiesystems
- Setzt die vom Energiemanagement vorgegebenen Betriebsstrategien um
- Möglichkeit das System energieautark zu betreiben oder Fahrzeuge vollständig CO2-neutral zu laden

⑦ Lithium-Ion-Batterie
- Batterietechnologie, die auch in Elektrofahrzeugen verwendet wird
- 100 kWh Speicherkapazität womit ein 2-Personenhaushalt bis zu 11 Tage versorgt werden kann

ETAGE 2

ETAGE 1

ETAGE 0

ETAGE -1

DC / AC

Energiemanagement
- Übergreifendes Steuerungssystem zur Optimierung des Energiesystems
- Lokale Abstimmung von Energieerzeugung und Verbrauch

Fuhrparkmanager
- Stornierung, Anlegen und Änderung von Fahrten
- Planung von Wartungs- und Säuberungsarbeiten

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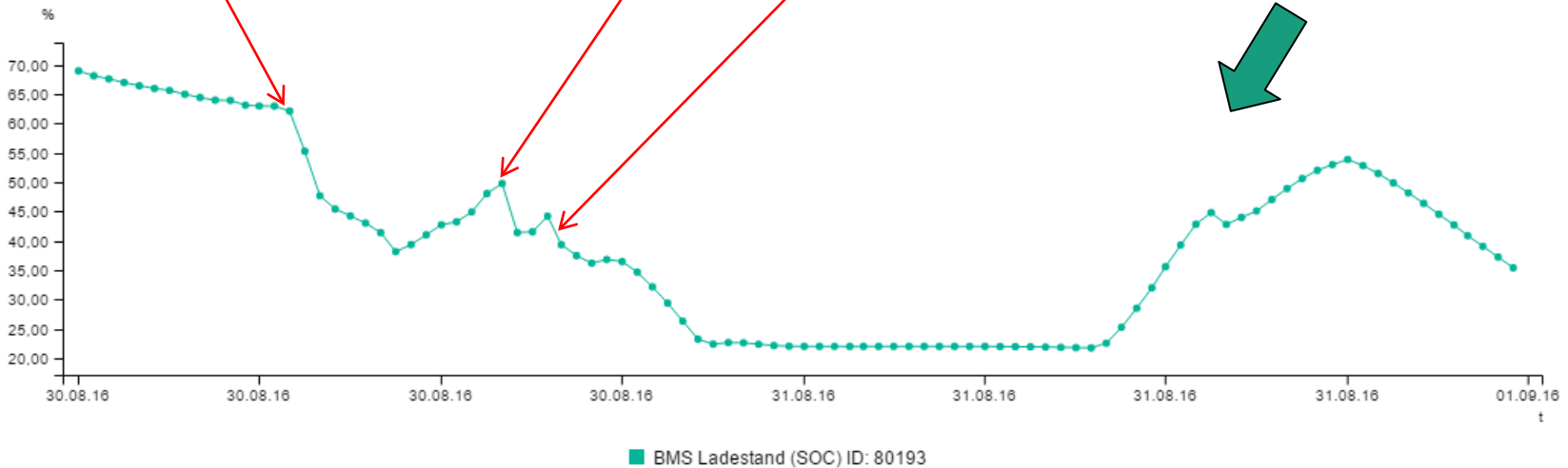
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Fast charging as a challange to electricity grids

Fast charging of electric prototype 60-80 kW

SOC of MSG battery for buffering local energy usage

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connected

Intermodal travel chains
Using Smartphone sensors to track mobility behaviour

Bus
100 g
CO_2/km

By foot
0 g
CO_2/km

Car
149 g
CO_2/km

Subway
13 g
CO_2/km

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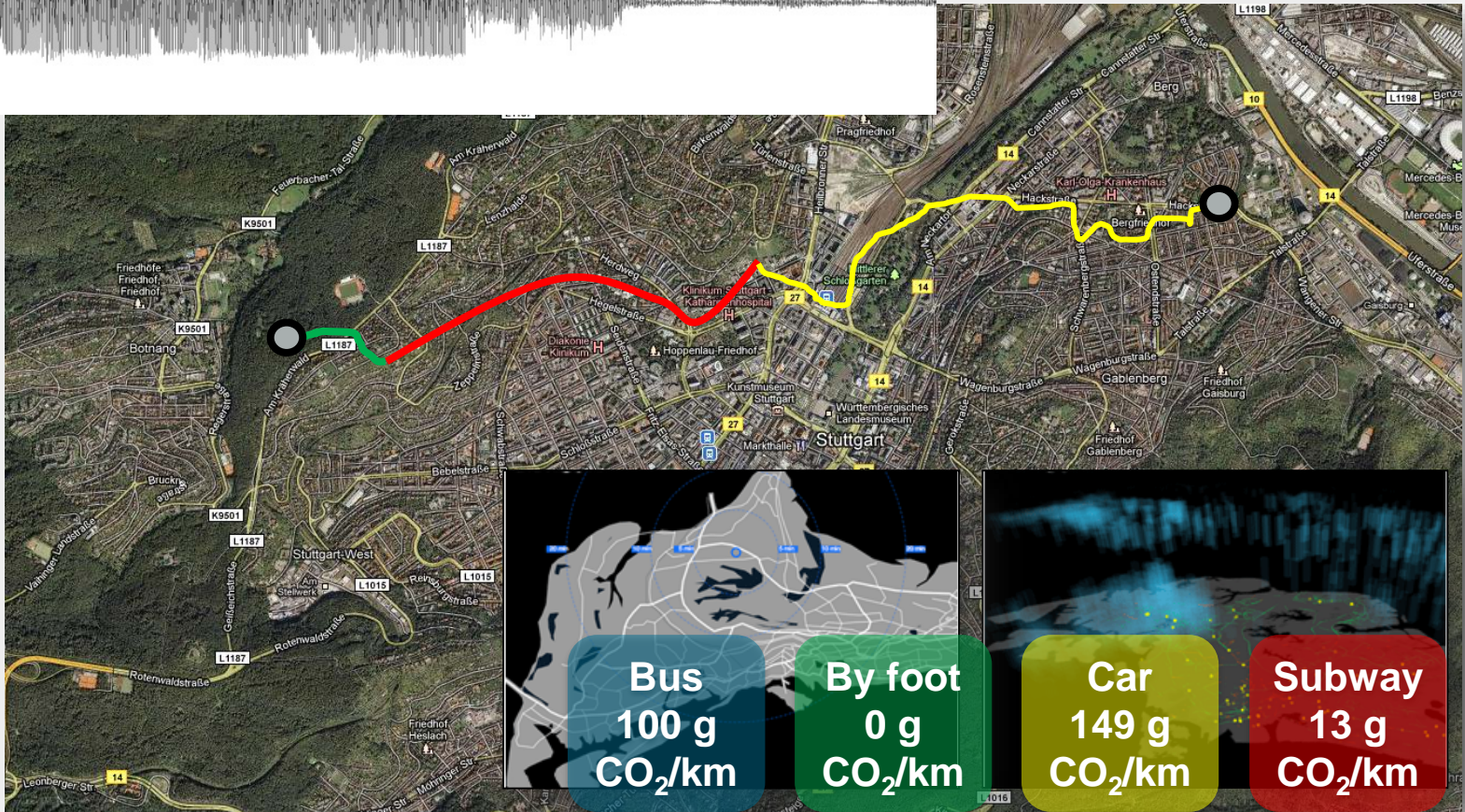
Five different types of Data relevant for Planning
Basic differences in Content and possible outcomes

Surveys	**Information collected directly from the traveler. In the most widespread Plan**
Automatic traffic counts	**Includes all locally fixed technical counting mechanisms. E.g. induction loops and cameras, both as infrastructure and as vehicle-bound.**
Floating Car Data (FCD)	**GPS movement data obtained directly from vehicles with permanently installed or portable modules.**
Mobile GPS Data (MGD)	**GPS data collected by mobile phone - usually linked to an application.**
Mobile Network Data (MND)	**Data records collected from the communication's network of mobile network operators. Geolocation via assignment to mobile cells.**

ROUTE 1
ZÄHLSTATIONEN

ROUTE 2
FLOATING CAR DATA

ROUTE 3
MOBILE GPS DATA

MOBILE APPLICATION DATA

ROUTE 4
MOBILE NETWORK DATA

ROUTE 5
BEFRAGUNGEN

ORTUNG

GPS-SIGNAL

ZÄHLUNG

INFORMATION

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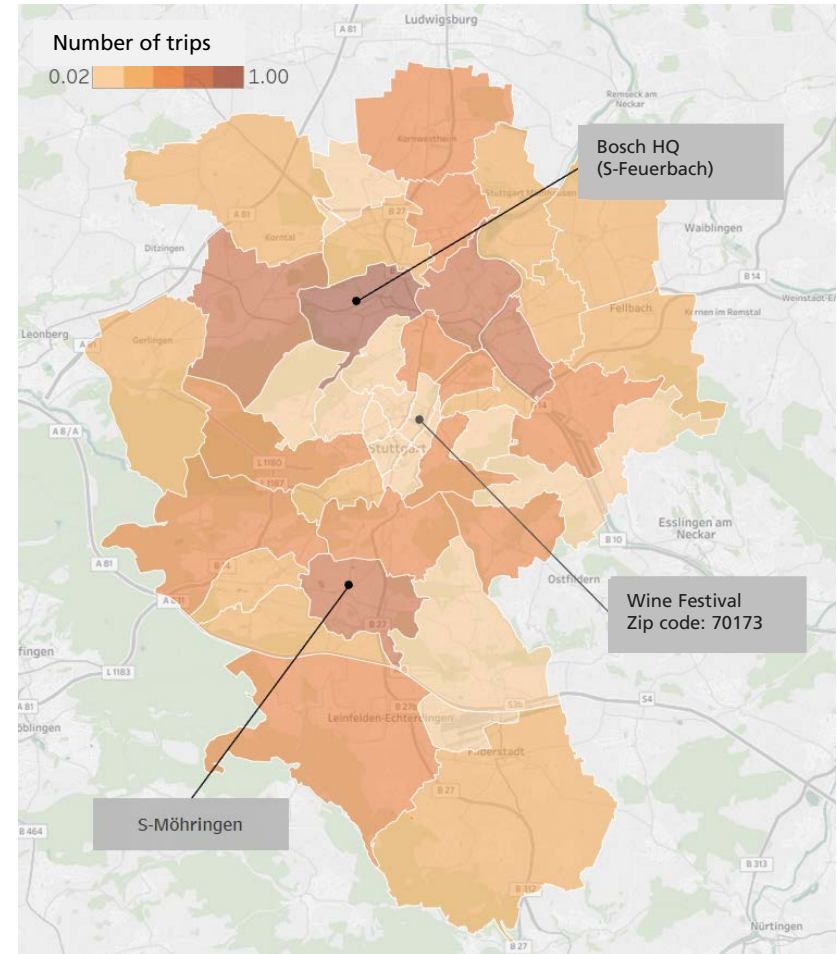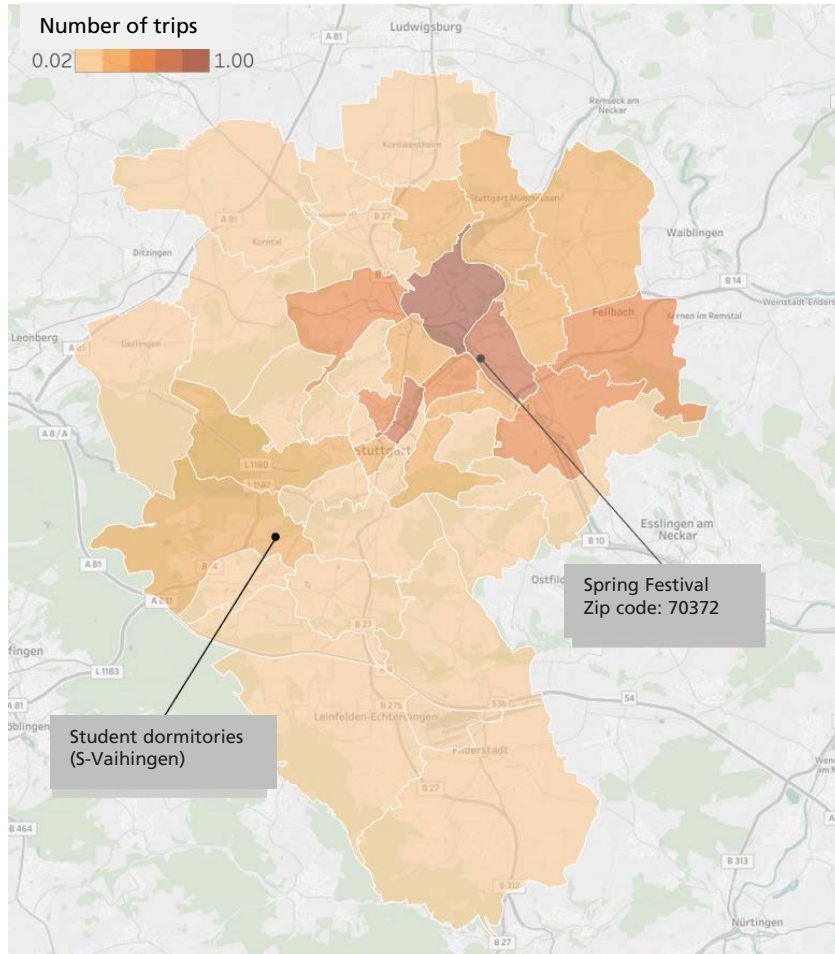Technologiemanagement IAT

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Traffic linkages in Stuttgart
Comparison between morning and afternoon
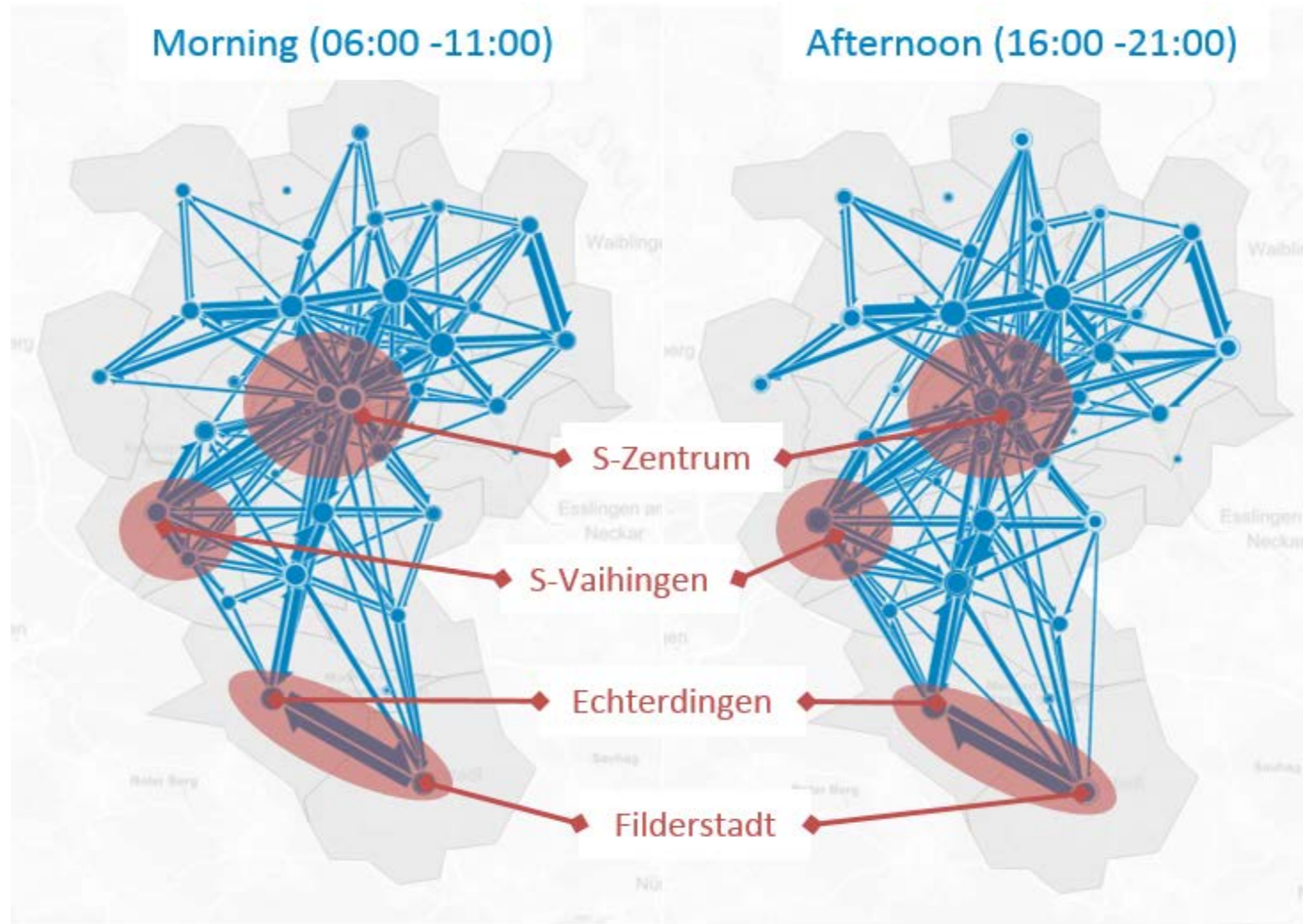
Catchment area
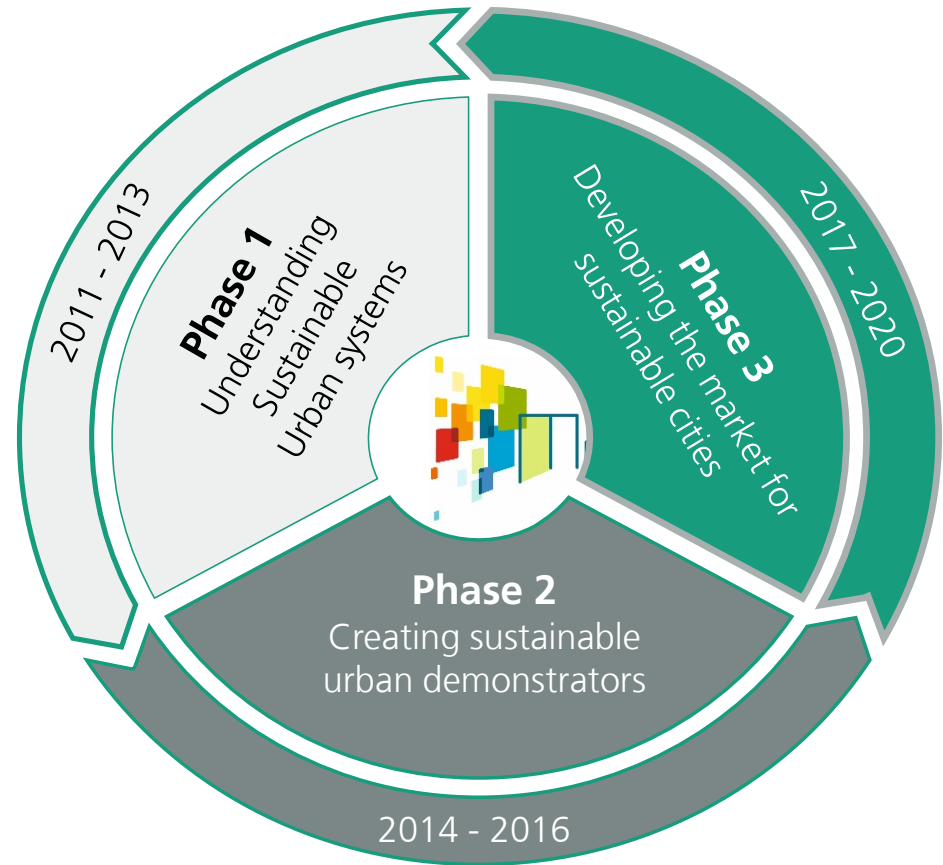## Comparison between Spring Festival (left) and Wine Festival (right)

Number of trips
0.02 — 1.00

Spring Festival
Zip code: 70372

Student dormitories
(S-Vaihingen)

Number of trips
0.02 — 1.00

Bosch HQ
(S-Feuerbach)

Wine Festival
Zip code: 70173

S-Möhringen

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… and how to implement them?

- after successful pilots

- with the right partners (public and private entities together)

- having access to the relevant information for making the right decisions

Morgenstadt

- Morgenstadt – one of the key forward-looking projects (Zukunftsprojekte) in the **Action Plan of the Federal Government's High-Tech Strategy 2020**

- 12 Fraunhofer-Institutes started the »**Morgenstadt-Initiative**« in 2011 for supporting the national initiative

- The **innovation network »Morgenstadt: City Insights«** is a long-term alliance to increase uptake of urban innovations between cities, companies and research.

2011 - 2013

Phase 1
Understanding Sustainable Urban systems

2017 - 2020

Phase 3
Developing the market for sustainable cities

Phase 2
Creating sustainable urban demonstrators

2014 - 2016

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Partners

Initiatives

Exchange platform for the Smart City community

Training Programs for Smart Cities and Societies

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BABLE – exchange platform for smart cities

BABLE is an exchange platform for the Smart City community - a digital toolkit to facilitate implementation of Smart City Solutions

Facilitate replication of successful projects

Simplify procurement of innovation

Guide towards implementation

Facilitate replication of successful projects

⌂ Use Case » E-Charging Station with remote control in Mülheim

Public C...

E-Charging Station with remote control in Mülheim

The goal of the solution is to promote the replacement of fossil fuelled vehicles by facilitating the use of EVs. The charging infrastructure enables the tenants to charge their electric vehicles. It is implemented in collaboration with various share E-mobility providers rendering the use of a private car unnecessary. Customers need to register on tankE website to use the charging station. Some charging station are connected with smart light poles

Customers can start and stop the charging by sending a text message. The charging station is connected to the virtual power point in teh area, increasing the share of local renewable energy used and improving the grid performance.

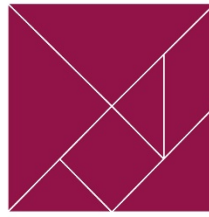| General Information |
| Products |
| Benefits |
| Implementation |
| Insights |
| **Financing** |
| Replicate |

Return On Investment Period

Initial Investment Amount < 50,000

Scale of Investment Each charging station is between 10-12K Euros.

FINANCING (INVESTORS)

Eu Funds
bears 70% of the costs

Rheinenergie
bears 30% of the costs

Our Smart Triad

PRODUCTS
by companies

SOLUTIONS
by Bable

USE CASES
by cities

- Cities from over 14 countries in Europe are registered BABLE users already
- Many more cities from across the world are already using the information provided freely and openly on the web

JOIN NOW

CONTACT

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