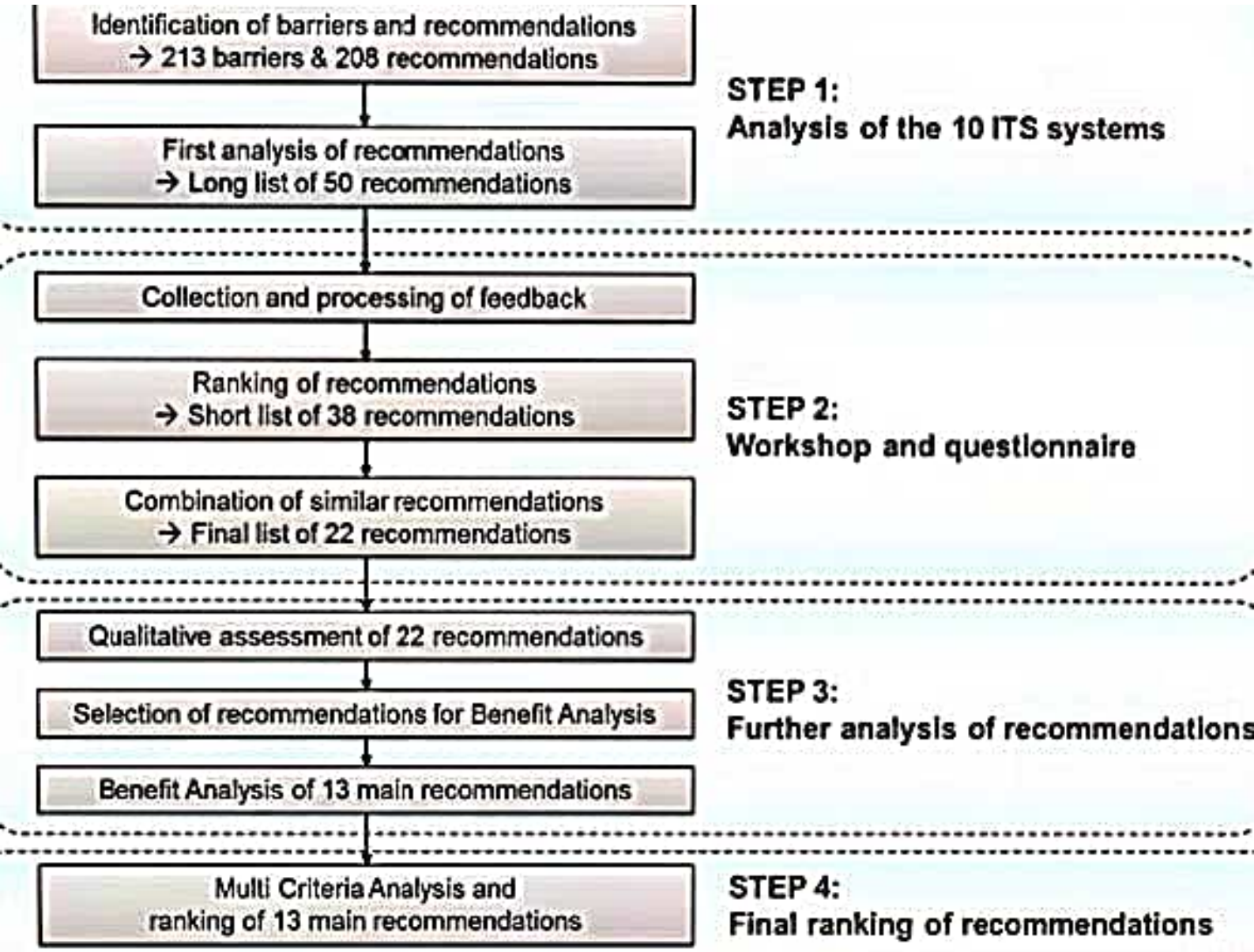
Author (s)	Title	Problem	Solution
LAO2013	Estimating freeway traffic measures from mobile phone location data	High cost in Installation, Maintenance, Limited coverage problems in GPS based sensors	Proposed a relatively simplistic clustering techniqu in mobile phone for vehicle count, density, spee
Hussein Dia,2011	Development and evaluation of arterial incident detection models using fusion of simulated probe vehicle and loop detector data	Performance of various data fusion neural network architectures and probe vehicle penetration rates and loop detector configurations	Automatic incident detection on arterial roads
Bachman 2012	Fusing a Bluetooth Traffic Monitoring System with Loop Detector Data for Improved Freeway Traffic Speed Estimation	Comparison loop detector data and compared against GPS collected probe vehicle data with Bluetooth Monitoring system	Improve the accuracy of traffic speed estimation
Bachman 2013	A comparative assessment of multi-sensor data fusion techniques for freeway traffic speed estimation using micro-simulation modeling	Real-time traffic speed estimation	Seven multi-sensor data fusion-based estimation techniques are investigated

Table 3: Summarized literature of Freight Management System, Commercial Vehicle Operations (CVO) and advanced fleet management

Author(s)	Title	Problem	Solution
Poon, T C May 2009	A RFID case-based logistics resource management system for managing order-picking operations in warehouses	Difficult and lengthy process of Collecting the real time data with bar-code-based or manual-based	RFID technology for order-picking operations
Crainic, December 2009	Intelligent freight-transportation systems: Assessment and the contribution of operations research	Worse performance in Logistics and electronic business for operation and fleet management	Research-based decision-support software sugge for ultimate performance of Freight ITS.
John Zumerchik	Automated Transfer Management Systems and the Intermodal Performance of North American Freight Distribution	High embedded costs in freight transportation	Automated transfer management system (ATMS at terminals and distribution centers
Jeffrey S May 2011	Use of a video monitoring approach to reduce at-risk driving behaviors in commercial vehicle operations	Risk for a vehicle crash and/or serious injuries	Onboard safety monitoring (OBSM) system
C. Bouvard June 2011	Condition-based dynamic maintenance operations planning & grouping. Application to commercial heavy vehicles	Deficiency in Maintenance planning in commercial heavy vehicle	Static or Dynamic methods are used for efficienc
Miguel Andres Faghzzi, July 2010	The impacts of congestion on commercial vehicle tour characteristics and costs	Increased travel times and the uncertainty brought about by congestion impacts the efficiency of logistics operations	Tour model
Lee, J B May 2013	Commercial vehicle pre-clearance programs: Current issues and recommendations for potential	Inefficient weigh stations	Vehicle pre-clearance programs


Identification of barriers and recommendations
→ 213 barriers & 208 recommendations
First analysis of recommendations
→ Long list of 50 recommendations
STEP 1:
Analysis of the 10 ITS systems
Collection and processing of feedback
Ranking of recommendations
→ Short list of 38 recommendations
Combination of similar recommendations
→ Final list of 22 recommendations
STEP 2:
Workshop and questionnaire
Qualitative assessment of 22 recommendations
Selection of recommendations for Benefit Analysis
Benefit Analysis of 13 main recommendations
STEP 3:
Further analysis of recommendations
Multi Criteria Analysis and
ranking of 13 main recommendations
STEP 4:
Final ranking of recommendations

The main focus of ITS	Functions of ITS	Example of ITS
Monitoring of the roads	• monitoring technical condition and safety, • monitoring of climatic conditions, • monitoring devices,	• Detection of exceptional events and warning systems • CCTV • Weather Stations • Lighting control system of tunnels • Traffic sensors
Tracking of individual vehicles	• preventing collision situations, • obstruction recognition, • alert the driver, • emergency call,	• eCall • Electronic toll collection • GPS, Galileo • Anti-collision radar • Driver assistance systems • Monitoring system drive • Automatic identification of vehicle costs
Monitoring and management of transport processes	• informing drivers, • stop the flow of traffic, • change of driving parameters, • preventing collision state.	• Intelligent system of analyze density of traffic from video • Dynamic vehicle guidance • Automatic control system operation in the critical place of transport infrastructure

ITS Category	Specific ITS Applications
1. Advanced traveler information systems (ATIS)	Real-time traffic information provision
	Route guidance/navigation systems
	Parking information
	Roadside weather information systems
2. Advanced transportation management systems (ATMS)	Traffic operations centers (TOCs)
	Adaptive traffic signal control
	Dynamic message signs (or "variable" message signs)
	Ramp metering
3. ITS-enabled transportation pricing systems	Electronic toll collection (ETC)
	Congestion pricing/electronic road pricing (ERP)
	Fee-based express (HOT) lanes
	Vehicle-miles traveled (VMT) usage fees
	Vatiable parking fees
4. Advanced public transportation systems (APTS)	Real-time status information for public transit system (eg, bus, subway, rail)
	Automatic vehicle location (AVL)
	Electronic fare payment (eg, smart cards)
5. Vehicle-to-infrastructure integration (VII) and vehicle-to-vechicle integration (V2V)	Cooperative intersection collision avoidance system (CICAS)
	Intelligent speed adaptation (ISA)