

## Business potential and market opportunities of intelligent LBSs for personal mobility – A European case study

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### Abstract

The article presents a first hypothesis of business models for an intelligent LBS for personal mobility. Two business models have been developed inside **FP7 i-Tour** project. i-Tour stands for “intelligent Transport system for Optimized URban trips” and is a so-called Collaborative Focused Research Project presented to the call on Surface Sustainable Transport topic “SST.2008.3.1.2 Intelligent mobility systems and multi-modal interfaces for transport of passengers”. In order to develop business models for next generation personal mobility systems, an as-is analysis has been performed, resulting in a scenario characterized by the wide diffusion of wireless connections at urban and regional scale (e.g. UMTS, Wi-Fi or WiMax); by info-mobility services promoting multi-modal transport; by the development of transportation services based on localization technologies. The business models have been, then, proposed taking into account two different business strategies and two different organizations, and developing a financial analysis, including a break-even analysis useful to support a first feasibility study for a distinctive go-to-market strategy.

**Keywords:** *Personalised multimodal travel information system; user-friendly; open standard, data collection; Location-based info; augmented reality; adding points of interest.*

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### 1. Introduction

i-Tour is the acronym for a three-years European funded project by the Seventh Framework Program on Research [1]. i-Tour stands for “intelligent Transport system for Optimized URban trips” and it is a so-called Collaborative Focused Research Project presented to the call on Surface Sustainable Transport topic “SST.2008.3.1.2 Intelligent mobility systems and multi-modal interfaces for transport of passengers” [2]. i-Tour will develop an open framework to be used by different providers, authorities and citizens to provide intelligent multi-modal mobility services. i-Tour client will support and suggest, in a user-friendly way, the use of different forms of transport (bus, car, railroad, tram, etc.) taking into account user preferences as well as real-time information on road conditions, weather, public transport network condition. To do so, i-Tour promotes a new approach to data collection based on recommender system based on the information provided by the whole user community. i-Tour mobility client applications will feature a very user-friendly interface accessible from PCs, PDAs and smartphones. i-Tour clients are designed to promote use of public transport by encouraging sustainable travel choices and by providing rewarding mechanisms for users choosing public travel options. Sustainable travel preferences,

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DOI: 10.5383/JUSPN.04.01.002

e.g. measured in terms of CO<sub>2</sub> emission saved by using public transport, are rewarded, e.g. through free public transport tickets, thus promoting and encouraging environmental friendly travel behaviors. During its progress, i-Tour project will release a business plan that aims at describing a common strategy towards exploitation of the i-Tour tangible and intangible results. The business plan will progressively focus on go-to-market strategies for i-Tour. Starting from this, a go-to-market strategy can be outlined for next generation personal mobility systems (here after the system) in general. Having performed a financial analysis for this strategy, it has been observed that break-even is likely to be attained when population of reached areas tops 50 million, 20 to 30 metropolitan areas across Europe being involved. Stabilization of product/customers would bring 4,6 million EBITDA in 5 years.

### 2. Content

#### 2.1. AS-IS Business scenario analysis

Recent years have seen the increasing success of navigation technologies, fuelled by the booming market of retail personal navigation systems. Expected technological development

together with the forthcoming availability of GALILEO services, will increase the diffusion and acceptance of transportation services based on localization technologies. Widespread diffusion of novel info-mobility services promoting multi-modal transport will have a profound impact on citizen's lives across EU, in terms of:

- a) Safety, as 40,000+ people die on Europe roads each year with a cost for the European economy of approx. 200 B€ p.a.
- b) Efficiency, as congestion costs an estimated 1% of EU total GDP or 100 B€ p.a.
- c) Environmental sustainability, as transport accounts for 30% of total energy consumption in the EU, with the vast majority being consumed by road transport.

There are a multitude of timetable information systems available for public transport. Most public transport operators offer web-browser-based tools. An increasing number of services are also available via mobile phones, and there are various WAP, HTML, SMS and mobile application solutions. Some use real-time data and others are based on a pre-installed static database. Some have a permanent data connection to any server, while others use technologies like SMS. Many applications request address or station information, whereas the use of localization based on cell phones or GNSS will become more relevant in future. Most solutions offer pre-trip route guidance or on-trip information, although currently there is no real navigation system for public transport networks. The LBS functionality is mainly limited to unshielded areas or is not highly accurate as it is necessary to identify a passenger's position in relation to a public transport vehicle. In the meantime, private car navigation has achieved a large market penetration. It can be assumed that most public transport passengers know about or already use this technology in their cars or have come into contact with it. To benefit from the success of car navigation, those using public transport should be offered comparable functions and equivalent handling as that in their cars. So, the as-is scenario is characterized by the wide spread of wireless connections at urban and regional scale (e.g. UMTS, Wi-Fi or WiMax); by info-mobility services promoting multi-modal transport; development of transportation services based on localization technologies. Furthermore, there are already existing routing initiatives, e.g. Google transit [3], London buses iPhone application [4]. Those relevant initiatives support routing through public transport networks. However, current systems do not support customization, in terms of user travel preferences, they do not provide support of real-time information and they do not promote an open approach based on common standards. All these applications are based on the wide-spread of 3D geo-browser applications such as Microsoft Virtual Earth, Google Earth and related to the opportunity to have users as data-rich collection systems and as content producer Virtual Communities (e.g. Wikipedia, Google Earth). Here follows some examples of already-on-the-market systems and applications, showing that much is being done, but there remains space for an all-comprehensive initiative such as i-Tour, whose features are, altogether, not matched by any of the following.

The Garmin-Asus A10 smartphone [5] combines the versatility of the Android™ platform with Garmin's GPS location technology. In addition, A10 comes preloaded with over 140,000 points of interests.

AGIS NAVFone [6], a brand of digital maps for smartphones, and a best-selling navigation application for iPhones is also available on the Samsung Bada, and even the Android operating systems. NAVFone satisfies digital map and navigation needs.

Google Maps [7] is a map service that one views in one's web browser. Depending on one's location, one can view basic or custom maps and local business information, including business locations, contact information, and driving directions. Transit on Google Maps [3] is a public transportation planning tool that combines the latest agency data with the power of Google Maps. It integrates transit stop, route, schedule, and fare information to make trip planning quick and easy for everyone. For agencies around the world, Google Maps is a cost-effective solution targeted at transit novices and seasoned travellers alike. Google Maps is available in 12 different languages and is compatible with screen readers for the visually impaired. The Transit on Google Maps feature is available on selected mobile devices through Google Maps for mobile. Public transportation information is also included in Google Earth. It is a free service on a desktop or laptop computer and on a mobile device users only pay for connection.

Infoblu [8] provides traffic information on a radio channel. Infoblu provides traffic news also on Ciao Fiat Mobile iPhone App and Nokia smartphones with OVI Maps (GPRS).

TomTom [9] is the world's leading provider of location and navigation products and services. Products include portable navigation devices, in-dash infotainment systems, fleet track and trace solutions, maps and real-time traffic services.

TTS Italia service "Infomobilità in Italia" [10]. Info-mobility is intended as systems finalized at informing the user in all its travel phases, by supplying advanced services. Supplied data to the user might be related to network traffic conditions, planned events such as work in progress or unexpected events such as accidents, congestions or other anomalies. Info-mobility has the aim of supporting the user in its travel decisions, just before starting or during it, giving functional information for a comfortable and efficient trip, and of promoting multi-modal choices, different from automobile.

A wholly-owned subsidiary of the Michelin Group, ViaMichelin [11] designs, develops and markets digital travel assistance products and services for road users throughout Europe, offering a wide range of services to both the general public and the business sector including mapping, route plans, on-line hotel booking, Michelin Guide hotel, restaurant and tourist recommendations and weather and traffic reports. These services are available across a range of digital channels including the Internet, mobile handsets and personal navigation devices.

The City Advisor project [12] is designed to simplify travelling in cities. Installed on smart phones, its features will a real-time guider. This project is based on an open map format.

Foursquare [13] is a location-based mobile platform that makes cities easier to use and more interesting to explore. By "checking in" via a smart phone app or SMS, users share their location with friends while collecting points and virtual badges. Foursquare guides real-world experiences by allowing users to bookmark information about venues that they want to visit and surfacing relevant suggestions about nearby venues. Merchants and brands leverage the foursquare platform by utilizing a wide set of tools to obtain, engage, and retain customers and audiences.

Some FP7- funded projects, on similar topics, are hereafter summarized:

"SMARTFREIGHT - Smart Freight Transport in Urban Areas" [14], start date 01/01/2008 – duration 30 months, completed. The overall objective of SMARTFREIGHT was to develop knowledge, a framework and technology that can benefit the society by making urban freight transport more efficient, environmentally friendly and safe. The detailed objectives, 1) new traffic management measures towards individual freight

vehicles, 2) better interoperability between traffic management and freight distribution management systems, 3) better coordination of all freight distribution in a city, have been then addressed.

“eCoMove – Cooperative Mobility Systems and Services for Energy Efficiency” [15], is a 3-year integrated project (April 2010 - March 2013), funded by the European Commission under the 7<sup>th</sup> Framework Programme of Research and Technological Development. This project will create an integrated solution for road transport energy efficiency to help drivers, freight and road operators:

- Save unnecessary kilometres driven (optimised routing)
- Save fuel (eco-driving support)
- Manage traffic more efficiently (optimised network management)

The project’s core concept is that there is a theoretical minimum energy consumption achievable with the “perfect eco-driver” travelling through the “perfectly eco-managed” road network. By applying the latest vehicle-to-infrastructure and vehicle-to-vehicle communication technologies, the project will create an integrated solution comprising eco-driving support and eco-traffic management to tackle the main sources of energy waste by passenger and goods vehicles.

“WISE TRIP - Wide scale network of e-systems for multimodal journey planning and delivery of trip intelligent personalized data” [16], start date 01/02/2008 – completed. Mobility and demand trends of tourism, travel and citizen transport need data from various transportation actors for information and route guidance. This project aims to co-ordinate systems which provide journey planner services to cooperate and form complex answers, produce real-time personalized information and deliver it at crucial points during the trip.

“VIAJEO - International Demonstrations of Platform for Transport Planning and Travel Information” [17], start date 01/09/2009, duration 36 months. The VIAJEO project will design, demonstrate and validate an open platform which will be able to: support the transport operations, planning and a wide range of traveler information services; deliver dynamic information independent from the language to improve their provision of transport information and traveler services through integrated traffic data collection and management; deliver a solution that enables cross-modal journey planning, dynamic route guidance, effective payment access and improved personal mobility, etc.; provide standardized interfaces to connect a variety of entities needed for the mobility services. VIAJEO will involve users, traffic managers, public authorities, transport operators, equipment manufacturers, vehicle manufacturers, service providers, application and service developers, content owners and providers, and research organizations.

“i-Travel - service platform for the connected traveler” [18], start date 01/01/2008, completed. i-Travel is an original

concept that combines three key innovations. The goal of the overall i-Travel IP is to develop, validate and demonstrate an innovative solution for a personalized, context-aware online 'virtual travel assistant' service for travelers, both before and throughout their journey, based on the integration of e-commerce and internet technologies to create the first 'e-marketplace' in the traffic and travel information services sector and on the creation of a wide-ranging community of information and service suppliers who through i-Travel can expand their customer base while fulfilling travelers’ needs.

Moreover, there are applications using navigation technologies such as GPS, forthcoming GALILEO such as “SMART-WAY - Galileo based navigation in public transport systems with passenger interaction” [19]– project funded by European GNSS Agency start date 01/02/2010 – project duration 24 months. The idea behind SMART-WAY is to develop a mobile public transport passenger navigation system, giving passengers the possibility to act as they would with common car navigation systems. Once they have entered their destination they will be able to get on and off any public transport vehicle whenever and wherever they want to. The system will always guide them to the destination, so passengers will no longer be tied to a (digital) printout of their route.

And “OPTITRANS” [20] project, funded by the European Commission under Framework Programme Galileo 2007 - GSA Call 1, start date 05/01/2009, duration 24 months, aims to create a Mobile GNSS platform which will provide commuters/ travellers with the ability to plan their trip in an efficient manner in order to utilise and share a combination of public/private transportation by combining information from various public transport authorities and other private vehicle owners. It will display to the commuters the optimum router/transport combinations for their trips, based on their location.

All the above products/applications/initiatives have been analyzed and classified, taking into consideration i-Tour functionalities such as Software, For Mobile Use, Public Transit Option, Navigator Characteristics, Real-time Updates, Automatic Suggestions, Route Comparison (by price, traffic, weather, etc.), Comprehensive POI Information, Comprehensive Public Transit Information, User Feedback, Environmental Care, Serious-game interface, (Useful) for Transport Service Providers.

Hereafter a table of synthesis for this classification is produced.

**Table 1. Classification of existing products, applications, initiatives**

From this table, one may assume that, for the time being, there isn’t an application / system / project that covers all next generation personal mobility systems functionalities, as provided and foreseen in i-Tour.

|                | Software | For Mobile Use | Public Transit Option | Navigator Characteristics | Real-time Updates | Automatic Suggestions | Route Comparison (by price, traffic, weather, etc.) | Comprehensive POI Information | Comprehensive Public Transit Information | User Feedback | Environmental Care | Serious-game interface | for Transport Service Providers |
|----------------|----------|----------------|-----------------------|---------------------------|-------------------|-----------------------|---|-------------------------------|--|---------------|--------------------|------------------------|---------------------------------|
| Garmin Phone   |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| NAVfone        |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| Google Transit |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| Infobias       |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| Tom Tom        |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| In Citta       |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| ViaMichelin    |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| City Advisor   |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| foursquare     |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| SMARTFREIGHT   |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| ECOMOVE        |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| WISETRIP       |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| VIAJEO         |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| i-TRAVEL       |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| SMART-WAY      |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| OPTI-TRANS     |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |
| i-Tour         |          |                |                       |                           |                   |                       |   |                               |  |               |                    |                        |                                 |

i-Tour system will satisfy a real market need, for commuters and city new users, to travel multi-modal inside an urban area. It will be a “stargate” for accessing all-in-one territory information, based also on a loyal community made of trustable and reliable users’ feedback.

## 2.2. New generation personal mobility systems’ business model

### 2.2.1 Target market - Market segments definition

The natural target for next generation personal mobility systems is not the ultimate user (traveler, commuter) but an entity providing transportation and /or information services to the end user.

Customers could, therefore, be identified among the following categories:

- Telco operators;
- Mobile producers, both hardware (e.g. Nokia) and software (e.g. Microsoft);
- Public administrations (e.g. local authorities responsible for transport management);
- Central procurement bodies (e.g. Consip in Italy, it can be considered a Stakeholder rather than a customer);
- Web companies (e.g. Google);
- Services providers (e.g. transport info, road network, weather) via web (e.g. viamichelin);
- Satellite navigators (e.g. TOMTOM, Magneti Marelli), may be stakeholders rather than customers;
- IT outsourcing companies (e.g. IBM, EDS).

It should be noted that transport service providers may find it useful to integrate their system within i-Tour because ultimate users can express a sentiment about the services offered through i-Tour. In fact, people can be sensors for public transport operators in term of delays, crowd levels, perceived quality, and in general they can express an overall satisfaction in using public transportation means.

The natural environment for ultimate users are Larger Urban Zones (LUZ). Moreover, in order to perform a financial analysis, a scenario analysis has been done for LUZs in order to collect data for:

- potential users volumes inside LUZs, in terms of number of travelers, numbers of commuters, number of smart phones sold in the area;
- Travel time inside LUZs, transportation network and means;
- segmentation in terms of user / use (variability, constancy);
- CO<sub>2</sub> emissions per travel;
- etc.

### 2.3. Business models

Inside the i-Tour project, the goal of identification of new business models for next generation personal mobility systems, based on real-time personalized LBS (Localization Based Services) of interest for urban travelers, is pursued. These models will be the basis for a coming 5 year business plan including the required investments and the estimated Return on Investment (ROI). Existing economic figures will be shown hereafter, with the advertence that they will be further elaborated in the next two years.

Two business strategies have been identified:

1. To market the entire system – server + data exchange interfaces, and provide assistance for system use.
2. To market server access and interfaces configuration – exclusive and non-exclusive license, on a territorial base, and provide assistance for system use.

For the purpose of this business plan, it is assumed that the system will be marketed using business strategy number 2.

Two alternative organizations have been identified:

- a. A new company (or entity different from a commercial company) so as to go to market maintaining capacity and opportunity to manage the innovation process; or
- b. A strong partner (or more than one, per each European country or group of EU countries) for industrialization, placement and assistance.

Two business models will be analysed on depending on the organization configuration.

First business model: newco strategy (business strategy 2 + organization configuration a)

Revenues: Annual license evaluated on the basis of number of inhabitants of each metropolitan area. A royalty of 5 cents per inhabitant is used as a tentative value.

Fixed Costs: R&D costs already sustained + management costs (evolutionary maintenance, marketing, customer assistance, etc.) (around 2,5 M€ / year).

Variable costs: customization costs, to be sustained only in the first licensing year (around 80 thousand €).

Second business model: partnership strategy (business strategy 2 + organization configuration b)

System owner Revenues: Percentage on the annual license evaluated on the basis of number of inhabitants of each metropolitan area. On the basis of a sensitivity analysis, royalty can go as low as 2 cents per inhabitant, to attain break-even at the same level.

System Owner Costs: R&D costs already sustained (around 1 M€ / year), evolutionary maintenance.

Variable costs: customization costs, to be sustained only in the first licensing year (around 80 thousand €).

| Business strategies \ Institutional configurations   | Institutional configurations   |  |
|--|--|--|
|  | a) A new company representing the present consortium so as to go to market maintaining capacity and opportunity to manage the innovation process | b) A strong partner (or more than one, per each European country or group of EU countries) for industrialisation, placement and assistance |
| 1) To market the entire system (server + data exchange interfaces, and sell assistance for system use)   | 1a   | 1b   |
| 2) To market server access and interfaces configuration (exclusive and non-exclusive licence, on a territory base, and sell assistance for system use) | 2a → 2b  | 2b   |

Fig. 1. Business model alternatives

It should be highlighted that in this ultimate configuration, the i-Tour consortium shall have the opportunity to configure itself as a non-profit organization, acting on the market for having revenues only for recovering the so-called system owner costs. In that way, it might be easier to transfer the system to Public Administrations, letting the business partner obtain revenues and profit.

## 2.4 Financial analysis

A financial analysis for both business models has been conducted with two main objectives:

- Provide a five-years business plan for market exploitation of the system;
- Provide a break-even analysis useful to support a feasibility study for systems' go-to-market strategy.

The financial analysis is based on the following assumptions:

**Newco strategy** - Variable costs consist of the customization costs to be sustained the first year the system is deployed. Fixed costs consist of R&D costs already sustained and of management costs. R&D costs estimation has been done, taking the i-Tour project cost, spread over five years, as a test. Management costs have been estimated, considering evolutionary maintenance, marketing costs, customer assistance, and so on.

**Partnership strategy** - Variable costs consist of the customization costs to be sustained the first year the system is deployed. Fixed costs consist of R&D costs already sustained. R&D costs estimation has been done, taking the i-Tour project cost, spread over five years, as a test. No management cost are present, because they are to be sustained by the commercial partner.

The annual license price may be determined in various ways. Tentatively, it has been fixed as a function of the number of inhabitants of metropolitan areas involved. The objective set for metropolitan areas to be reached is 10 each year, for the first three years. It is assumed that areas reached in the previous years will maintain the system in the following years. The composition of each of the 10 metropolitan areas set is three large, three medium, four small.

In case of the partnership strategy business model, revenues are calculated on a percentage of the annual license.

Hereafter a break-even analysis is provided for both cases to support a feasibility study for go-to-market strategy. It may be noted that in both cases the break-even point is attained at

around 50 Million population reached: as described above, this is the result of a sensitivity analysis placing unit royalties at 5 cents and 2 cents per inhabitant, respectively.

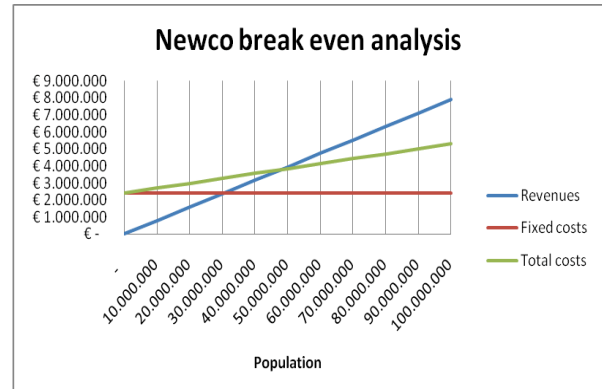


Fig. 2. Break-even analysis for business model "newco strategy"

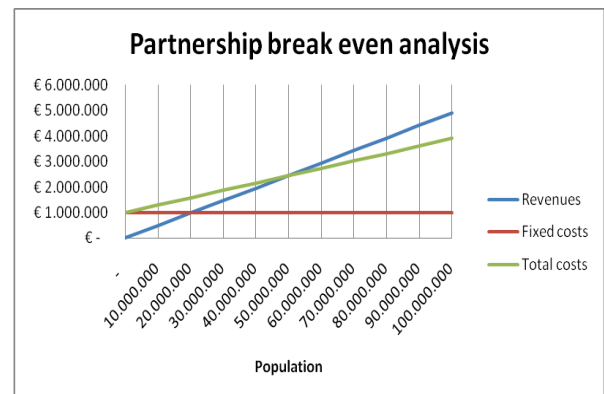


Fig. 3. Break-even analysis for business model "partnership strategy"

## 3. Conclusion

As already reported above, the business models will be further developed, in order to deploy a 5-year business plan including the required investments and the estimated Return on Investment (ROI). It is expected that, many aspects, including technology, users' needs satisfied, constraints pertaining to the utilization in the diverse social and legislative environment, competitive strengths and weaknesses will be increasingly focused. In parallel, the quantitative part of the Plan will benefit from refinements and risk analysis, possibly resulting in different alternatives being quantified and evaluated. The details about price, placement and promotion will be part of a final Business Plan.

Even though i-Tour project is still at an early stage, the endeavour was made to quantify the economics of the Business Plan, with special reference to a first feasibility study, in order to assess the magnitude of the effort needed to break even in a reasonable time span. The economic figures, together with the qualitative, will be further refined and detailed in the future editions.

## Nomenclature

|        |  |
|--------|--|
| B      | Billion  |
| EBITDA | Earnings Before Interest, Taxes, Depreciation and Amortization   |
| EU     | European Union   |
| GDP    | Gross Domestic Product   |
| GNSS   | Global Navigation Satellite System   |
| GPRS   | General Packet Radio Service   |
| GPS    | Global Positioning System  |
| GSA    | GNSS Supervisory Authority   |
| LBS    | Location Based Services  |
| LUZ    | Larger Urban Zones   |
| PC     | Personal Computer  |
| PDA    | Personal Digital Assistant   |
| POI    | Point of Interest  |
| R&D    | Research and Development   |
| ROI    | Return on Investment   |
| UMTS   | Universal Mobile Telecommunications System   |
| TTS    | TTS Italia, the National Association for Telematics, Transport and Safety, has the purpose of contributing to the improvement of efficiency and safety in the Intelligent Transport System |
| Italia |  |
| WAP    | Wireless Application Protocol  |
| Wi-Fi  | Wireless Fidelity  |



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### Acknowledgments

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under the Grant Agreement number 234239. The authors are solely responsible for it and that it does not represent the opinion of the Community and that the Community is not responsible for any use that might be made of information contained therein. Authors want to thank Giulia Siccardi for the essential field work performed.

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