GUEST-OR
Linking Lean Business and OR

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Agenda

- Why a Lean methodology
- GUEST
- Case studies
  - Waste collection
  - Car-sharing BMs and tariffs

A little bit of history

- GUEST: Lean Business methodology
  - G. Perboli – Prof. in Strategic Magement and OR in Politecnico di Torino
  - R. Gentile – CEO of BDS, a consultancy company in Business Development and Strategic Management
- What links startuppers and researchers

  Jake: We're putting the band back together.

  Mr. Fabulous: Forget it. No way.

  Elwood: We're on a mission from God.

  The Blues Brothers (1980)
- Only success stories are told
- What makes projects fail?
  - www.autopsy.io
  - Wrong customer, wrong implementation for the customer

Macroscopic positioning

CLAIM

Companies need tool to efficiently manage their innovation and business development processes, reduce the gap between business areas (e.g., managers and marketing) and operations and innovation and reduce to time to implement their strategic decisions

GOAL

Introduce lean concepts in business development, project management and innovation management in a repeatable, sustainable and efficient way

VISION

Move from Lean Startup to Lean Business

Create an engineered process requiring a low learning curve based on Lean Startup

Why we need GUEST?

- As Is
  - Different methodologies to speed up business development and innovation management
    - Require specific training
    - Often domain dependent
      - WCM
      - Agile
      - Lean Startup
      - Lean Production
- To Be
  - Single framework adaptable to different domains
  - Can include different actors and different stakeholders
  - Easy to manage and implement
  - Low learning curve

Definition

GUEST is a Lean Business methodology developed by G. Perboli and R. Gentile with the aim of providing at firms an innovative structure for the business management.

The methodology supports

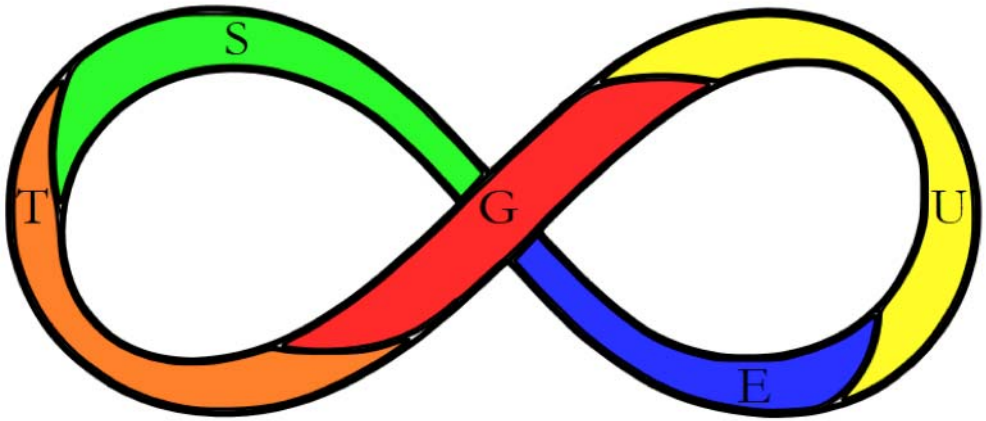
- firms that are at the end of the *Start-up* period, to the future developed of their business models
- SMEs to implement new business
- Innovation projects

Multi-Actor Complex System (MACS)

- Support the actors in the control of their projects, from the idea of new product or service, to the implementation
- Control the decisional process
- Evaluate the decisions
- Give a standardization of documents and tools used by different stakeholders, to connect in a common framework their vision, issues, results, problems and opportunities, but also to allow an easily following benchmark

GUEST is divided in five consecutive steps:

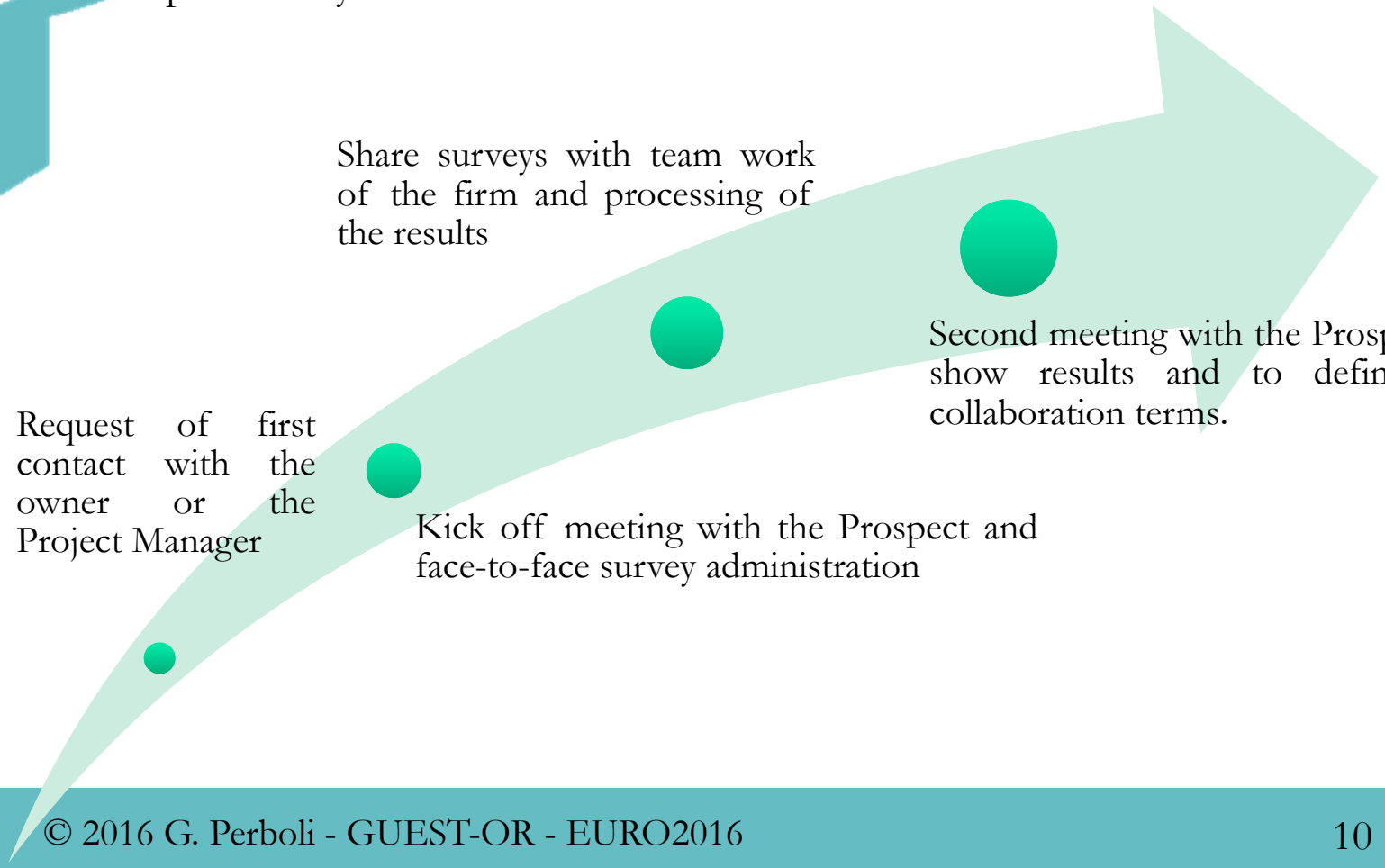
1. Go
2. Uniform
3. Evaluate
4. Solution
5. Test



1. **GO** **Description** of the environment
2. **UNIFORM** **Standardize** the information to define the solution canvas
3. **EVALUATE** **Define** the model(s) and the solution structure
4. **SOLVE** **Implement** the solution
5. **TEST** **Test plan**

1st Step: GO

The scope of this first step is to establish an approach with the firm, gather data and information for build a knowledge base and make a first evaluation of the project and business potentiality.



GO SURVEY

For the qualitative data gathering is used a **Standardize Survey** that results from the merger of the Solution Canvas and the Basel II Guidelines for SMEs.

This survey provides a full description of a company profile and its environment.

CUSTOMER SURVEY

ADVISORY SURVEY

General Information

Activities

Commercial Information

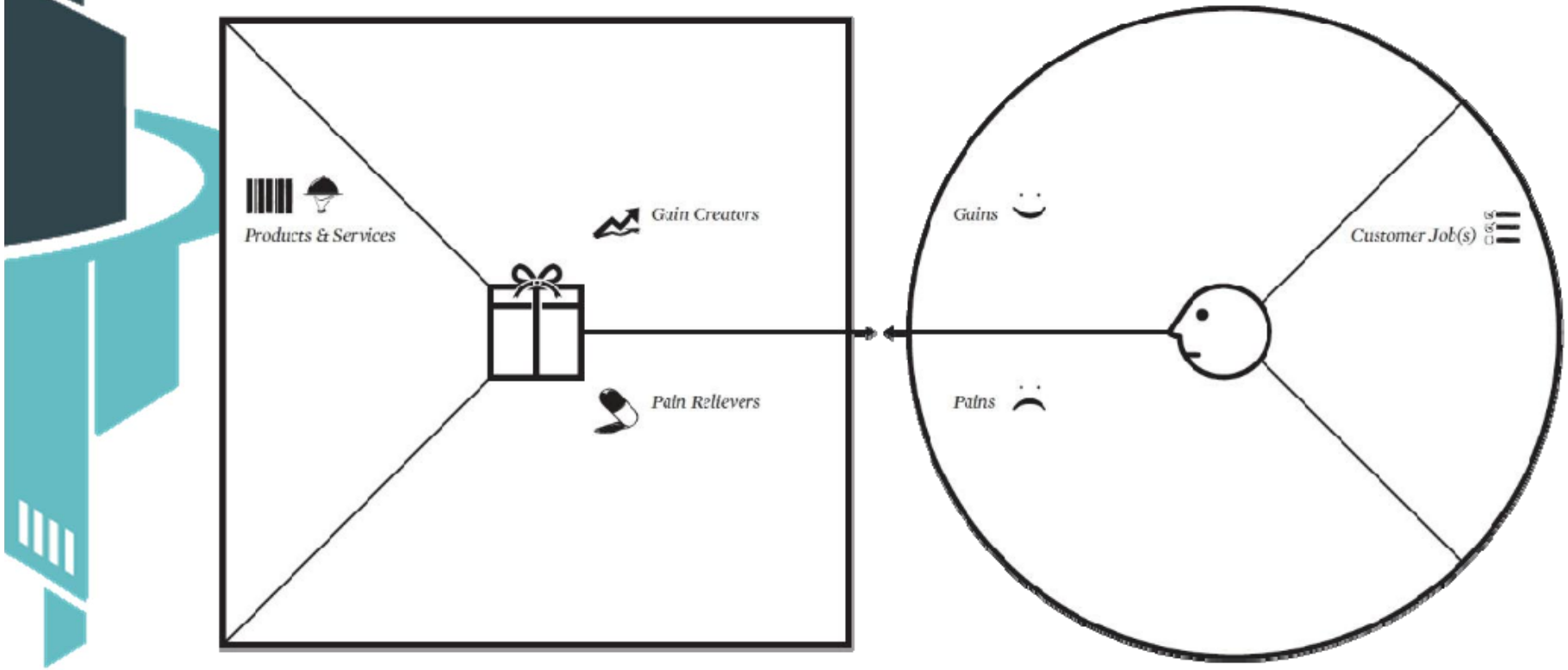
Customers

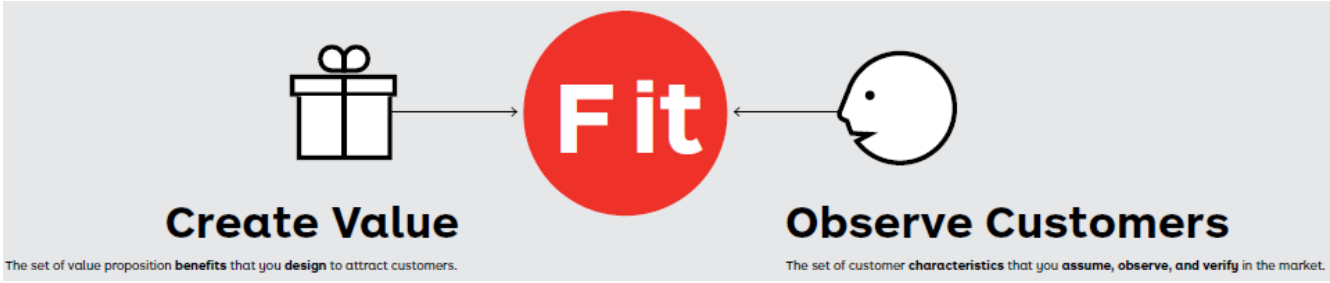
Suppliers

Competitors

Evaluation

Value Proposition Canvas





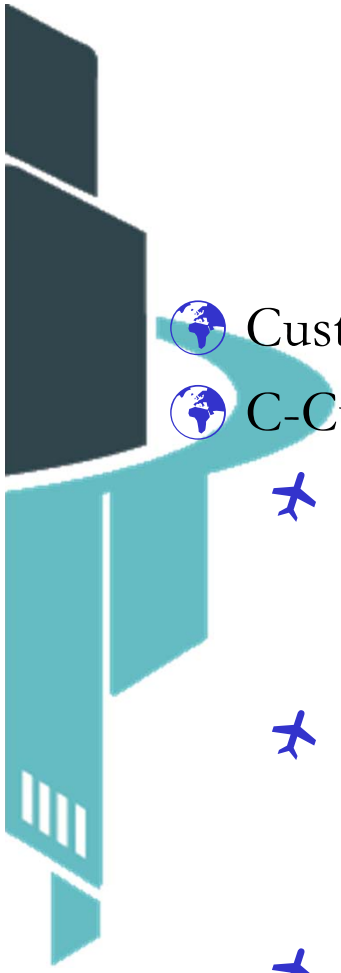
2nd Step: UNIFORM

- Assess in a standard way, the information collected in Go phase
- Obtain a common vision of the MACS.

- Assumption
  - Governance and the state-of- the art of the company and its business models are described
- Tool: **Solution Canvas** proposed by Perboli and Gentile

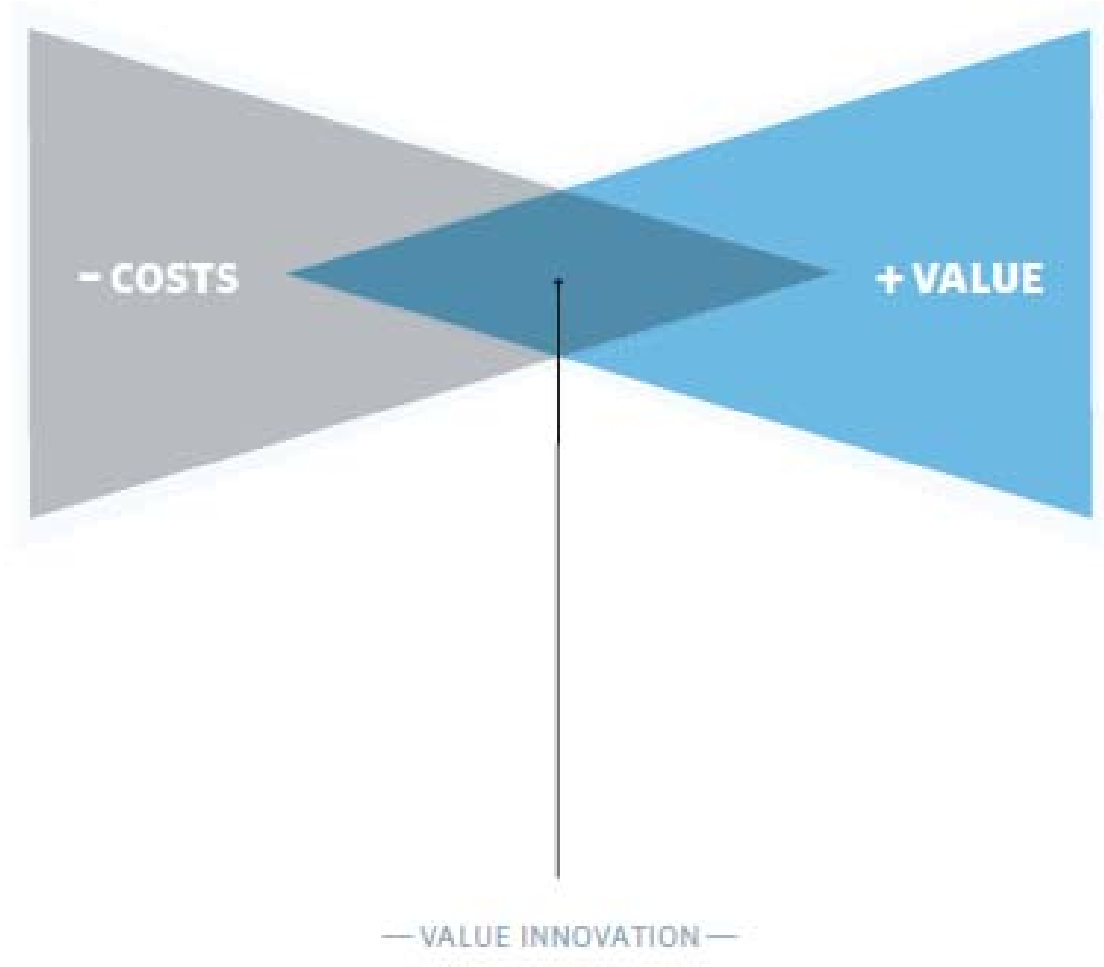
Blue Ocean Strategy

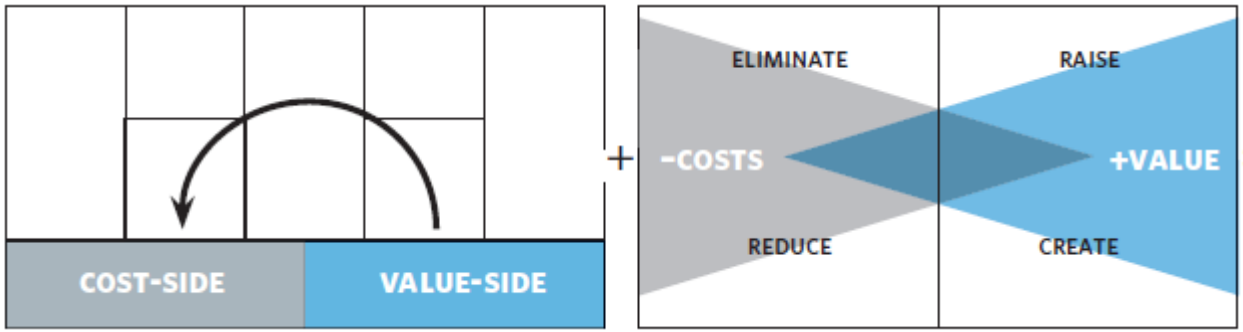
- Strategic model by Kim and Mobourgne
- Key points
  - Create new business horizons
  - Develop strategic and operational actions to create new products/services
  - Focusing on the value of the innovation

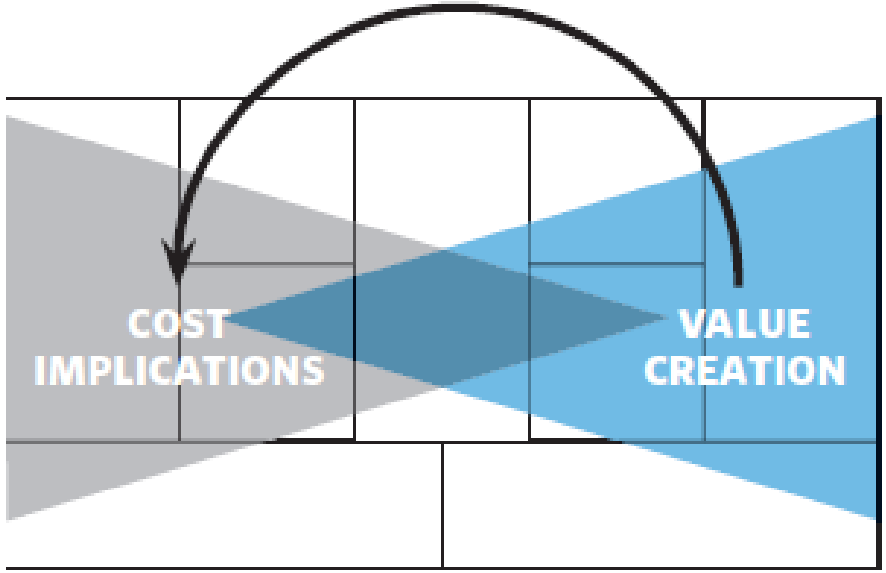


Our implementation

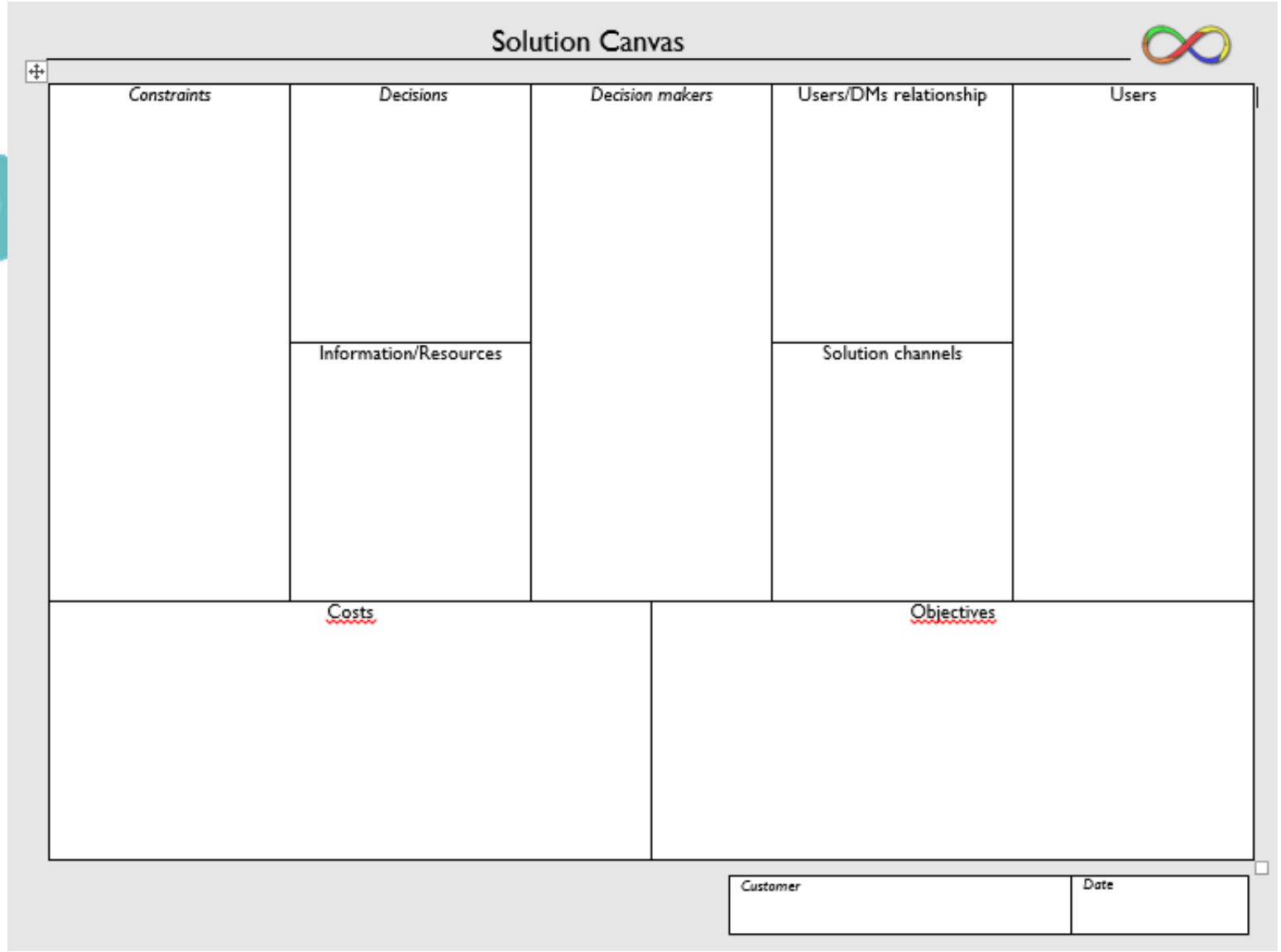
- Customers: users and decision makers (DMs)
- C-Cube rule
  - Customers (that will pay for)
    - Am I focusing on the right users/ DMs types?
    - Customer hypotheses/validation
  - Customers (that would like to pay…but they don't know yet)
    - Who will pay for my OR&MS solution?
    - Customer discovery
  - Customers (that will never pay for)
    - Why they should pay for my OR&MS solution?
    - Customer validation


- COSTS
+ VALUE
— VALUE INNOVATION —

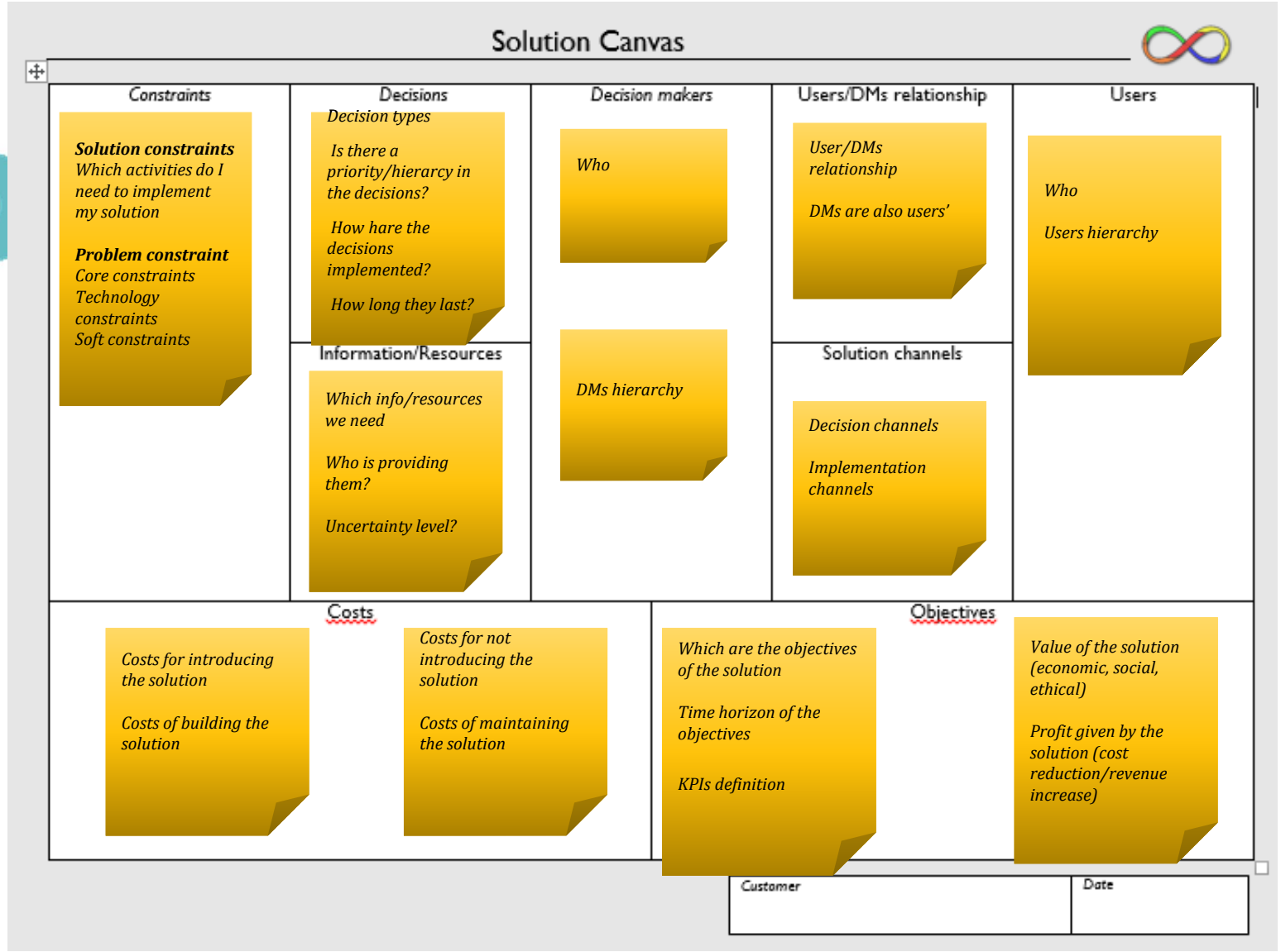

COST-SIDE
VALUE-SIDE
+
ELIMINATE
RAISE
-COSTS
+VALUE
REDUCE
CREATE


COST
IMPLICATIONS
VALUE
CREATION

Solution canvas



Solution canvas



3rd Step: EVALUATE

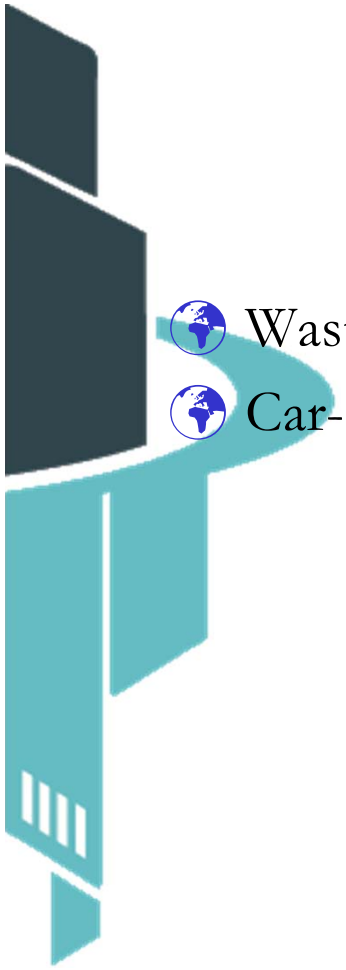
- Build your model(s)
  - LB
  - MIP
  - Stochastic
- Check the feasibility of the solution
  - Exact
  - Heuristic
  - …
- Discuss the model by the Solution Canvas
- Define KPIs to evaluate your work
  - OF is not enough

4th Step: SOLVE

- Implement the solution
- Integrate with other customers' appliances
- Measure the KPIs

5th Step: TEST

- Build a test plan
- Define the expected outcomes
- Monitor the solution AND keep track of the issues



Two case studies

- Waste collection
- Car-sharing Business Models and Operations analysis

ONDE UWC – Garbage collection

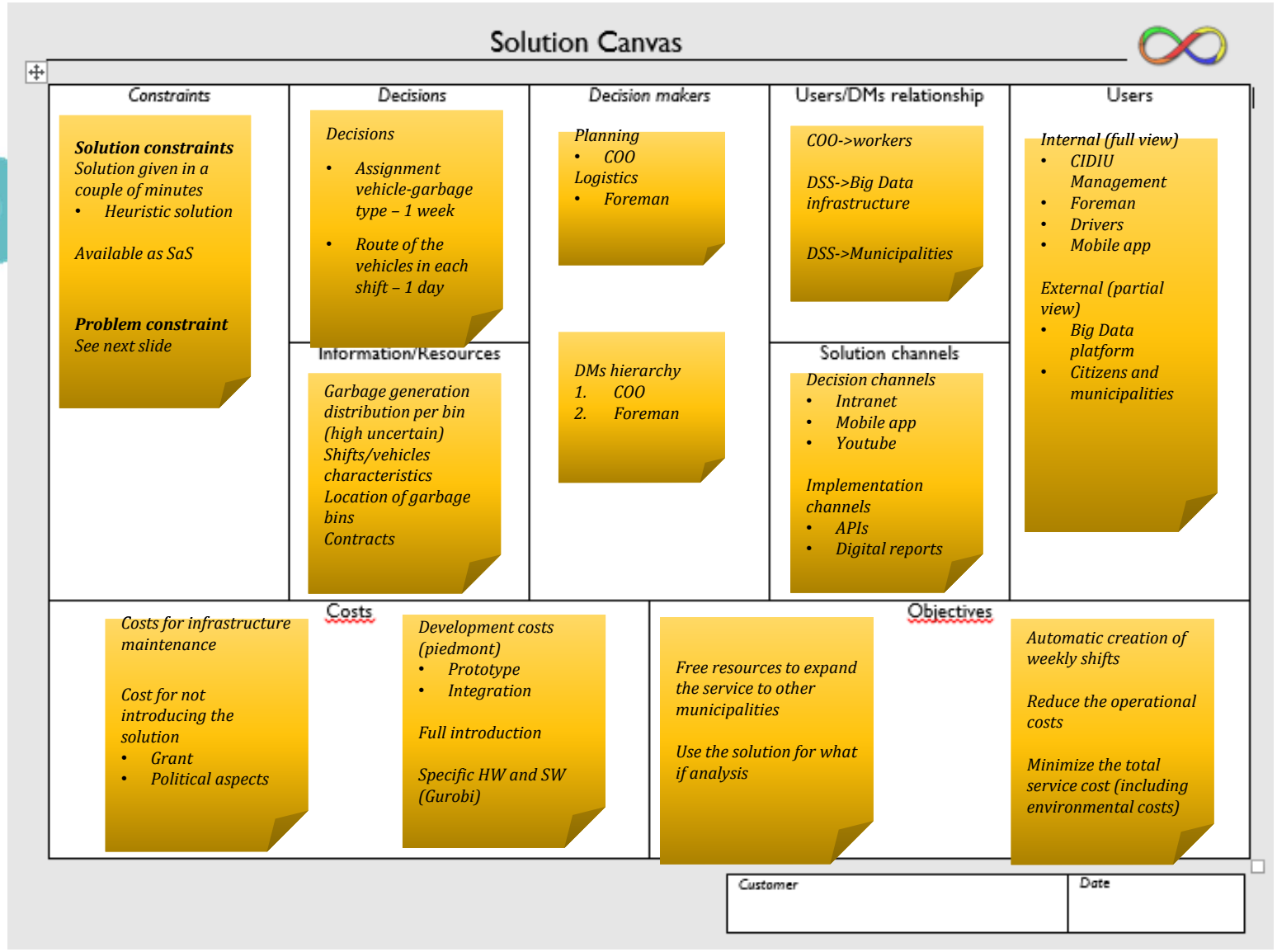
- Waste collection in Turin
- Project funded by the Regional Council of Piedmont
  - Issue: 9 months from the kickoff to the integration
  - We used the GUEST methodology to reduce the time for defining the optimization solution and the related models
- Objectives
  - Optimization: build a scheduler for the weekly shifts reducing the total costs
  - Increase the awareness of the citizens about waste collection
  - Collect field data and store in an Open Access form

Go

- Two technical meetings
  - CIDIU
    - President
    - COO
  - Representatives of the other companies involved in the project
    - Nord Engineering
    - Moltosenso s.r.l.
- 2 full days with the workers

Go – present situation

- Periodic waste collection
  - Periodicity not required by the contracts with the municipalities
  - Used to simplify the shift creation
- Different waste types
- 3 shifts with different costs
  - Third shift is an extra shift: increment of +50% of the costs
- KPIs
  - Vehicles per shift: 1.5 in the mean
  - Mean % volume used in the garbage bins: 28%
  - Extra shifts impact: 12%


Solution Canvas
Constraints
Solution constraints
Solution given in a couple of minutes
• Heuristic solution
Available as SaS
Problem constraint
See next slide
Decisions
Decisions
• Assignment vehicle-garbage type – 1 week
• Route of the vehicles in each shift – 1 day
Information/Resources
Garbage generation distribution per bin (high uncertain)
Shifts/vehicles characteristics
Location of garbage bins
Contracts
Decision makers
Planning
• COO
Logistics
• Foreman
DMs hierarchy
1. COO
2. Foreman
Users/DMs relationship
COO->workers
DSS->Big Data infrastructure
DSS->Municipalities
Solution channels
Decision channels
• Intranet
• Mobile app
• Youtube
Implementation channels
• APIs
• Digital reports
Users
Internal (full view)
• CIDIU Management
• Foreman
• Drivers
• Mobile app
External (partial view)
• Big Data platform
• Citizens and municipalities
Costs
Costs for infrastructure maintenance
Cost for not introducing the solution
• Grant
• Political aspects
Development costs (piedmont)
• Prototype
• Integration
Full introduction
Specific HW and SW (Gurobi)
Objectives
Free resources to expand the service to other municipalities
Use the solution for what if analysis
Automatic creation of weekly shifts
Reduce the operational costs
Minimize the total service cost (including environmental costs)
Customer
Date

Objectives

- Minimize the costs
  - Vehicle usage
  - Vehicle tours
- Limit the extra shifts
- Have space to manage bins with pickup problems in previous shifts

Constraints

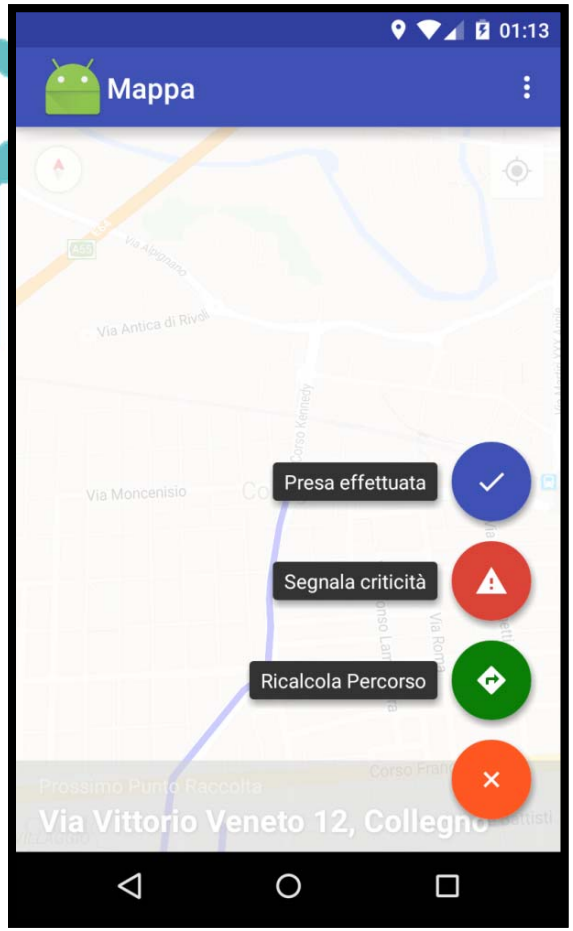
- Empty the bins before they reach the 80% of the volume usage
  - We break the periodicity
  - We use the contract
- Vehicles can pickup one garbage type per shift
- Vehicle tours limited to 6 hours
- Vehicle capacity
- Tours start at the depot, end to the specific garbage collection point

Evaluate

- MIP model with simplified routing
- Temporal/spatial network representation
- The size of the model explodes with the number of bins and the shifts
- Hard to find good solutions with 24 hours of computation on a 12 cores parallel machine
- Model used to share with CIDIU some preliminary solutions and check our hypotheses

Solve

- Optimization heuristic based on the usage of a series of simplified versions of the original MIP model
  - Cluster the bins related to the garbage distribution
  - Simplified model that builds the shifts on the clusters
  - Creation of the tours
- Implemented in C++/Gurobi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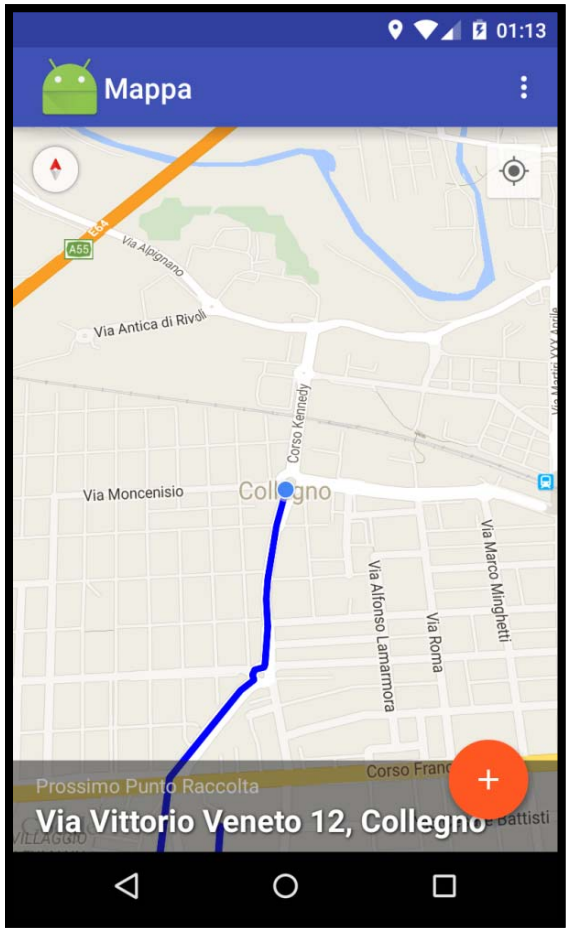
Mappa
Presa effettuata
Segnala criticità
Ricalcola Percorso
Prossimo Punto Raccolta
Via Vittorio Veneto 12, Collegno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Mappa
Via Antica di Rivoli
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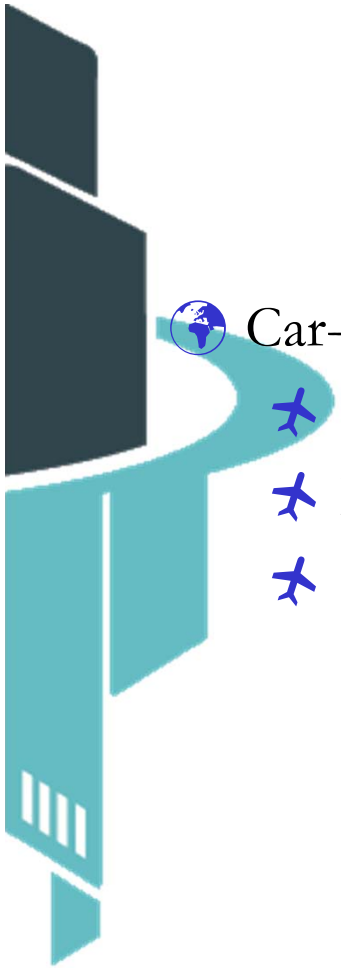
Corso Kennedy
Via Alfonso Lamarmora
Via Roma
Via Marco Minghetti
Prossimo Punto Raccolta
Via Vittorio Veneto 12, Collegno

Test - Results

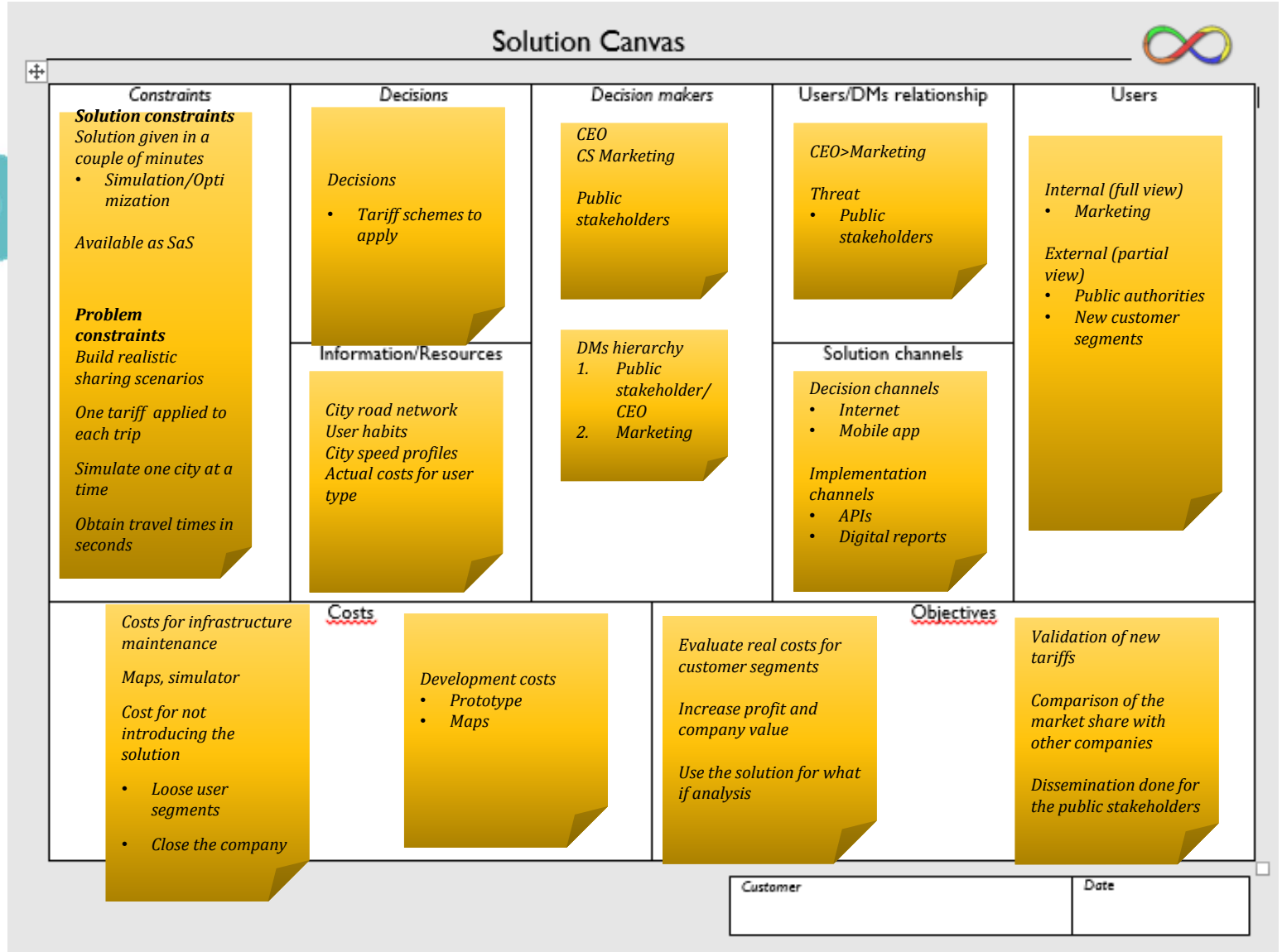
- New KPIs' values
  - Vehicles per shift: 1
  - Mean % volume used in the garbage bins: 70%
  - Extra shifts impact: 3%
- Some project KPIs
  - # meetings before first model: 2
  - TimeToFirstModel: 1.5 months
  - TimeToModel: 4 months (including test)
  - MVP: less than 6 months
- A small outcome
  - Video in Youtube



Car-sharing Business Models and Operations analysis

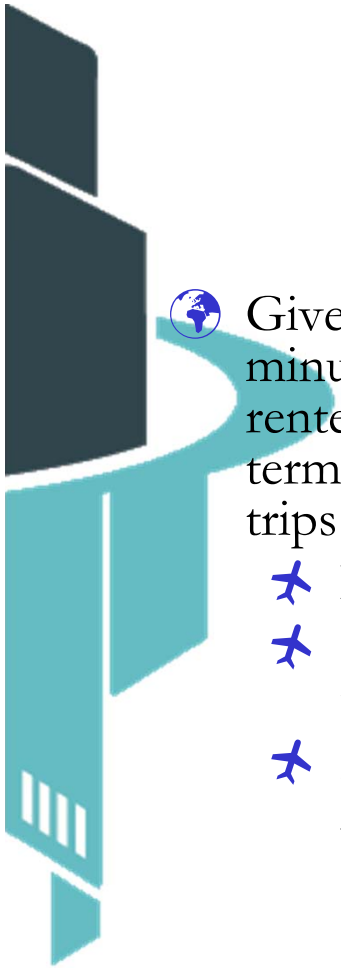
- Car-sharing business
  - Growing market
  - Exiting from the pioneering phase
  - Question: what can should we implement in a DSS to optimize the process?

- Taxonomy of 15 years of literature
  - Ferrero, F., Perboli, G., Vesco, A., Caiati, V., and Gobbato, L. (2015). Car-sharing services: Taxonomy and annotated review. Technical Report CIRRELT-2015-47, CIRRELT.
  - A lot of work at the operational level
  - Just a bit at strategic level
  - 1 for the business part
  - None about tariffs
- Business environment is changing
  - Reduced public funds
  - Car-sharing must be a competitive market
  - New tariff schemes similar to the mobile ones

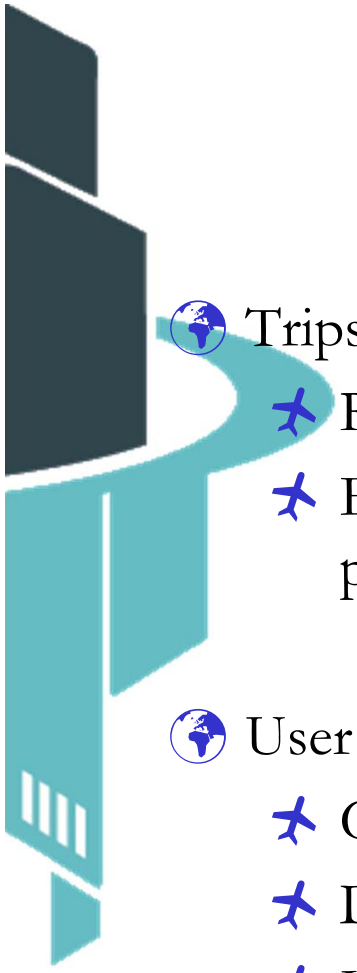

Solution Canvas
Constraints
Solution constraints
Solution given in a couple of minutes
• Simulation/Optimization
Available as SaS
Problem constraints
Build realistic sharing scenarios
One tariff applied to each trip
Simulate one city at a time
Obtain travel times in seconds
Decisions
Decisions
• Tariff schemes to apply
Information/Resources
City road network
User habits
City speed profiles
Actual costs for user type
Decision makers
CEO
CS Marketing
Public stakeholders
DMs hierarchy
1. Public stakeholder/ CEO
2. Marketing
Users/DMs relationship
CEO>Marketing
Threat
• Public stakeholders
Solution channels
Decision channels
• Internet
• Mobile app
Implementation channels
• APIs
• Digital reports
Users
Internal (full view)
• Marketing
External (partial view)
• Public authorities
• New customer segments
Costs
Costs for infrastructure maintenance
Maps, simulator
Cost for not introducing the solution
• Loose user segments
• Close the company
Development costs
• Prototype
• Maps
Objectives
Evaluate real costs for customer segments
Increase profit and company value
Use the solution for what if analysis
Validation of new tariffs
Comparison of the market share with other companies
Dissemination done for the public stakeholders
Customer
Date

Solution

- Better understanding of the user behaviours
  - Survey to about 1500 potential customers
- Better understanding of companies marketing
  - 5 companies analyzed by means of their Business Model Canvas
- Tariff simulation
  - Monte Carlo based simulation

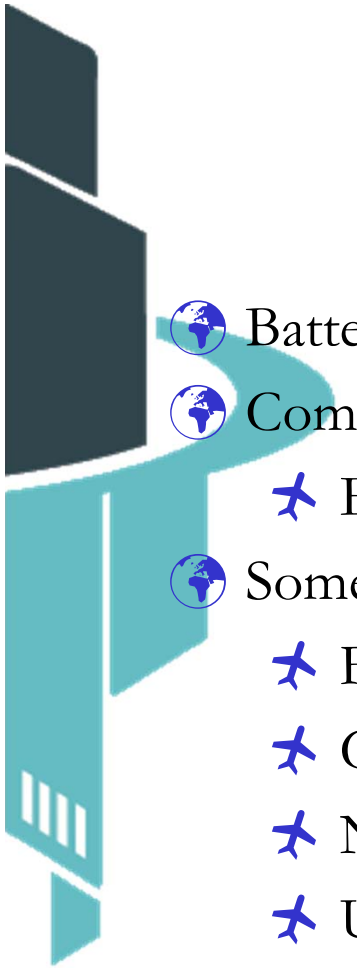


- Given a certain city, a set of tariffs described in terms of price per driving minute, price per parking minute (price paid by the customer if the car is rented, but in a parking slot), price per km, the customer preferences in terms of trips, trip types, kilometers traveled per year, and a list of possible trips
  - Identify a set of potential routes.
  - Create S scenarios with the random demands in term of customer trips, their temporal distribution and type.
  - For each scenario s and until the kilometers traveled per year are not reached
    - Extract a route from the routes list, assign a departure time according to the user preferences and simulate it in terms of actual travel time and apply to it the more profitable tariff of the user type.
- Given the scenario values in terms of cost paid to travel the kilometers traveled per year, compute the expected value of the cost.
- Compute the distribution of the expected value.



Scenarios

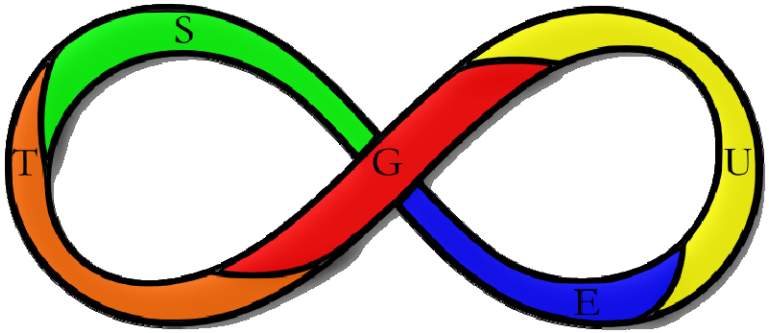
- Trips
  - Real traffic data gathered from the sensors in the city of Turin
  - Empirical speed profiles for different types of route (central, peri-urban, high speed)
- User types
  - Commuter, professional casual
  - Differ in time intervals and O/D pairs
  - KM/year ranging from 1000 to 15000



- Battery of tests over the Turin area
- Comparison of 3 companies profiles
  - Enjoy, Car2Go, CarcityClub
- Some results
  - Free flow is the best option for any type of user
  - Car-sharing is presently an alternative up to 7000 km/year
  - No marketing strategy for professional/SME users
  - Unawareness of the users to ownership costs
    - About 80% of the users think to pay for the ownership less than 2000 €/year

Conclusion and future perspectives

- Consolidation of the methodology both for OR/MS and Business Development
- Link between OR/MS and management
- Introduced in some large scale projects
  - SynchroNet EU project
- Present KPIs
  - Reduction of the time between first meeting and solution/model delivery up to 50%
    - ONDE-UWC 4 months to identify, discuss and test the model
    - Car-sharing: 5 months to define and validate the solution (including 3 months of literature analysis)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