Sharing and Coordination to reduce Transportation-raised Pollution

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Efficient use of resources on planet earth is one of the major challenges in sustainable development. In the urban environment, transportation needs a significant obstacle to the way to more sustainable societies. Growth in trade, mobility desires of individuals, and the ongoing trend of living in cities has dramatically increased this problem in cities all over the world. The negative impact of transport activities is manifold and not limited to the generation of emissions, noise, congestion, or fuel consumption. The European Environment Agency (EEA), e.g., announced that 400,000 premature deaths each year are caused by air pollution – only in Europe. Nevertheless, transport resources are often used insufficiently. This is mainly caused by a lack of sharing, collaboration, or coordination of community members, using these resources. For instance, recently shared mobility systems, as car sharing systems, have been introduced. These systems make use of modern information technology and systems to organize sharing among users, but still need to be enhanced in order to effectively serve transport objectives. On the other hand, there are further urban transport applications that would widely profit from sharing among users, but still lack necessary information systems to enable sharing. With this project we address these cases and develop effective decision support solutions for mobility sharing with the objective of a sustainable urban transport. We conduct empirical studies in order to understand the needs of members in different transport communities. On this foundation we design individual planning approaches that use sharing ideas to promote problem-specific sustainability objectives. We make results to international stakeholders and related communities. To this end, we have focused on four international cases as illustrated below.

Selected related articles:
- **Frederik Schulte, Stefan Voß, and Martin Winkler.** (2020). "Sharing and Coordination to reduce Transportation-raised Pollution." *Transportation Research Part B*. Available at: https://www.sciencedirect.com/science/article/pii/S0191261520301628

**Vehicle Sharing (Hamburg)**

- **Algorithmic approaches, system planning, and apps that let you find a shared vehicle when you need it and enable you to share a drive when you want it.**

**Current market figure from Europe shows that recently introduced car-sharing services can be a breakthrough for the car-sharing idea. Taking the step from a niche service to a major means of transportation and a serious alternative to a car is a well-considered one. This convenience is on-foot and part-way almost at any place within cities seems to connect new user groups, making it an attractive production-service system (PPS) for the urban environment. It is an emerging phenomenon on many levels: from a 24/7 service to eight conventional car. Theoretical research has shown that in order to use this potential and to continue growing and more users of car sharing as a mobility solution, there is a need for self-owned cars, available availability of shared vehicles to be caused. Literature shows that PPS initiatives in urban environments often fail to identify key elements to sustainable applications of the industry. PPS will approach decision support for vehicle reservations in a new way by sharing ideas to promote problem-specific sustainability objectives. We make results to international stakeholders and related communities. To this end, we have focused on four international cases as illustrated below.

**Empty Container Management (South America)**

- **Inventory control of empty containers in arterial transportation systems has a significant impact on the efficiency and sustainability of container transport. In traditional container transportation, containers are transported between terminal and outbound container by container trucks. To address the demand of empty containers, we have developed a container management system to control empty containers. To satisfy the demand of empty containers, we reposition empty containers from one area to another based on several inventory policies. For the repositioned containers, we may check the number of empty containers need to be used in the container company after a specific time. To evaluate inventory policies, simulation is used to estimate the expected costs and benefits. We use the information-based optimization to estimate performances of the inventory policies.**

**Push-Back Vehicles (Oslo)**

- **Decision support that help airport ground service personnel at the right time to deliver their services to the ground.**

**Container Trucks (Valparaiso)**

- **Matching systems that enable brokers to share capacity and extend.**

**Vehicle Routing**

- **As an empty container strategy that makes use of empty trips or routes to avoid**

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