



Shared Autonomous Vehicles in rural public transportation systems

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Implications on the regulatory context of the Swiss regional
public transportation

Content

- New service concepts for rural transportation systems: Shared Autonomous Vehicles (SAV) and their implications on a rural public transportation system
- Current regulatory context of the Swiss regional public transportation
- Possible regulatory adaptations

Relevance of the research

Possible consequences of autonomous and shared autonomous vehicles (SAV)

- + Reduction of traffic accidents (Fagnant & Kockelmann 2015)
- + Cheaper and more sustainable than traditional transportation modes (Bösch, Ciari & Axhausen 2016; Brown, Gonder & Repac 2014)
- + / - Influence of travel behaviour (Fagnant & Kockelmann 2015)
- Increase of vehicle kilometers travelled (Fagnant & Kockelmann 2015)
- Substitution taxi and bus drivers' task
- Research focus on urban areas

Study Context

- Focus on new service concepts with SAVs in a rural context

*"[...] it can be expected that public transportation will still be required in larger cities and can play an important role on regional relations with sufficient demand. Yet, **particularly in rural areas and smaller cities**, it will likely be **superseded by shared autonomous vehicle fleets**."*
(Meyer et al. 2017: 90)

- Focus on the regulation: past showed that the regulator often was lacking behind new mobility solutions emerging on the market. (Deighton-Smith 2018)

Current regulatory context: Swiss regional public transportation (1/2)

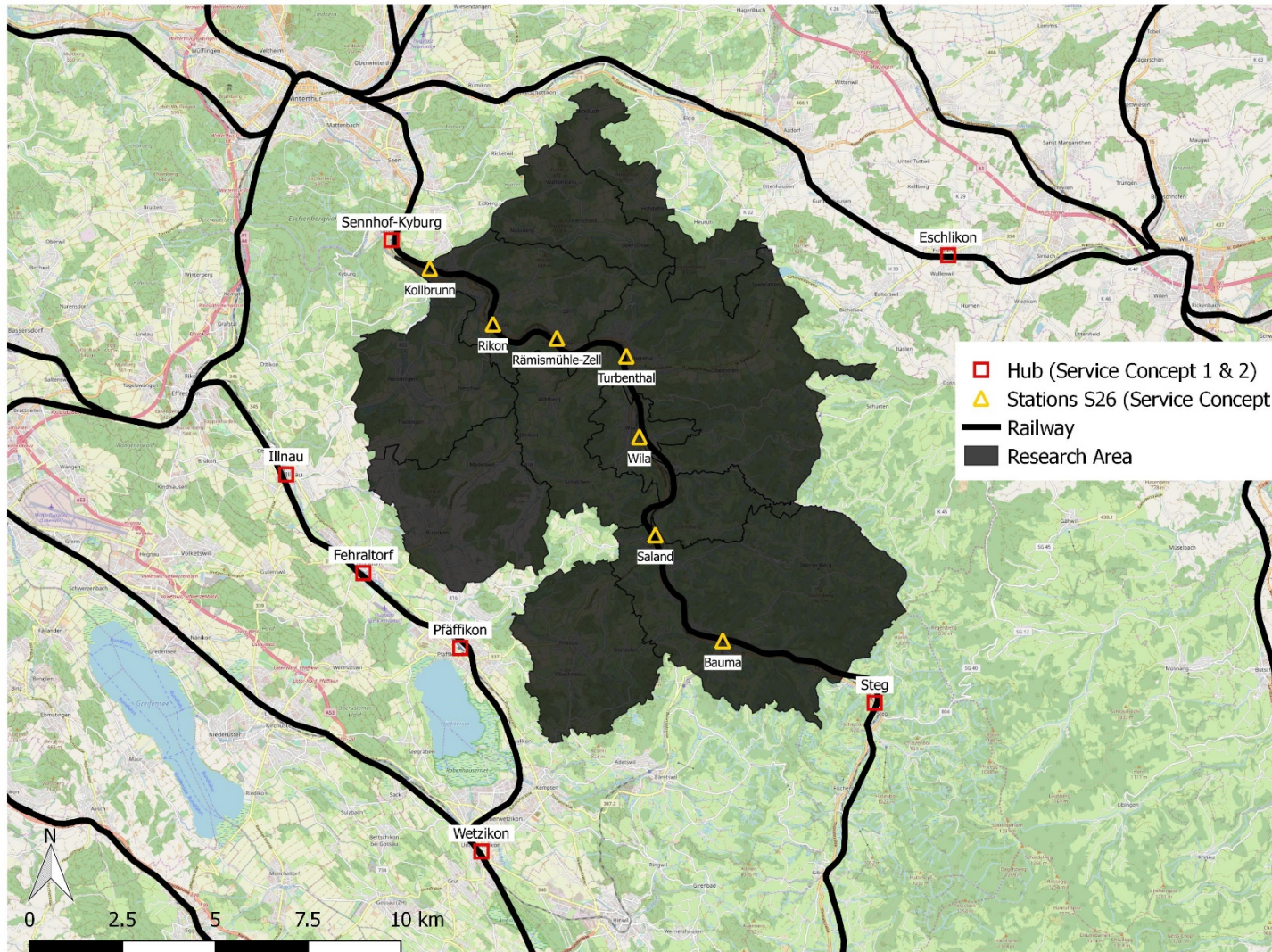
- Regional public transportation: transportation system provided within and between adjoining regions & rough allotment of local communities (min. 100 inhabitants). (BAV 2019)
- Cantons responsible for inviting tenders for new lines
- New lines if they
 - increase the accessibility of the areas along the line
 - are requested by the regional politics (especially for the needs of the economic development of peripheral and mountainous regions)
 - are conform with the land use planning
 - are conform with environmental protection
 - are conform with the needs of handicapped persons(Schweizerische Eidgenossenschaft, 2010)

Current regulatory context: Swiss regional public transportation (2/2)

Obligations of the transport operator

- Transport obligatory
- Timetables and operation hours
- Tariffs for the services adjusted to frequency, quality and costs of the service
- Tariff integration in the subordinate public transportation system and tariffs

Case study approach with two different scenarios



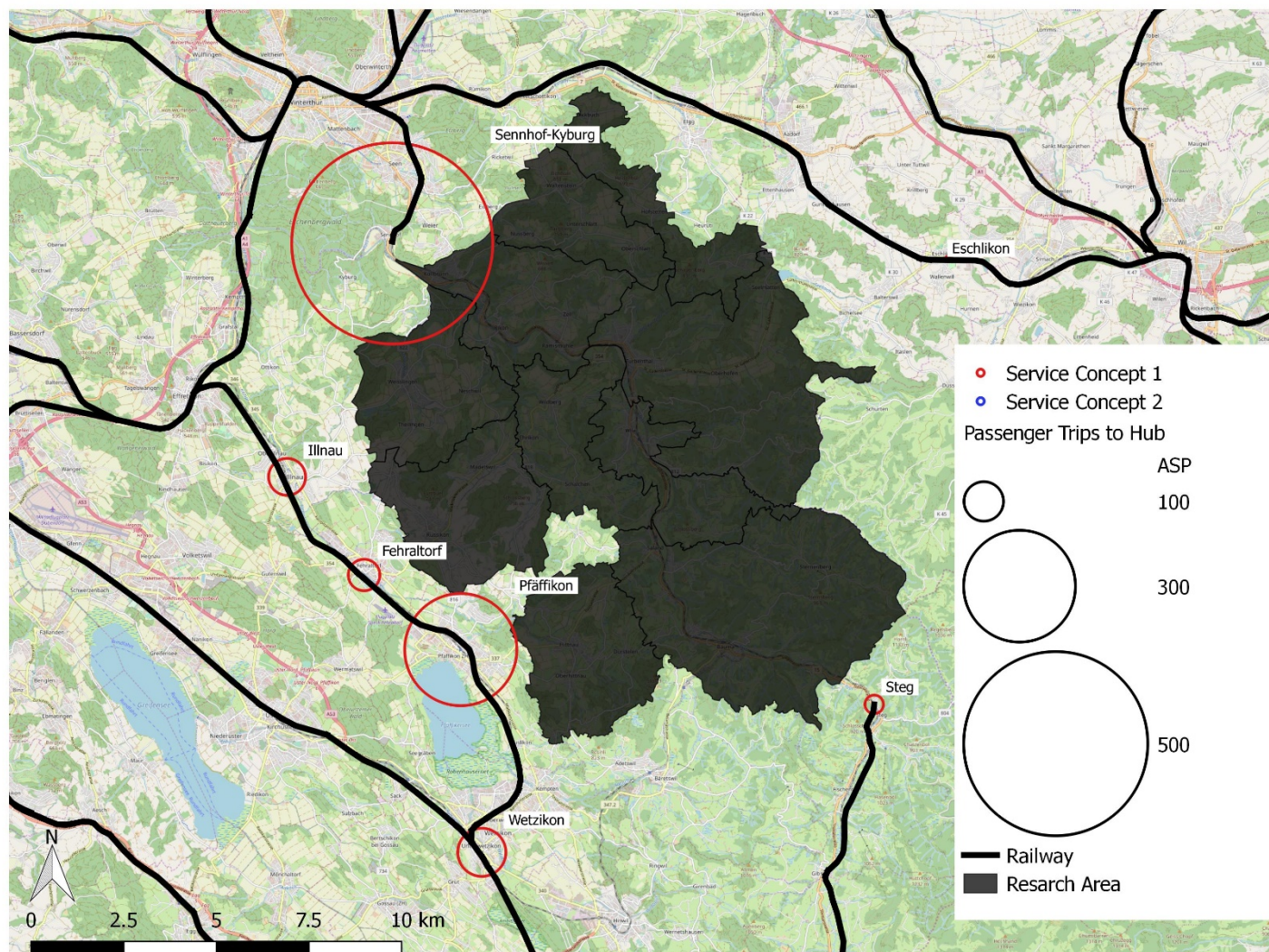
Methods

- Step 1: Development of two service concepts with matching hub concept
- Step 2: Assessment of demand, costs and revenues
 - Public transport demand (2013) for average weekday (average and peak-hour)
 - Apportionment of demand using origin-destination trips (overall traffic model)
 - Assignment of outbound trips to a hub (local traffic: direct SAV-trips)
 - Change of demand based on elasticities (frequency, travel time, changes)
 - Costs and revenues based on current economic situation
 - Costs for autonomous vehicles; degree of utilization of SAV: 2,5 persons per vehicle (Bösch et al. 2016; Bösch et al. 2018)
 - Assumption of stable prices for public transport
- Step 3: Consequences on S-train (commuter railway) and long-distance traffic
- Step 4: SWOT analysis of the concepts

Results

Service Concept	Bus & S-Train	SAV	SAV & S-Train
Costs per year (in CHF)	16'225'381	11'802'264	14'001'723
Revenues per year (in CHF)	8'303'053	13'086'264	15'170'297
Cost-efficiency	51%	111%	108%
Demand in public transport per year	2'895'432	3'834'997 +32.46%	3'760'417 +29.89%
Kilometers travelled per year (in km)	1.17 mio. (bus)	16.39 mio. (SAV)	9.73 mio. (SAV)
Size SAV fleet peak hour	-	174	111
Size SAV fleet off-peak hours	-	102	63

Results



There will be changes on the regulatory context ...

- Single operators vs. one regional network operator
 - The regulations open for regional network operators
 - The regulator enforces the operator to maintain S-train infrastructure
 - **one operator** is responsible for **both transport modes** in order to cross-finance the S-train service
- Single bus lines vs. flexible on-demand SAV network
 - An on-demand SAV network makes **timetables obsolete**
 - The regulator has to define **measures for the quality of the connectivity** between different transport modes
 - The call for tender is necessary only once and for the entire network; the regulator has to define and check the service quality in order to **maintain the public service standards**

... but not everything has to be adapted

- Sustaining stakeholders needs
 - Access for handicapped persons
 - Regulator provides possibilities to intervene, today
- Peripheral and mountainous regions can request new public transportation services for better economic development
 - SAVs may help to better connect peripheral regions, problem of the critical mass remains.
 - Regulator has to ensure the access to up-to-date public transportation systems. Possibility of incentives for service operators (f.ex. allowing cross financing between different regional SAV networks of the same operator)

Literature

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