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# Performance Evaluation for Bike-Sharing Systems: a Benchmarking among 50 Cities

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# Agenda

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- Introduction

- Objectives

- Methodology

- Results

- Conclusions

# Context

- Today, **54% of the world's population** lives in urban areas, a proportion that is expected to increase to **66% by 2050** <sup>1</sup>
- Cities all over the world struggling to maintain **cost effective and sustainable transport systems**
- Growing concerns with the **impact of greenhouse emissions** from the transport sector



***Bike Sharing* emerges as a solution**

# New form of sustainable transport capable of meeting the increasing mobility demand

"A **bike-sharing system** or **bicycle-sharing system** offers a self-service, short-term, **one-way urban bicycle rental in public spaces**, for several target groups and **with network characteristics.**" <sup>1</sup>

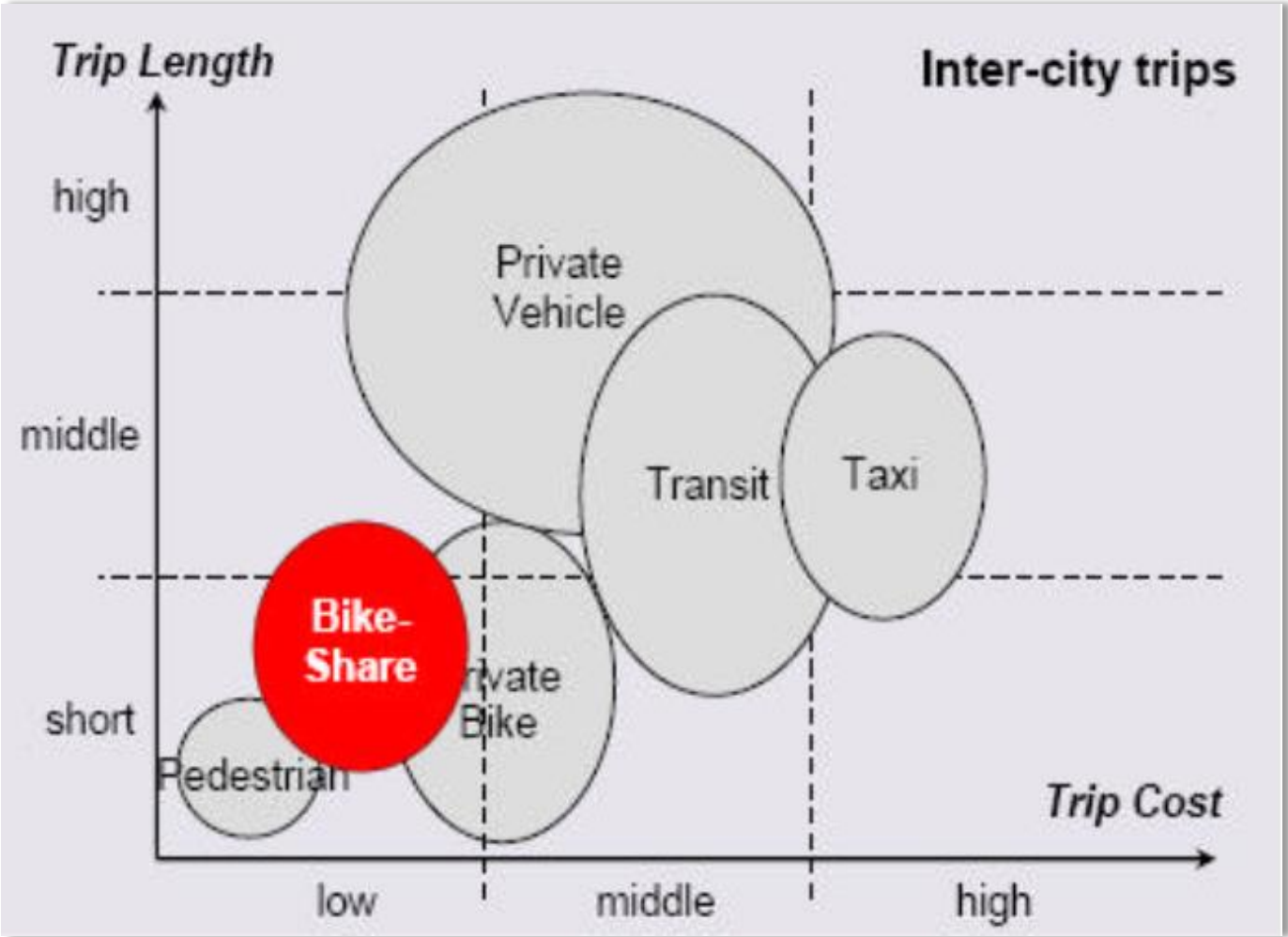


Source: <sup>1</sup> OBIS (2014) - Optimising Bike-Sharing in European Cities

From left to right: [TO]Bike in Turin, Italy; Municipal Public Bicycle System in Beijing, China; Bike Rio in Rio de Janeiro, Brazil.

# Bike sharing plays an important role in the niche of short and low-cost trips

**Distance x cost for urban displacements**



Source: Midgley (2011)

# Bike sharing is a growing global trend

**Today there are more than 600 bike-sharing schemes spread across 5 continents**



Notes: systems in green are currently operating; blue question marks are schemes in planning or under construction; red triangles reflect bike-sharing schemes that are no longer operating. Retrieved from The Bike-sharing World Map - 2015

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The study sought to **evaluate the performance** of bike-sharing systems around the world

## Objective:

**To evaluate the performance of bike-sharing systems through KPIs and customer satisfaction**

## Secondary goals:

- To determine the **influence of business model and city size** on the performance of bike-sharing schemes
- To build a **bike-sharing database** that permits a benchmarking comparison and serves as **reference for future research in the subject**



# Agenda

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- Introduction

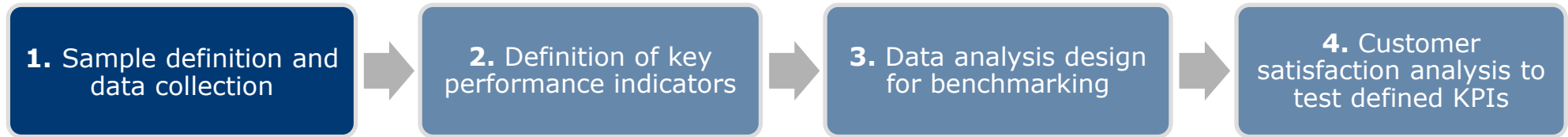
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# Extensive research was made to collect information on bike-sharing schemes around the world



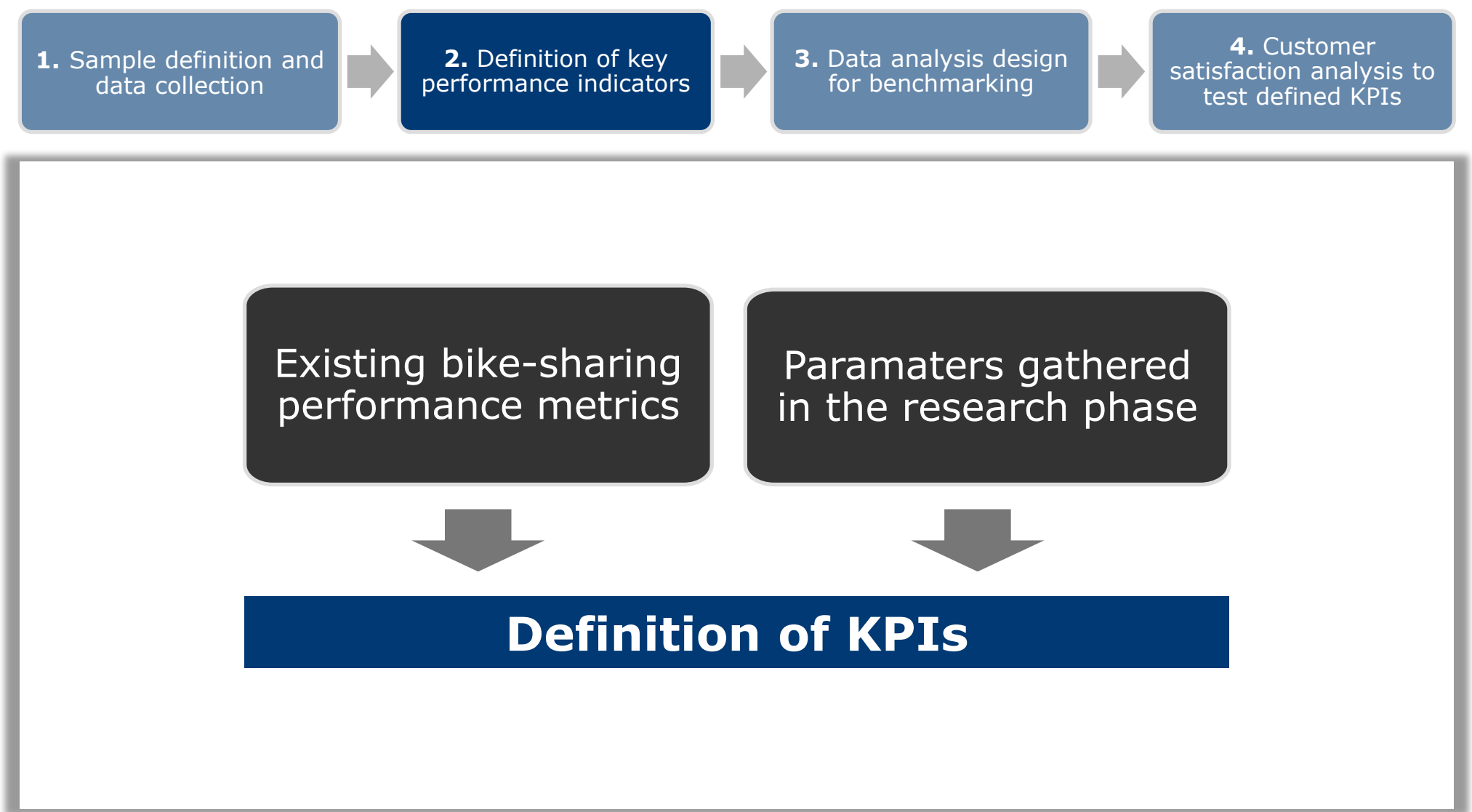
## Criteria for sample selection:

- Cities with a population **greater than 200.000 inhabitants**
- **Third and fourth-generation** bike-sharing schemes
- Bike-sharing schemes that had available data

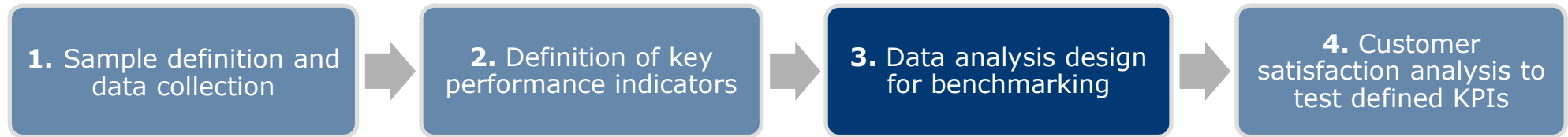


**50 cities**

# Key performance indicators were based on existing metrics and parameters gathered



# The performance evaluation was made in two different settings



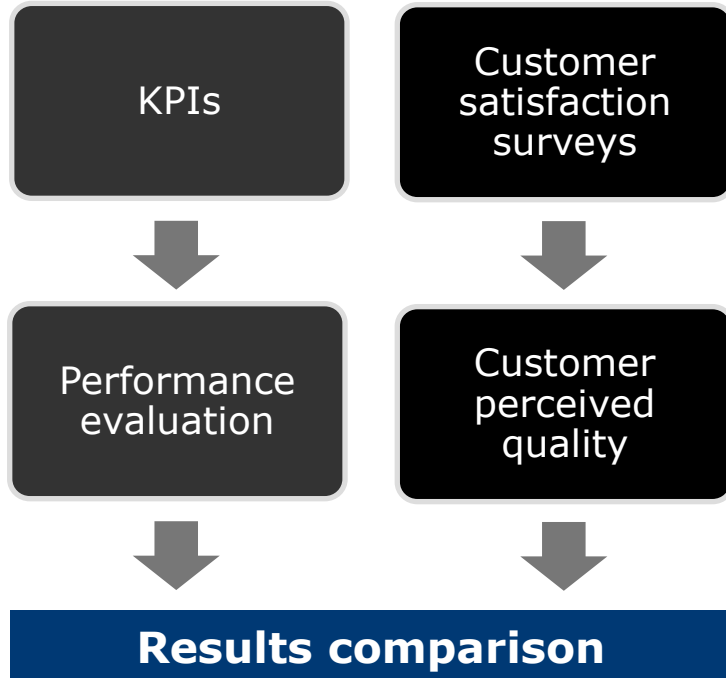
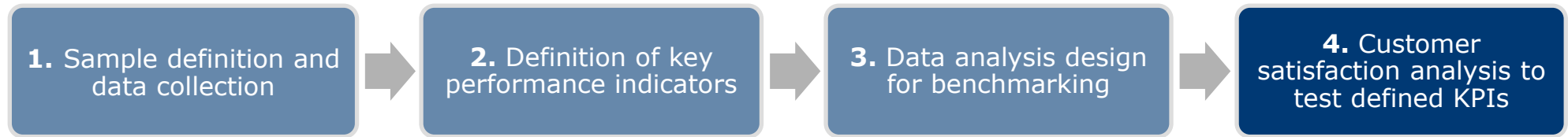
## BY CITY SIZE

City class	Population range
Medium	200K to 1M inhabitants
Large	1M to 5M inhabitants
Very large	5M to 10M inhabitants
Mega-city	More than 10M inhabitants

## BY BUSINESS MODEL

	Management	Financing
Public	Public	Public
Public-Private	Public	Private
Private	Private	Private

# Customer satisfaction was used to test the key performance indicators



## Case studies:

- **Turin, Italy**  
[TO]Bike: **Public business model**
- **Washington, USA**  
Capital Bikeshare:  
**Public-private partnership**
- **São Paulo, Brazil**  
Bike Sampa: **Private business model**

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# 1. A **large bike-sharing database** was created, serving as starting point for **future research** in the subject...

## System operation:

- Opening hours
- Operating months
- Registration price
- Initial free time
- Fee structure

## System investment:

- Initial capital cost
- Annual operating costs
- Cost of bicycle

## System dimensioning:

- Fleet size
- Number of docking stations
- Average distance between stations
- Number of docks

## Demographics and economic factors:

- City name
- Country
- Continent
- Population
- Urban area
- GDP per capita
- Kilometres of cycling lanes

## Basic system information:

- Programme name
- Beginning of operation
- Operator
- Business model

## System usage statistics:

- Number of registered users
- Average daily trips
- Average trip time

**26 parameters  
in 50 cities**

# ... and the definition of **KPIs** allowed for the **performance evaluation** of these systems

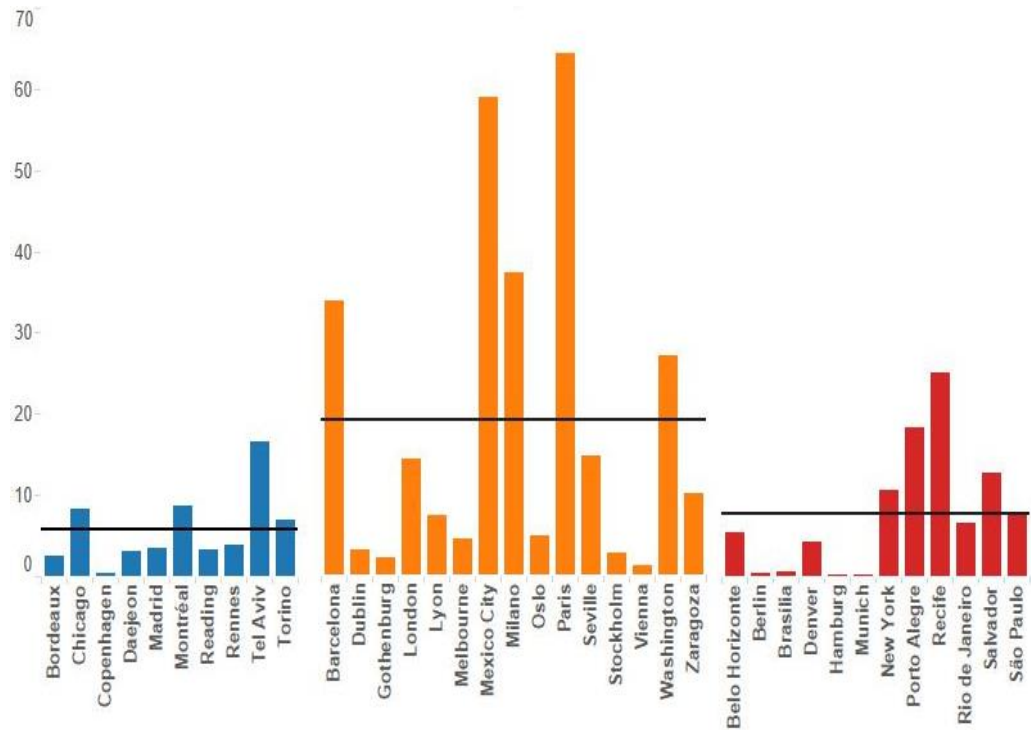
<b>KPI</b>	<b>Metric</b>
System station density	Average distance between stations
System fleet sizing	Number of bicycles per 100.000 inhabitants
System number of stations sizing	Number of stations per 100.000 inhabitants
System reach related to city infrastructure development	Registered users per kilometre of cycling lane
System fleet sizing related to city infrastructure development	Number of bicycles per kilometre of cycling lane
Parking space availability	Number of docks per bicycle
System network concentration	Average docks per station
Bicycle availability	Average number of bicycles per station
Fleet rotation	Average daily uses per bicycle
System usage	Average daily trips per registered user
System sizing adequacy	Number of bicycles per 100 registered users
System reach related to pricing	Registered users times register price
System pricing adequacy	Register price per GDP per capita
System market penetration	Registered users per total population

Source: adapted from ITDP - The Institute for Transportation and Development Policy

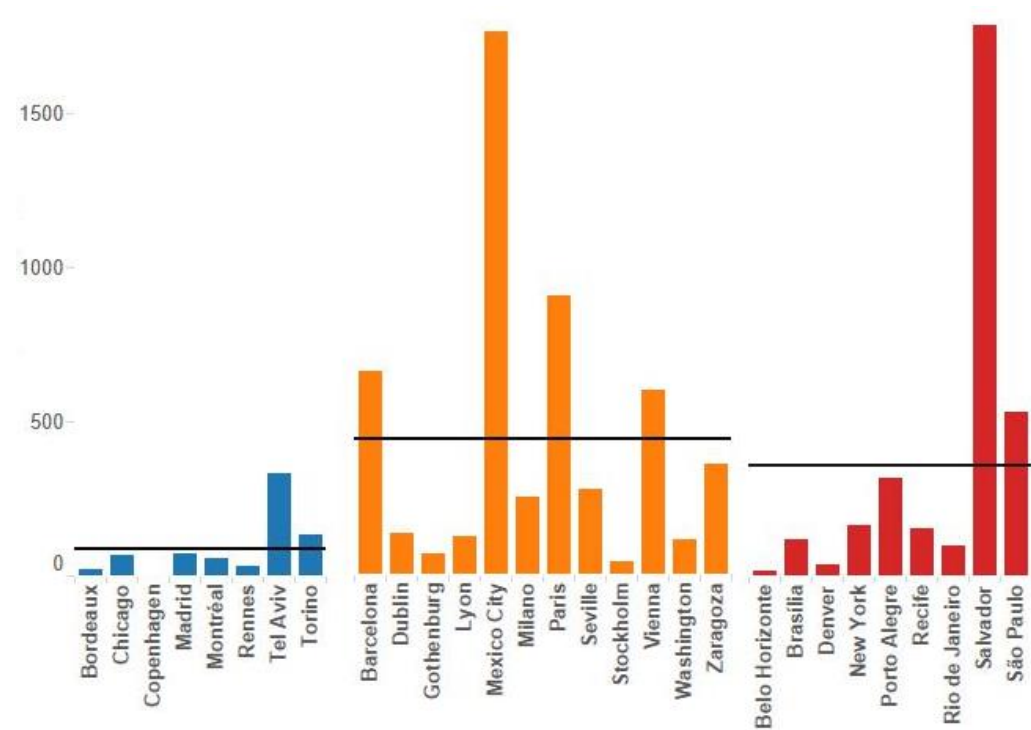


## 2. Schemes operating as a **public-private partnership** performed **better** in average...

**Fleet sizing related to city infrastructure**  
(number of bicycles per km of cycling lane)



**System reach related to city infrastructure**  
(registered users per km of cycling lane)



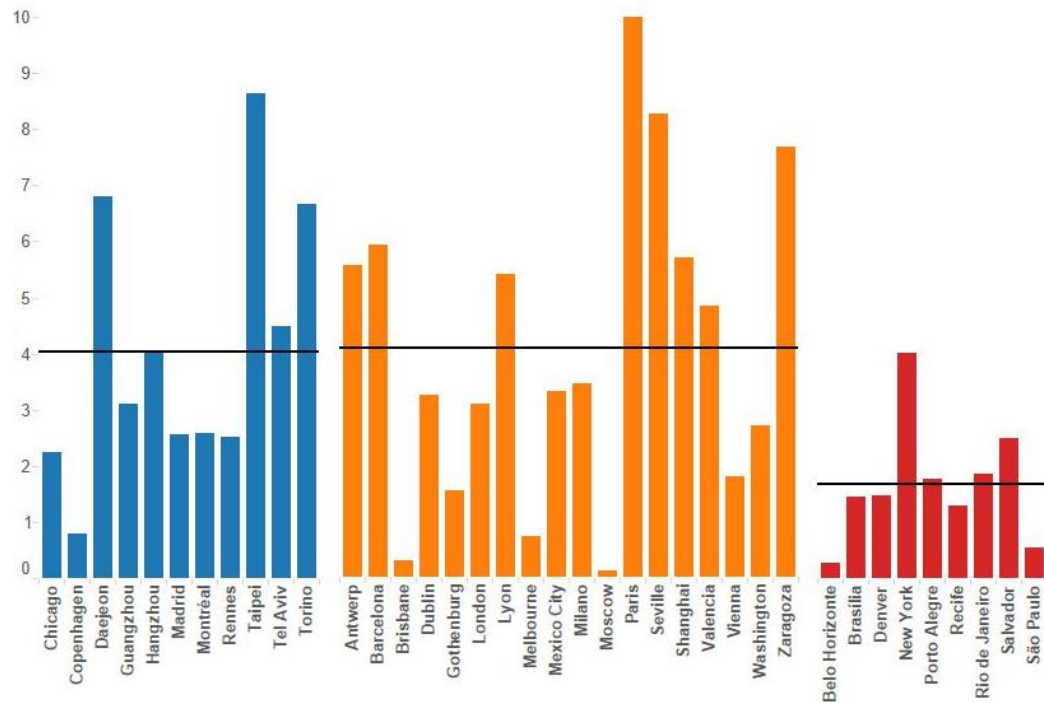
**Business model**



# ...and schemes with the **private business model** performed the **worst** in most cases

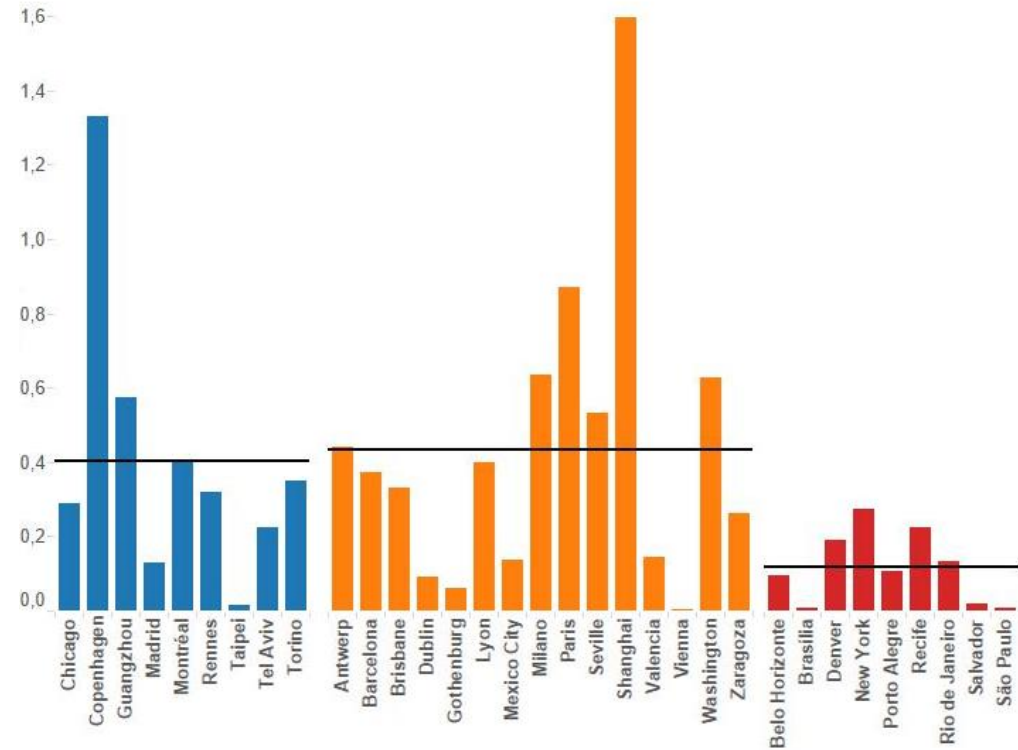
## Fleet rotation

(average daily uses per bicycle)



## System usage

(average daily trips per registered user)



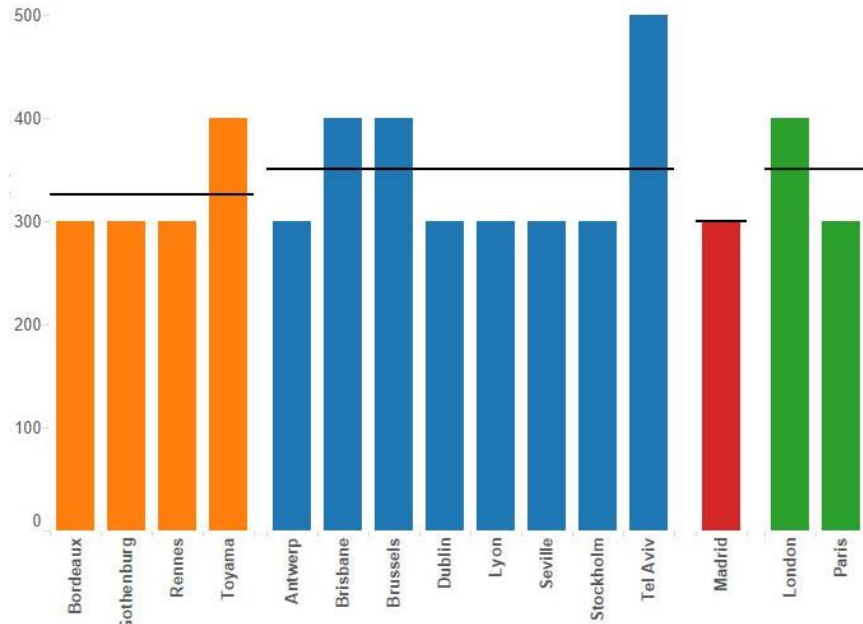
### Business model



# 3. The **size** of a city is **not directly correlated** with the **performance** of its bike-sharing system

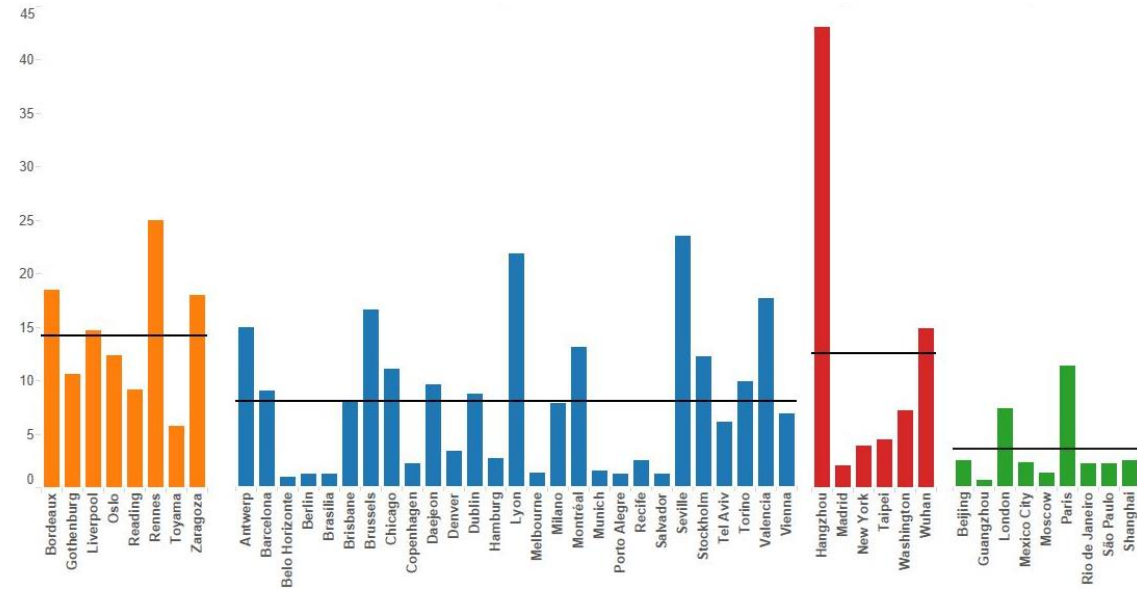
## Station density

(average distance between stations)



## System station sizing

(number of stations per 100.000 inhabitants)



### Population range



## 4. The **customer satisfaction surveys** reflected the **performance measured by the KPIs**

**5,06**

was the rating out of 10 that the users gave to the bicycle availability in the stations in Turin

[TO]Bike ranked the **6<sup>th</sup> worst system** in the KPI measuring bicycle availability

**8,39**

was the customer rating out of 10 for registration and hourly fees in [TO]Bike

Turin had a **very low relative price** as a percentage of city GDP per capita

**54%**

of the respondents complained that the lack of cycling lanes or paths is an issue affecting Capital Bikeshare

Washington presented one of the **shortest cycling networks** in length

**80%**

of the respondents in São Paulo did not regard the initial free time as a problem

Bike Sampa offers **1 hour of free time** instead of the usual 30 minutes

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# Conclusions

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- Most of **bike-sharing information** is **disperse**, unstandardised and difficult to obtain
- The employed **business model** **affects the performance** of a bike-sharing system
- The **city population** is **not directly correlated with the performance** of its bike-sharing system
- The designed **KPIs** **successfully evaluated the performance** of bike-sharing systems



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USP



# Thank you

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