



City logistics

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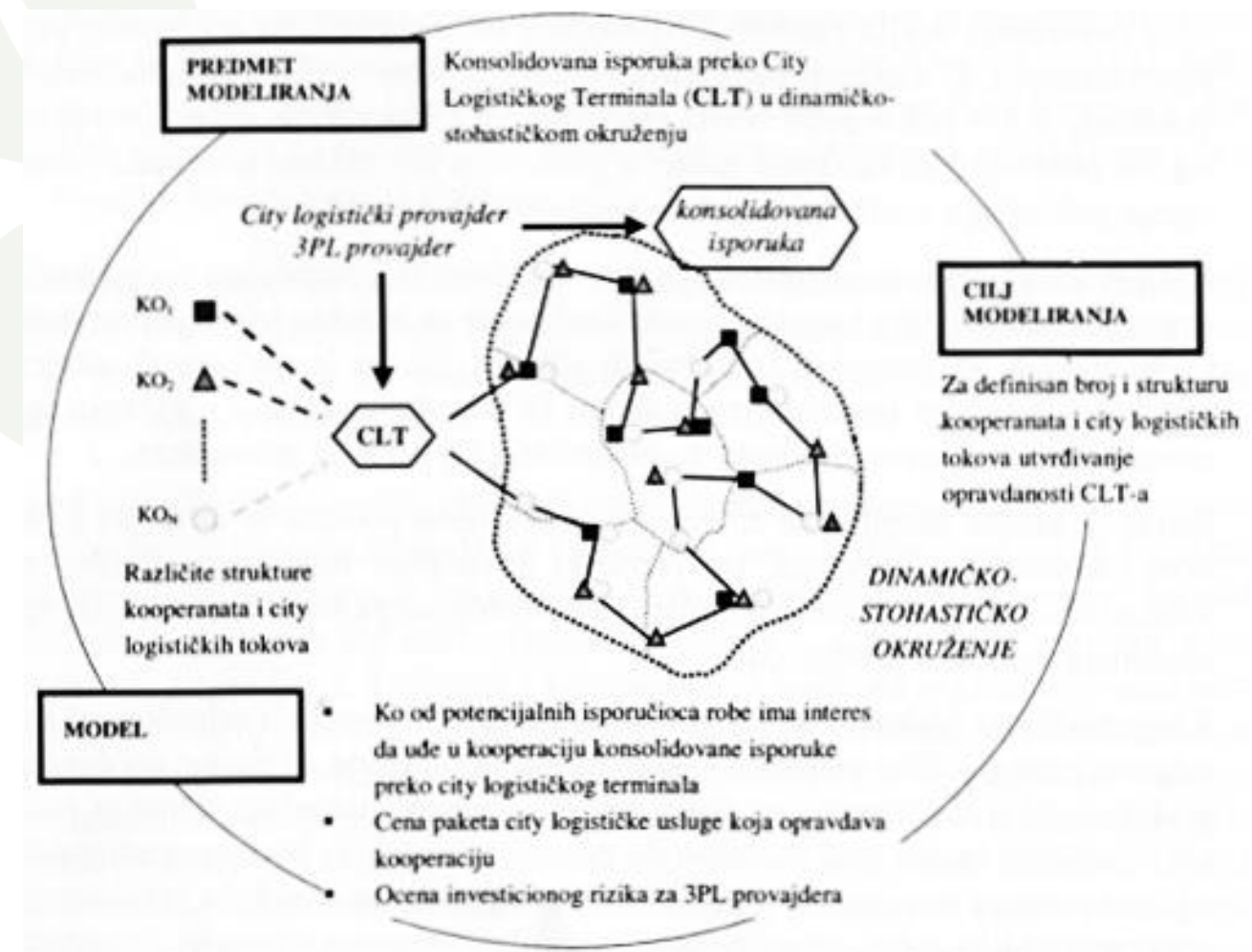
Sustainable Transportation within the Framework of Green Deal - SPHERE

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Subject and Objective of Modeling

Modeling of city logistics systems represents a key tool for understanding and optimizing complex urban flows. Through the precise definition of the subject and objectives of modeling, a systematic approach to solving urban logistics challenges is enabled..



The Concept of City Logistics

Etymology of the concept

The English word “city” comes from the Latin word “civitas” – a highly organized community used to describe the city-states of Ancient Greece. The Merriam-Webster dictionary defines a city as a place of residence larger than a village or settlement: a large, prominent, or important population center with various activities, less independent in food production, and usually dependent on manufacturing and trade..

Logistics component

Logistics involves planning, design, management, execution, control, and analysis of goods flows. It includes ordering, packaging, transport, warehousing, and inventory. In urban areas, flows of different goods, materials, and freight occur: commercial goods, finished products, semi-finished products, raw materials, construction materials, CEP (CEP = Courier, Express and Parcel) shipments, return materials, recycling materials, and waste materials.

Challenges in Defining City Logistics

A comprehensive and precise definition of city logistics is difficult to establish. Different authors and researchers have defined, in line with their own interests, concepts that are much narrower than the true meaning of the term. Often, other terms are used instead of “city logistics,” and in some cases city logistics is understood as only a specific conceptual solution..

Spatial Boundaries of City Logistics

Settlement

Basic level of spatial organization with specific logistics needs and constraints.

City

Central, most often historical zones with high building density and concentration of various activities

Agglomeration

Expanded urban area with complex logistics flows between connected urban units

Region

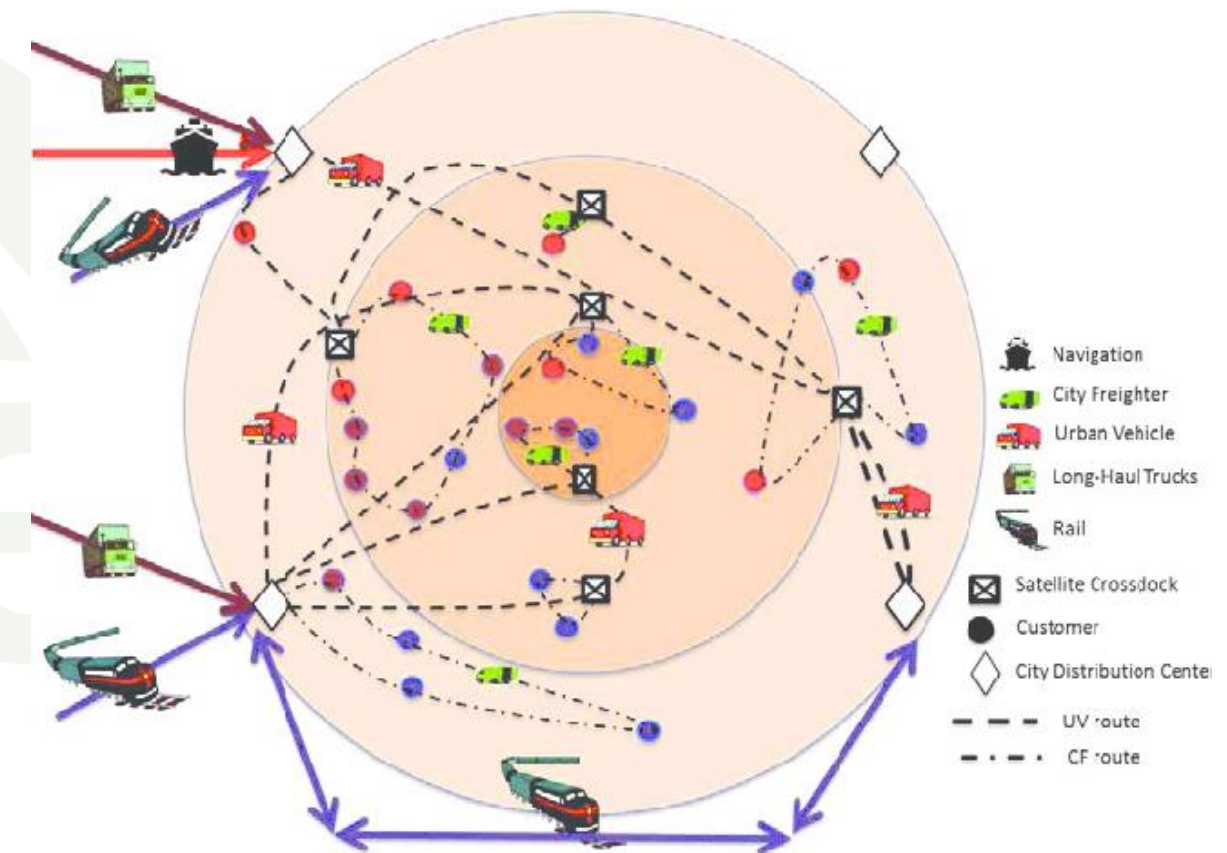
The broadest level of coverage, including urban-regional transport and intercity logistics connections

A review of the literature shows that city logistics is mainly focused on central, most often historical parts of the city. Central urban zones have a high building density and represent a concentration of various activities: trade, hospitality, housing, administration, industry, and culture. The street network is dense, with streets of different characteristics, often very narrow and one-way, especially in the historical parts of the city..

Scope of Flows in City Logistics

Most of the previous research on city logistics dealt only with specific flows: production industrial transport of raw materials, supply of wholesalers and retail stores with finished products, transport of KEP shipments, transport of construction materials, moving transport and home deliveries realized by goods vehicles.

There are few authors who dealt with all activities and flows of goods and materials that start, end or transit through the city: supply flows, transit flows, waste extraction flows, secondary raw materials and returnable materials, service flows, commercial flows. Failure to consider all flows and activities creates difficulties for the city authorities to determine the right measures aimed at their efficiency and encouraging the vitality of the city.



Types of Traffic and Categories of Vehicles

In many studies, urban freight transport is defined as the transport of consumer goods by truck and is mostly limited to the dominant road mode of traffic. Most of the data on urban freight transport refer to vehicles with a carrying capacity of over 3.5 t.



Freight Vehicles

Light trucks, vans, heavy freight vehicles over 3.5 t payload capacity used for transporting fast-moving consumer goods



Passenger Vehicles

Customer cars (from store to home), seller vehicles for goods delivery, vans used by service companies.



Alternative Modes

Bicycles, delivery motorcycles, walking between retail locations, environmentally friendly solutions.

In the city of Liège in Belgium, approximately 30% of deliveries are carried out by the owners of the establishments themselves. Individual goods deliveries by car in France amount to around 30 kg over distances exceeding 10 km each week. City logistics flows are supported by all modes and technologies of transport, as well as various forms of goods, material, and cargo transfer

Tasks and Objectives of City Logistics

Traffic efficiency

More efficient overall urban traffic flow by reducing the number of freight vehicles, which leads to decreased congestion in the urban street network, improved traffic safety, and reduced travel times.

Economic optimization

Focus on economics and energy consumption, including reducing distribution costs, which account for around 40% of the total costs of combined “door-to-door” transport.

Ecological aspect

Environmental protection and improved quality of life in the city through reduced emissions of harmful gases, noise, vibrations, and enhanced traffic safety

These disagreements regarding the tasks and objectives of city logistics are a consequence of its complexity, the large number of stakeholders involved, and their differing, often conflicting goals. Defining the objectives of city logistics in terms of optimizing only the transport component, and then only the road transport component, is contrary to the fundamental concepts of logistics and its principles.

Overall definition

City Logistics

City logistics encompasses all logistics strategies, technologies, and solutions that support all participants and functions within urban areas, regardless of their size and number, spatial distribution, or boundaries, in accordance with their individual and overall interests and objectives.

— Zečević

This definition emphasizes a comprehensive approach and the need to integrate all aspects of the urban logistics system, taking into account the diversity of stakeholders and their often conflicting objectives.

Urbanization and its effects

Global trend

Education and greater employment opportunities, along with a higher standard of living, have attracted a large number of people from rural areas to cities. Urbanization is a phenomenon present worldwide.

276

Million cities 1990.

Number of cities with over one million inhabitants

380+

Projection for 2010.

Projected number of cities with over one million inhabitants

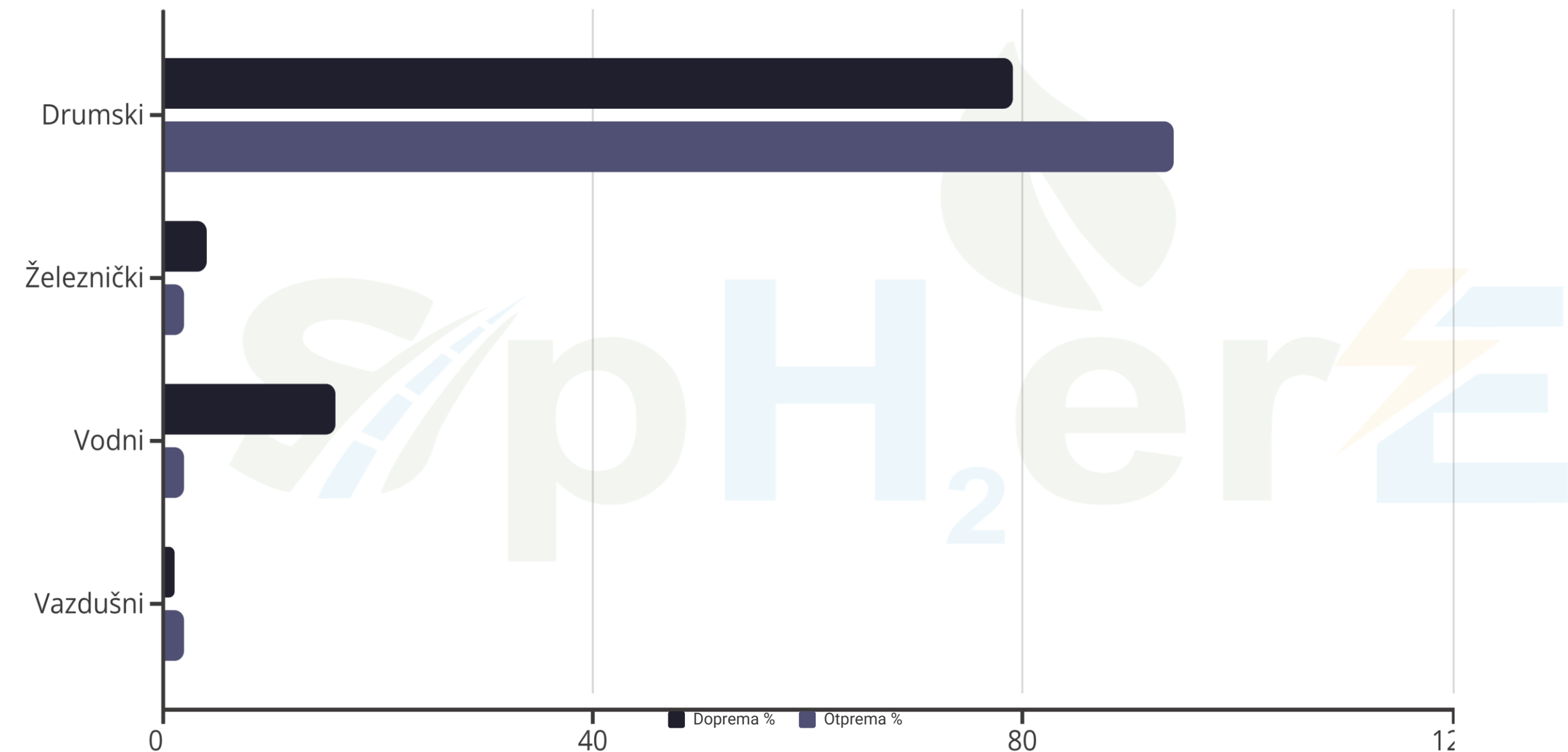
Logistics challenges

Rapid urbanization has caused major problems. Densely populated urban areas require the delivery of larger quantities of goods, which generates increased vehicle movement and greater congestion on city streets. This negatively affects living conditions, mobility, and the urban environment.

The annual volume of goods and freight generated in Paris is about 31.5 million tons, or approximately 15 tons per inhabitant.

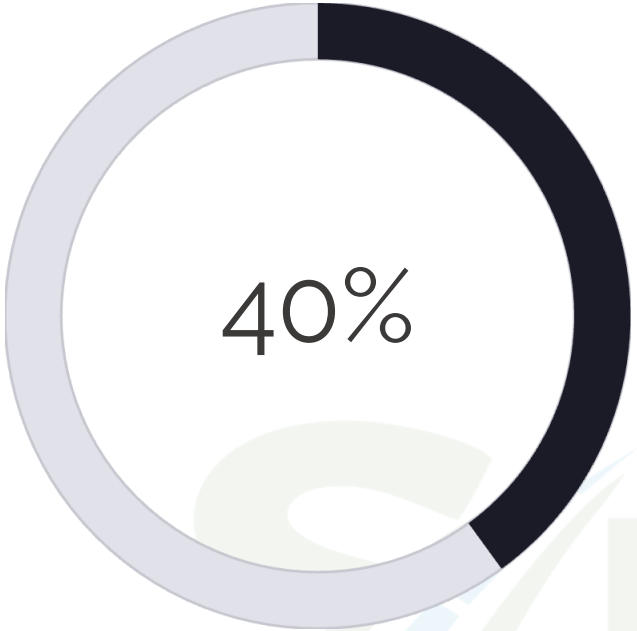
Domination of road transport

In the realization of freight flows, road transport has a dominant share, accounting for over 80% of freight activity. This fact is confirmed by the distribution of freight flows in inbound and outbound transport according to transport mode in Brussels.



In overall traffic in urban areas of Europe, freight transport (trucks over 3.5 t) accounts for about 10% (Germany – around 5%, England – up to 15%), while in Japan it is about 35% and shows a growing trend. According to some studies, by 2030 an increase in freight traffic of around 40% is expected when expressed in vehicle-kilometres traveled

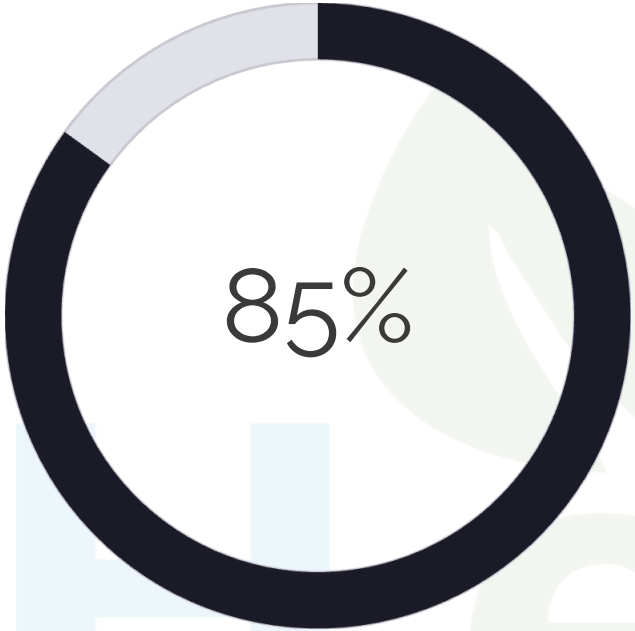
Economic Importance of Urban Transport



Distribution costs

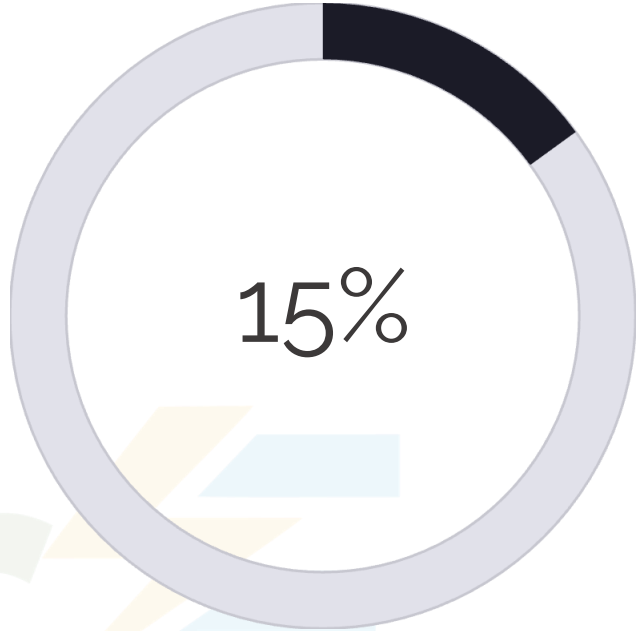
Share in the total costs of combined “door-to-door” transport.

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Delivered goods

Only 5% of road freight vehicle movements are used for execution.



Remaining deliveries

They require 95% of freight vehicle movements.

The importance of these costs will increase in the future, given the trend of reduced inventories and smaller but more frequent deliveries. In Genoa, in 40% of cases the shipment size is less than 15 kg. The total daily distance covered by freight vehicles in Vaasa is 51,281 km, or 0.9 km per inhabitant.

Sustainability problems

Sustainability problems of freight transport in cities have both a local and a global dimension.

Local dimension

From a city perspective, freight transport reduces accessibility, especially to certain parts of the city and during specific periods of the day (street congestion, time-based access restrictions). It leads to a decline in the quality of urban life through air pollution, noise, reduced traffic safety, and the occupation of significant urban space.

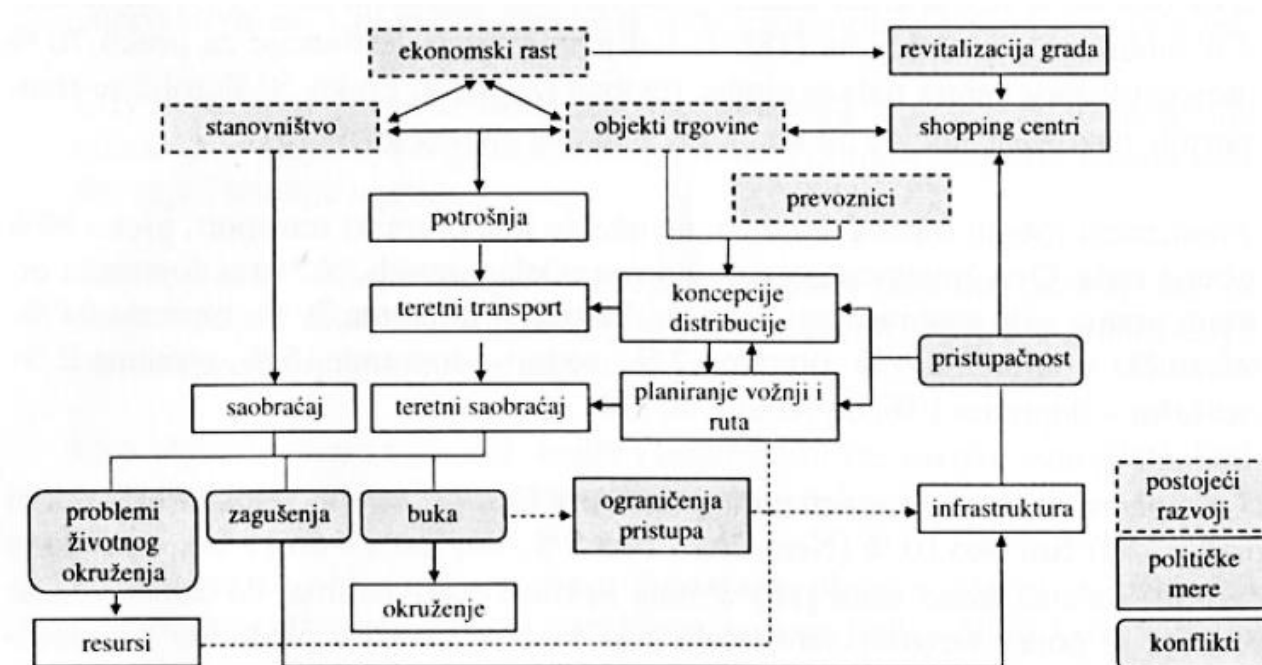
Global Dimension

Urban freight transport also contributes to the global sustainability problem, particularly through its negative impact on the environment via greenhouse gas emissions, consumption of natural resources, and generated waste. While the impact of freight transport from a single city on the global environment is relatively small, the cumulative impact of all cities is significant.

Conflict diagram

Freight transport in cities is initiated by the consumer, i.e. consumption, which is characterized by three indicators: what, how much, and where. These indicators depend on economic growth, as well as demographic and spatial development. The distribution of consumer goods contributes to increased traffic in cities and causes problems such as traffic congestion, various local disturbances, and broader environmental challenges.

Local disturbances form the basis for introducing various access restrictions, and these restrictions, together with traffic congestion, create another conflict known as the accessibility problem. Accessibility affects the organization of freight transport by influencing changes in delivery schedules and routes at the operational level, as well as changes in the logistics system (distribution concept) at the strategic level.



Environmental Impact

01

Emissions with global impact

- Climate change – emissions of CO₂ and greenhouse gases (CO₂ and CH₄)
- Acidification – concentration and emissions of NO_x, SO₂, and VOC (volatile organic compounds)

02

Local impacts

- Air pollution – concentrations of CO, NO₂, hydrocarbons (HC), aerosols, and lead
- Various disturbances – noise, vibrations, traffic safety

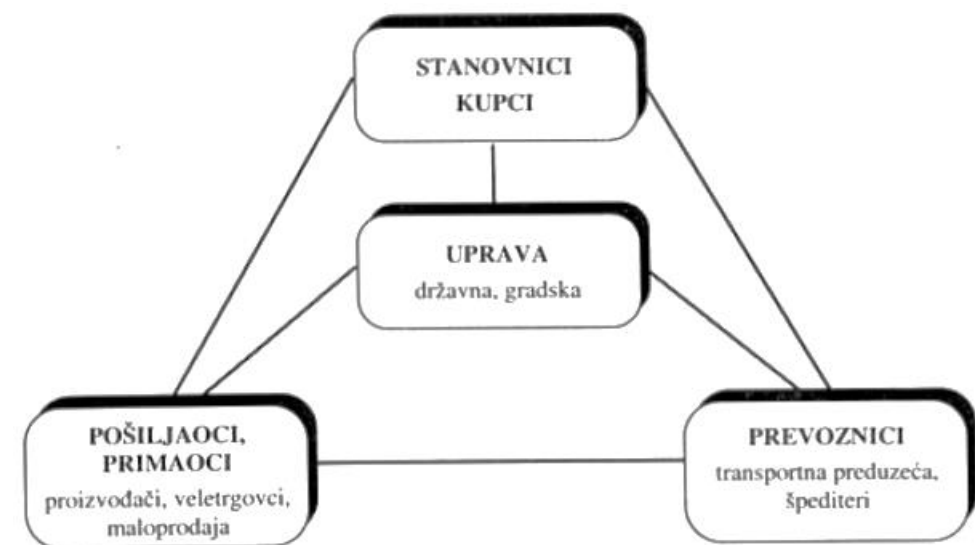
03

Resource consumption

- Materials
- Energy
- Space

☐ In Bremen, a city with around 500,000 inhabitants, more than 500 tons of fuel are consumed daily for transport, resulting in the following air pollution emissions: CO – 34, NO_x – 18, HC – 8, and particulate matter – 0.16. In Zurich, one third of the population lives in areas where noise levels are at the legal limit.

Key factors of City Logistics



In urban freight transport, there are four key stakeholders, and each of them has their own requirements and objectives, which are very often in conflict :



Shippers and Receivers

They send or receive goods and demand from carriers to maximize the level of service in terms of cost, collection/delivery time, transport reliability, and information availability. In Japan, 45% of pickups and 52% of deliveries are required within a specific time window.



Carriers

They aim to minimize the costs of collecting and delivering goods while maximizing profit. They offer an increasing level of service, especially transport reliability. They face problems caused by street congestion and traffic jams, which lead to poor vehicle utilization.



Residents

People who live, work, and shop in the city. For them, trucks entering local streets are undesirable. They aim to minimize traffic congestion, noise, air pollution, and traffic accidents near places of residence, work, and shopping.



City administration

Their goal is the economic development of the city and the increase of employment opportunities. The focus is on reducing traffic congestion, improving environmental conditions, and increasing traffic safety. They are responsible for coordinating and preparing city logistics initiatives.



Thank you!