Sustainable deployment of cooperative ITS for logistics - Evaluation

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Why Evaluate ITS & C-ITS?

- Evaluation is the process of determining the value, the importance and the quality of a thing, of a process and of a project based on predetermined criteria.
  - Understand the impacts
  - Quantify the benefits
  - Help make future investment decisions
  - Optimize existing system operation and design
The EasyWay project proposes the following classification of Field Operational Tests (FOTs):

- **Pilot project**: technical focus on meeting the specifications on a wide area
- **Implementation project**: evaluation of socio-economic impacts of the proposed solution
- **Demonstration project**: focus on scalability combining the above two categories
Field operational tests

Source: EasyWay Euro-Regional Project Evaluation Guidelines, 2005
Evaluation framework of COGISTICS

- FESTA (FREILOT, COMPASS4D)
  - Research questions, hypothesis, indicators, measurements
- AMITRAN
  - Methodologies for CO2 emissions estimation
- TRADITIONAL TOOLS
  - CBA, CEA, MCA
- DESIGN SCIENCE (innovative products)
  - Functionality, completeness, consistency, usability
- AGILE APPROACH
  - Customer oriented design (flexible)
Evaluation framework of COGISTICS

- **FESTA (FREILOT, COMPASS4D)**

  - Context
    - Function Identification & Description
    - Use Cases
    - Research Questions & Hypotheses
    - Performance Indicators
    - Study Design
    - Measures & Sensors
    - Ethical & Legal Issues
    - Socio-economic Cost Benefit Analysis
    - Impact Assessment
    - Research Questions & Hypotheses Testing
    - Data Analysis
    - Database
      - Measures
      - Performance Indicators
    - Data Acquisition
    - Using
    - Preparing
    - Analysing

  - **Implementation plan**

  - **7th ECITL Conference 5th – 7th November 2014 Dortmund**
Evaluation within the project

EVALUATION

OPERATION

DISSEMINATION

BUSINESS MODELS

T.4.1 Evaluation Framework

T.4.2 Evaluation criteria and performance targets

T.4.3 Pilot operation specifications

T.4.4 Assessment tools

T.4.5 Data Analysis and monitoring

D.4.1

D.4.2

Evaluation requirements

Definition of the experimental procedure

Data to be collected

Indicators and measurements

Evaluation methodology

Results

Results

Baseline & Functional Operation durations

Monitoring tools

Requirements for data storage/delivery

Data

Evaluation tools

Indicators

Evaluation criteria and performance targets

T.4.3 

T.4.4 

T.4.5 

T.4.2 

T.4.1 

IMPLEMENTATION

OPERATION

DISSEMINATION

BUSINESS MODELS
Evaluation within the project

Implementation
- Position
- Speed

Vehicle
- Consumption
- Speed
- Acceleration
- Break
- Traffic flow
- Accidents
- Fleet performance
- Acceptance

Sensors
- GPS
- CAM
- TMC
- Surveys

Measurements

Database

Processing

Estimations

Indicators

Evaluation
- Simulations

Operation
- Acceleration
- Consumption
- Emmissions

Means consumption
- Mean speed
- CO2 emissions
- Network performance

Performance

Acceptance

FREILOT
Urban Freight Energy Efficiency

compass 4D

CO-gISTICS

7th ECITL Conference 5th – 7th November 2014 Dortmund
Lessons learnt

- Problem: Large variability of results (due to the assumptions)

<table>
<thead>
<tr>
<th>Research team</th>
<th>Significant assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandava S., Boriboonsomsin K., Barth M. (2009)</td>
<td>Light traffic conditions</td>
</tr>
<tr>
<td>Li M., Boriboonsomsin K., Wu G., Zhang W.B., Barth M. (2009)</td>
<td>Two consequent signalized intersections</td>
</tr>
<tr>
<td>Barth M., Mandava S., Boriboonsomsin K., Xia H. (2011)</td>
<td>Signalized arterial</td>
</tr>
<tr>
<td>Xia H., Boriboonsomsin K., Barth M. (2013)</td>
<td>Medium demand and low user penetration rates</td>
</tr>
<tr>
<td>Barth M., Boriboonsomsin K. (2009)</td>
<td>Real world experimental run</td>
</tr>
<tr>
<td>Schuricht P., Michler O., Bäker B. (2011)</td>
<td>Very low traffic conditions</td>
</tr>
<tr>
<td>Asadi B, Vahidi A. (2011)</td>
<td>Integration of dynamic eco-driving into adaptive cruise control</td>
</tr>
</tbody>
</table>

12%-14% 47% 56% 0%
Energy savings Reduced emissions
Lessons learnt

- Need to define evaluation “standards”
  - Road type (arterial, urban, interurban)
  - Geographic extent (urban area, route)
  - “Network” characteristics (spacing, cycle time)
  - Congestion (high, medium, low, very low)
  - Penetration (infrastructure and vehicle side)
  - Service(s) logic (“hand made”)
  - Simulation algorithm (traffic + fuel/emissions)

- Need for standardized test beds
Lessons learnt

- Early evaluation results based on simulations should be taken into account during the implementation of the ITS
  - The System will collapse if provided during peak hours
  - Priority can be provided to up to $x$ trucks
  - Distance between intersections should be larger than $x$ m
  - Scaling issues
- Monitoring is fundamental (early detection of problems)
  - Technical issues
  - Organization issues
  - Operation issues
Lessons learnt

- Do not forget the aim of the service (society, profit, environment)
- Stakeholders commitment should be achieved from the start of the project (self-sustainable services)
- Standards should be used, but not always will be available (one step forward)
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Thank you for your attention!