

SINFONIA webinar

“Data for citizens: using sensors and interactive totems to provide smart urban services?”

June 17th, 2020



A choice experiment to assess the interest and willingness of citizens to multifunctional interactive totems

Adriano Bisello - EURAC



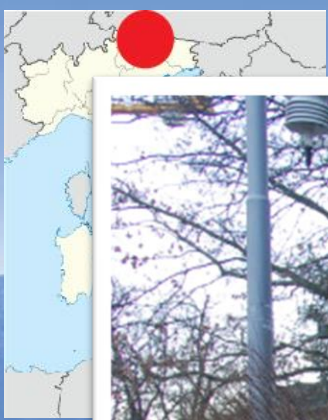
This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 609019

The SINFONIA Smart City Project



FP7 8.8.1 Energy SCC
STARTED IN JUNE 2014
SIX YEARS PROJECT

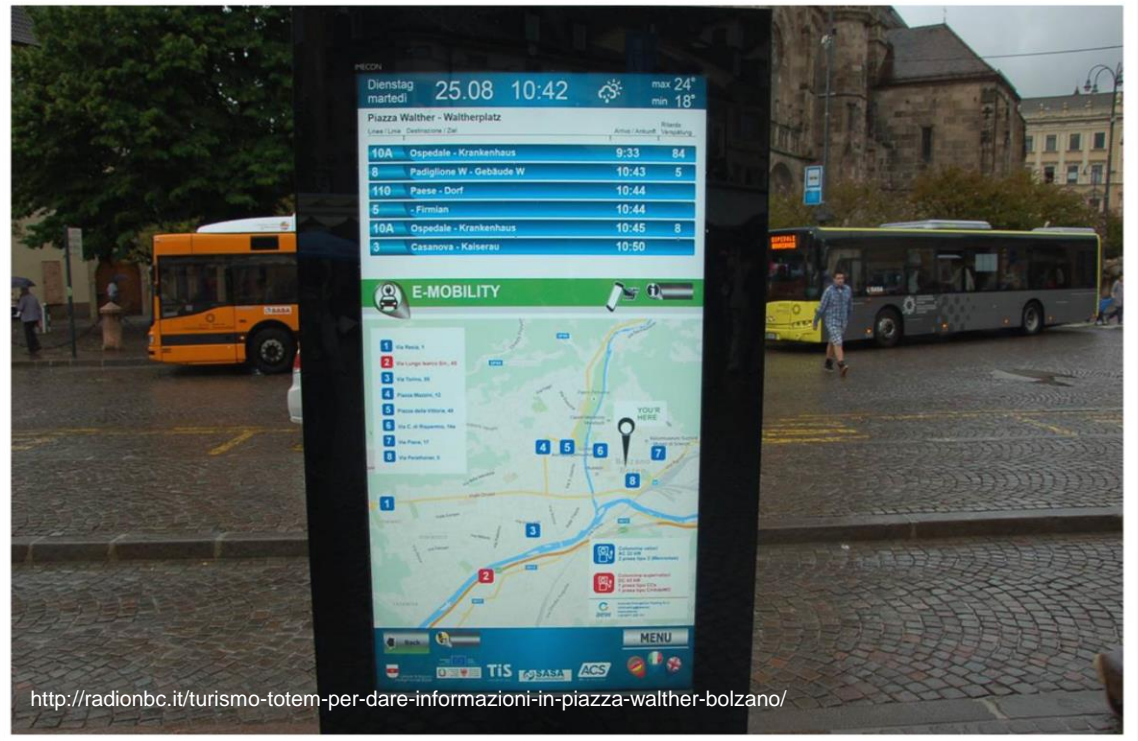




caratteristiche/



<http://www.mobilitypress.it/bolzano-presentato-nuovo-paddock-dellaria/>



<http://radionbc.it/turismo-totem-per-dare-informazioni-in-piazza-walther-bolzano/>

Since 2005, Bolzano (100,000 inhabitants) has developed an ambitious investment plan for large scale urban refurbishment in collaboration with both public and private stakeholders. The work undertaken in SINFONIA is part of this plan, and aims to achieve 40% to 50% primary energy savings in the demo sites and to increase the share of renewables in the district of Bolzano SW (South West) by 20%.



BUILDING REFURBISHMENT

37,000m² of social housing buildings from the 50s-70s will be retrofitted to achieve high energy performance and improve interior comfort while ensuring cost effectiveness and minimal impact on tenants.

MEASURES INCLUDE:

- Building envelope insulation;
- Integration of renewable energy sources for electricity, heating and domestic hot waterSolar PV panels;
- Additional storeys using innovative timber construction technologies.

DISTRICT HEATING & COOLING

The district & cooling network will be extended and optimised to reduce the CO₂ equivalent emissions and the nitrogen oxides emissions.

MEASURES INCLUDE:

- Real time monitoring and forecasting of peak loads and energy demand;
- Hybrid hydrogen/methane backup system;
- Feasibility study for recovery of wasted energy in the local industrial park.

ELECTRICITY GRID

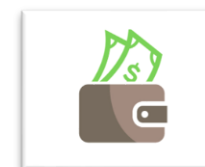
Bolzano will implement an Urban Service-Oriented Sensible Grid (USOS-grid) system in the South West district for improved energy distribution control.

MEASURES INCLUDE:

- Recharge points for vehicles and bicycles;
- Meteorological stations for local climate condition monitoring;
- Smart retrofitting of the public lighting system.

Questions

- Do people like “smart points/totems” providing information and services?
- What info and services are the most significant?
- Is there a willingness to pay for these info and services?

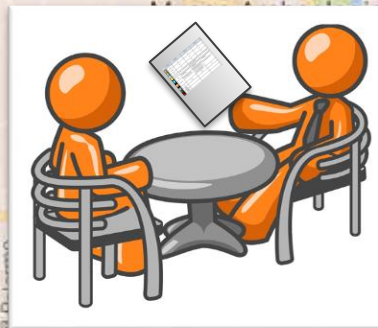


Preliminary considerations

- ICT, smart cities and sustainable development are a trending topics
- There is a real case study (EU Project SINFONIA - Bolzano)
- There is no market, so far for integrated infrastructures



Choice Experiment method



>200

WTP



Willingness to pay (WTP)
is the maximum price at which
a consumer will buy
a product or a service



Some examples

What is the value of telecare programs that helps elderly people to live independently at home?

How much would you pay to avoid the hassle of spam mail?

What is the economic value of a stream with crystalline waters?

How much is worth energy efficiency in buildings?

Techniques

Table 4 Non-market evaluation techniques

Group	Typology	Technique
Indirect methods	Revealed preferences	Travel cost
	Revealed preferences	Hedonic pricing
Direct methods	Stated preferences	Contingent valuation method (CVM)
	Stated preferences	Choice experiment (CE)
Second best	Stated/revealed preferences	Benefit transfer (BT) Value-function transfer



observed decisions for private goods (related to the non-market good) and theoretical assumptions



based on what respondents state in interviews/questionnaires

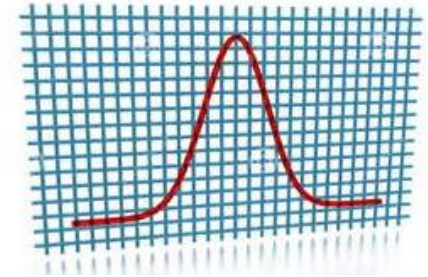
Economic valuation methods for non-market goods and services comprise a range of empirical approaches to estimate a monetary value for the trade-off a person would be willing to make to increase the amount or the quality of a good or service for which there exists no market (Kriström and Johansson, 2019)

Methods

$$U_{int} = V_{int} + \varepsilon_{int}$$

Multinomial Logit Model (MNL)

$$V_{nt} = \beta_t X'_{tn}$$



Assumes:

- Independently and Identically Distributed (IID) random terms,
- Independence from Irrelevant Alternatives (IIA)

Can not capture preference heterogeneity across respondents.

Mixed Logit Model (MXL)

$$P_{ni} = \int \frac{e^{\beta'_n X_{ni}}}{\sum_j e^{\beta'_n X_{ni}}} \varphi(\beta | b, \Omega) d\beta$$

Assumes:

- a random distribution of the parameters

It is possible to compute individual parameters

Methods

$$WTP = \frac{-\beta_i}{\beta_{cost}}$$

**Services available
at the totem**

β_i = coefficient of any non-monetary attribute

β_{cost} = Coefficient of the monetary attribute












Cost



Attributes

Stated Preferences of citizen
-> Choice Experiment (CE)

Non-
attrib
attrib

	SERVICES	OPTION 1	OPTION 2	OPTION 3
	SOS	NO	YES	NO
	WATER	YES	NO	NO
	WI-FI	YES	NO	NO
	ELECTRICITY	• TABLET or SMARTPHONES	• TABLET or SMARTPHONES • ELECTRIC BICYCLES	• TABLET or SMARTPHONES
	INFO	• WEATHER and ENVIRONM. CONDITIONS	• WEATHER and ENVIRONM. CONDITIONS • TOURISTIC and CULTURAL	• WEATHER and ENVIRONM. CONDITIONS
	MOBILITY	• FREE PARKING SPACES • FREE CHARGING POINTS	• FREE PARKING SPACES • FREE CHARGING POINTS • TRAFFIC CONDITIONS and PUBLIC TRANSPORTS	• FREE PARKING SPACES
	COST	2.00 €	2.50 €	0 €
	BEST OPTION			
	WORST OPTION			

ions
cles
orts
(G)

Looking at the three alternatives (options):

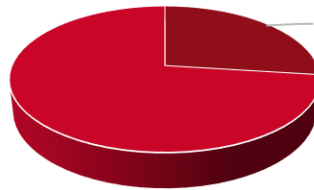
- 1. what is the best?*
- 2. what is the worst?*

Mo
attr

Results

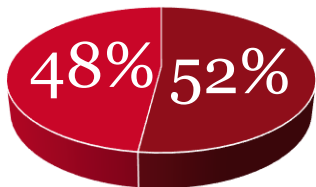
221 Complete
questionnaires:
3536 Observations

Motherlanguage



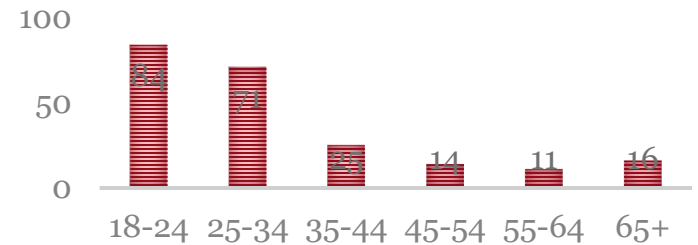
■ German ■ Italian

Gender

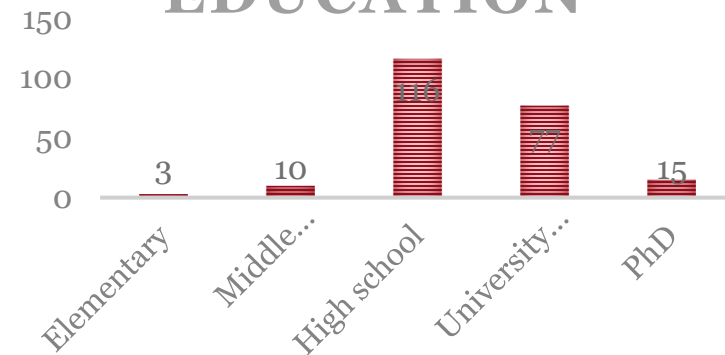


■ Women ■ Men

AGE STRUCTURE



EDUCATION



	MNL		
Attributes	Estimate	Std. error	Signif.
SOS	0.98	0.24593	***
WATER	0.94	0.17552	***
WIFI	1.49	0.20919	***
E_DEVICES	1.27	0.24841	***
E_BIKES	0.94	0.26922	***
E_CARS	1.82	0.34712	***
I_WHETHER	0.38	0.30919	
I_TOURISTS	0.95	0.24985	***
I_RESIDENTS	1.41	0.24156	***
M_CHARGE	0.71	0.24982	**
M_TRAFFIC	1.51	0.24229	***
M_PARKING	1.58	0.23408	***
SQ	0.53	0.34851	
COST	-0.415	0.03587	***

Results



- Do people like “smart points/totems” providing information and services?
- Yes, because having the totem is preferred to the “Status Quo” (without a totem)

MNL

Attributes	Estimate	Std. error	Signif.
SOS	0.98	0.24593	***
WATER	0.94	0.17552	***
WIFI	1.49	0.20919	***
E_DEVICES	1.27	0.24841	***
E_BIKES	0.94	0.26922	***
E_CARS	1.82	0.34712	***
I_WHETHER	0.38	0.30919	
I_TOURISTS	0.95	0.24985	***
I_RESIDENTS	1.41	0.24156	***
M_CHARGE	0.71	0.24982	**
M_TRAFFIC	1.51	0.24229	***
M_PARKING	1.58	0.23408	***
SQ	0.53	0.34851	
COST	-0.415	0.03587	***

Results



- What info and services are the most significant?
- The majority of the suggested service are significant, especially those integrating functions

	MNL		
Attributes	Estimate	Std. error	Signif.
SOS	0.98	0.24593	***
WATER	0.94	0.17552	***
WIFI	1.49	0.20919	***
E_DEVICES	1.27	0.24841	***
E_BIKES	0.94	0.26922	***
E_CARS	1.82	0.34712	***
I_WHETHER	0.38	0.30919	
I_TOURISTS	0.95	0.24985	***
I_RESIDENTS	1.41	0.24156	***
M_CHARGE	0.71	0.24982	**
M_TRAFFIC	1.51	0.24229	***
M_PARKING	1.58	0.23408	***
SQ	0.53	0.34851	
COST	-0.415	0.03587	***

Results



- Is there a willingness to pay for these info and services?
- Yes, the coefficient cost is negative, while other estimates are positive
 - Wi-Fi
 - Charging devices + bikes + cars
 - Whether + touristic + city Info

Results

Comparison of the models:

MNL

LL	-2270
N	
Parameter	
s	14
AIC	4542
BIC	4548
Responde	
nts	221
Observati	
ons	3536

MXL

LL	-2109
N	
Parameter	
s	27
AIC	4246
BIC	4252
Responde	
nts	221
Observati	
ons	3536

Preference heterogeneity seems to matter:
different categories of users may be interested to
different services

Conclusions and Lessons Learned

- Do people like “smart points/totems” providing information and services?



- **Yes, the coefficients are positive**
 - > the SQ situation has no significance
 - > some differences across respondents (MXL)

- What info and services are the most significant



- **Wi-Fi connection, information about mobility and combined charging points (devices / bikes / EV) are relevant for respondents, regardless of the analysis method (MXL or MNL)**

- Is there a willingness to pay for these info and services?



- **Yes, in particular for Wi-Fi and integrated services**

Grilli, G., Tomasi, S., & Bisello, A. (2018). Assessing Preferences for Attributes of City Information Points: Results from a Choice Experiment. *Green Energy and Technology*, (Smart and Sustainable Planning for Cities and Regions. Results of SSPCR 2017), 197–209. https://doi.org/10.1007/978-3-319-75774-2_14

SINFONIA webinar

“Data for citizens: using sensors and interactive totems to provide smart urban services?”

June 17th, 2020



A choice experiment to assess the interest and willingness of citizens to multifunctional interactive totems

Adriano Bisello – EURAC
adriano.bisello@eurac.edu

THANK YOU! ANY QUESTIONS?



This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 609019