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D6.1: Report on Living Lab activities for Data Set selection & definition on Sensor Networks

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D 6.1: Report on Living Lab activities for Data Set selection & definition on Sensor Networks

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Statement of originality:

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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1. INTRODUCTION

The participants involved in Work Package 6 are responsible for preparing an Open Sensor Network (OSN) architecture connected to an Open Data platform. The aim of this deliverable is to introduce "Open Sensor Networks" into an Open Data context. It also defines a methodology that allows gathering information from different sensor networks placed in the cities involved in the Open Cities Consortium.

This document also explains which business areas have been selected in order to implement the OSN architecture.

1.1 DELIVERABLE OBJECTIVES

This deliverable accomplishes with the content requirements exposed in the Open Cities Description of Work. The main objectives of this document are:

- To define the required features of an Open Sensor Network
- To set an Open Sensor Network into an Open Data environment
- To define a methodology for gathering data from the OSN of the different cities
- To execute an Open Data survey
- To extract the information from the Open Data survey
- To select the most relevant business areas
- To define Apps for an OSN architecture

1.2 DELIVERABLE SECTIONS

The document is distributed in four parts that follow a logical order to make it easier for the reader to directly find information:

- The first part of the document sets the Open Sensor Networks into an Open Data environment.
- The second part of the deliverable defines the methodology followed to implement a survey in order to obtain the information of the existing sensor networks initiatives from the participant cities.
- The third part discusses the results obtained from the city surveys.
- Finally, the fourth part describes the deliverable conclusions and proposes applications that could be implemented based on the Open Sensor Network platform.

2. OPEN SENSOR NETWORKS

The aim of Work Package 6 is to develop a Wireless Sensor Network interconnected with an Open Data platform. A Wireless Sensor Network (WSN) consists of spatially distributed autonomous wireless sensors to monitor physical conditions, such as temperature, sound, vibration, pressure, motion or pollutants, and to cooperatively pass their data through the network to a single or replicated data-processing location(s), the sink(s).

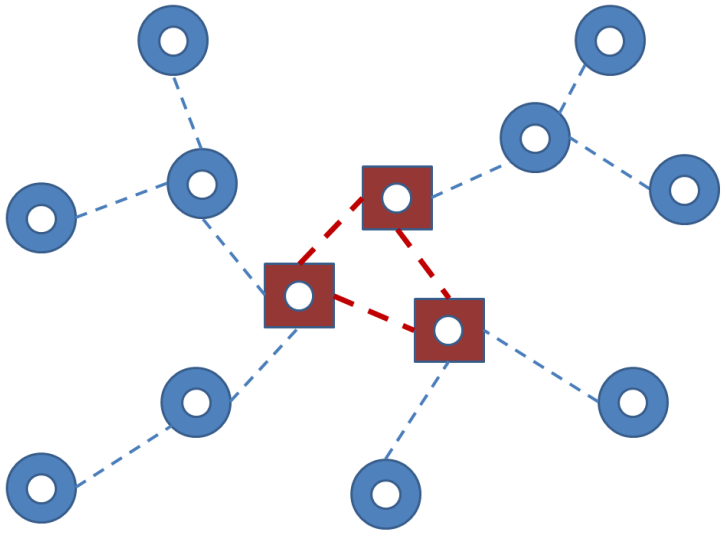

Figure 1: Open Sensor Network, where red squares are the data collection points (sinks) and the blue ones are sensors, spread through the city

2.1 OSN DEFINITION

An Open Sensor Network (OSN) is a Wireless Sensor Network that manages Open information in an Open environment. The Open concept can adopt different meanings; however, in our case, an OSN stands for an interoperable sensor network, where many vendors or entities can connect their sensor solutions and those sensors interact with other ones or with the centralized data system using standard communications.

Furthermore the "Open" meaning is increased by adding an Open Data connotation. Open Data is a philosophy and practice that seeks to ensure that certain data are freely available to everyone, without restrictions on copyright, patents or other control mechanisms. Therefore, an Open Sensor Network forwards Open Data extracted from different sensor initiatives to a central point where data are stored and processed.

2.2 OSN IN AN OPEN DATA ENVIRONMENT

The Open Cities Project is a Pan-European initiative aimed at evaluating how the different Open Data platforms of the main cities involved in the project can interact with one another in order to provide a new range of applications and Mobile Apps to the citizens. This opening of public data (Open Data) will cause an explosion of new applications that will stimulate the market and it will bring benefits to citizens, public entities and the private sector.

The Open Sensor Network is the link between the sensor and the data repository where the information is processed and stored, as it will measure public data from different sensors and forward the gathered information to the central point within a wireless environment.

2.3 OSN FEATURES

An Open Sensor Network, as all wireless networks, has some requirements and limitations that must be taken into account, being the most significative ones as follows:

- Dynamic Data: an OSN manages dynamic information that is continuously updated and continuously changing. The OSN must manage a high volume of transactions from the sensors to the central point.
- Scalability: an OSN requires a high degree of scalability. The OSN must support hundreds of sensors and must accept the upgrade of new ones without affecting the whole system.
- Stability: an OSN requires a high degree of stability. The OSN must guarantee high reliability and possible problems in some sensor must affect the whole system.
- Low latency: the OSN must guarantee low latency in transaction as some applications could require near real-time data gathering.
- Security: despite the fact that information is mostly public, a wireless network must guarantee a certain degree of security, and therefore some signalling and system messages must be encrypted. However, the Open Data are public once they have been processed and adapted to a standard format, not in the early stage when they are obtained directly from the sensor.
- Compatibility and Standardization: an OSN must accept a connection from different vendor interfaces in order to offer sensor heterogeneity and multi-vendor compatibility.
- Standard Connectivity: an OSN must offer standard connections in order to interact with other Third Party architectures.

3. SURVEY METHODOLOGY

In order to obtain the required inventory of Open Sensor Networks from the different Open Cities participants, a survey was defined. This survey was defined with the joint collaboration of Work Package 4 - Open Data, as strong similarities with the ongoing task were found. In this section, the procedure we followed to define the survey will be presented.

3.1 SURVEY OBJECTIVE

The main objective of the survey was to obtain information about the current state of the Open Data initiatives and to obtain a detailed inventory of the Wireless Sensor Networks in the participant cities. To avoid ask the same questions for static data (e.g.: names of the streets) and dynamic data (e.g.: traffic in one street), a unique survey form for WP4 and WP6 groups was created.

3.2 LIVINGLABS METHODOLOGY

The Living Lab concept was developed by Professor William J. Mitchell, of the MIT Media Lab and School of Architecture. In constantly evolving social and work environments, Professor Mitchell proposed user-centric research methods in real life environments to identify and build prototypes, and to evaluate multiple solutions.

Innovation can be defined as all methods and processes that allow product, applications and service improvements. Within a Living Lab context, the user triggers innovation instead of a company. However, this starting point must usually be induced.

According to *Anna Ståhlbröst* when the aim of a study is to understand users' needs, the motivation for involving users in the process is obvious, and to really harvest the potentials that user involvement holds, it is important to know whom to involve, when to involve them, and how to involve them. Following her statement and his quotation of *Ives and Olson* it can be categorized different sets of degrees of user involvement into the six subsequent clusters:

- *No involvement*; refers to the situation in which users are unwilling, or not invited, to take part of the development
- *Symbolic involvement*; refers to the situation in which input from users is requested but not used
- *Involvement by advice*; in this category, users' advice is asked for with help of interviews or questionnaires

- *Involvement by weak control*; refers to the situation in which users have the responsibility to "sign off" at each stage of the development process
- *Involvement by doing*; refers to the perspective that users are design team members, or official "liaisons" with the development team
- *Involvement by strong control*; in this category, users might pay for new development out of their own budget, or the users' organizational performance evaluation is dependent on the outcome of the development effort.

For further information see *Ståhlbröst, 2008*[1] and *Ives and Olson, 1984*[2] .

In the framework of a project as Open Cities, different degrees of user involvement are expected. Therefore, collaboration was divided into three categories:

- Urban city council's staff
- Citizens
- Technicians

Those three categories are involved in different ways to obtain different purposes. In this first deliverable city council's staff and also technicians were requested to participate. Before launching the challenges, each city will be ask to demand their citizenship which are the datasets they would like to have published, their motivation to publish them, and the purpose to do so.

3.2.1 Urban city councils' Involvement

Participants in the survey were the addressed cities and the public and private entities that collaborate distributing the survey to the different city councils within WP6. The following table shows the participants in the survey with their intermediary institution:

Number	City	Intermediary Institution
1	Amsterdam	Haag Society
2	Barcelona	UPF - NETS
3	Berlin	Fraunhofer FOKUS
4	Helsinki	Forum Virum
5	Paris	Cap Digital

Table 1 City Councils involved in the survey and Institutions that have been acting as a contact point

[1] *Forming Future IT- The Living Lab Way of User Involvement. Anna Ståhlbröst, Luleå University of Technology, 2008*

[2] *Ives, B., and Olson, M. (1984). User Involvement and Mis Success: A Review of Research. Management Science 30 (5):586-603*

Before sending the final survey, we maintained several questions and the survey was sent to direct contacts of each institution to correct or tick which questions they did not consider feasible to be answered, and which ones should be asked that were not originally included in the survey.

As a positive feedback we were asked to send a survey with a full explanation of all the terms included. It is easy to take for granted that everyone is aware of Open Data, but in any case it is highly advisable to write down a statement of what Open Data means in the context of this project.

Therefore, the survey was distributed accompanied by this clarifying Open Data definition, based in the one given by Helsinki Region Infoshare (consulted last time in March 2011):

(a) data that are available to anyone, free of cost,
(b) data that are easily accessible in varying digital formats, via APIs (application programming interfaces), and/or via web databases,
(c) data that are easy to understand; the structure and semantics are characterized using clear expressive language,
(d) data that may be reused freely without (or in some instances with few) restrictions as declared in an accompanying license, -and-
(e) data whose existence and location are widely known to the public.

For further information see Helsinki's Open Data web site[3].

3.2.2 Citizens' Involvement

Citizens have a key role throughout the project, although defining a survey is not a suitable task to involve them.
As mentioned, the next steps of the project will include them as the key to decide which datasets must be opened, which ones are the best to be shared, or which may never be opened according to their privacy point of view.

In the meetings held in Forum Virum, Helsinki City council, Universitat Pompeu Fabra and Esade always involved some users that attended the conference or worked in other areas, attracted by the title of Open Data.

[3] *Helsinki's Open Data webpage, What is Open Data? http://www.hri.fi/en/about/open-data/*

3.2.3 Technicians' Involvement

As it will be explained in the next point, tasks from WP4 and WP6 had a common base, as both of them requested data sets. Although those were different, great synergies between them were found.

FOKUS demanded a direct involvement in the definition of which areas were more interesting, and which explanation to specify and clarify them should be included-

From technicians' point of view we discussed in several audioconferences how to include some words in the dataset definition that would allow us to classify data as static (not generated by a sensor) or near real-time (provided by OSN). Finally we obtained a definition to be included in the spreadsheet that can be consulted in Error! Reference source not found..

All the technicians agreed that it was very important to add the person and mail of the owner or administrator of the dataset. This field was defined as "Data Manager Name and Contact Info".

We included the below listed points in order to define if it was an OSN or at least dynamic data. In the latter case data are usually linked to a sensor gathering network:

- Data Format
- Listing of Factors
- Data Timeperiod
- Data Size
- Data Access
- DataFreshness

Data freshness is a great value for applications; for instance, it is very important for traffic to be refreshed below 15 minutes in big cities, but if it was a village consisting of only one street, it should be refreshed every minute.

3.2.4 Meetings

Following this methodology, although we asked some questions through city councils and users, the best way to obtain a useful brainstorming and discussion was to gather the information in meetings of small groups, between 25 to 30 participants, that helped develop the survey and the results of those work packages.

The way to obtain this was doing a brainstorming with all the technicians involved in the project and also some technicians from Barcelona and Berlin city councils, and especially thanks to the more experienced ones who work at Forum Virum.

It is important to remark that in those meetings also city councils from outside the project, like Manchester or Lisbon participated through personal involvement of their staff and joined the ideas of the Open Cities Project city councils: Amsterdam, Barcelona, Berlin, Paris and Helsinki.

Meeting	Attendance	Date	Activities
Kick Off in ESADE	31	Barcelona, on November,1st 2010	Explanation of Open Data and first request for possible datasets
Meeting after official Kick Off	21	Helsinki, on November, 17th 2010	Calendar of Survey Creation and first brainstorming according to Open Data
Smart Cities	196 general meeting, 32 discussion	Helsinki, on November, 18th 2010	Explanation, discussion
Joint Meeting For Open Cities	28	Barcelona, on February, 10th 2011	Discussion about open Data and the Survey
Open Data as Innovation	115 general meeting, 25 discussion	Barcelona, on February, 11th 2011	Explanation about Open Data, discussion on how to fill the survey and possible difficulties

Table 2 Meetings according to attendance, place, date and activities carried out

Next meetings will be held in Budapest, on May, 17th, 2011 and Paris approximately by the end of June (date to be confirmed).

As an outcome of all of those meetings the final survey was obtained. It also became evident that some questions were very difficult to answer, as data size, if they were constantly growing or data access, if the city did not have a portal of Open Data during the period when surveys were sent.

3.3 OBTAINING THE SURVEY

3.3.1 Strong Collaboration with WP4

Collaboration with WP4 and its leader, Fraunhofer FOKUS Institute, was maintained in this entire first task. Once personal interviews with some of the participant cities had been performed, the collaboration between both institutions was reinforced in order to generate a single survey.

The joint work started in the Kick-off meeting, defining a work plan to carry out this first survey. The follow-up consisted in several audio-conferences that included an online brainstorming and discussions about the most suitable items that needed to be included in the surveys. After all audio-conferences and having held a full-day meeting in Barcelona, on February, 10th, to give a final review to the main points, we closed the main items to be included in the survey.

3.3.2 Interview with participants

To obtain previous feedback from the participant cities' point of view, interviews were carried out. Both WP4 and WP6 leaders held meetings with the Berlin Senate and with the Barcelona City Council. Only these two cities were analysed in detail due to the proximity with both institutions.

In those meetings an interview was performed, asking for the main problems that the cities would find to gather the requested information about Open Data initiatives and Sensor Networks inventory. Moreover, the cities provided some contacts to solve future doubts. Finally, the cities also provided some recommendations that have been taken into account in the final survey definition.

WP4 considers these previous informal interviews very positive and the degree of collaboration was high with this WP6.

3.3.3 Survey distribution

This point took a long time to be well defined. We must take into account to which institutions the surveys are being sent. City councils are composed by massive staffs and each platform may belong to different areas, so the request must be well directed to each area.

First of all, we created a new website and an online survey. The online survey was tested with Barcelona and Berlin City councils: five people editing the same answer sheet, some of them deleting others previous work, and plenty of work duplicated. As a result, it was decided to continue with a Google spreadsheet attached to the survey. The problem was that these entities were not all well prepared as a team and they had plenty of departments that had to collaborate in the answer of our survey.

The eventual solution was the creation of a text document that required general information about Open Data and how those city councils were going to achieve the goal in Opening their Data and which areas were going to be the first ones. In addition to that document, a second document was attached to the survey with a spreadsheet format. This second document included all the Open Data sets that were available in each department of the city councils and required different data for each of them.

3.4 SURVEY DOCUMENTS

Both text and spreadsheet documents were divided to obtain accurate information about the existing data Sets in each city council. Data was structured to allow the different departments in each city council to distribute the same document through their managers and then consolidate all the data in only one final document that they sent back to the Open Cities Consortium.

3.4.1 Text Survey: General Information

Available data sets are listed in the first document as an only text survey, which requires general information to locate the intentions of each city council. Moreover, it helps clarify who are the contact persons inside each city council, who act as Open Data Officers. The information included in the survey is listed in a summary table below:

Item	Sub-Item
The Organization and Current Availability of City Government Data	○ Please indicate your city and department, division, and/or agency that take part in the open data survey. ○ Please indicate any existing city-sponsored open data offerings, including, but not limited to websites. ○ Please name the *Open Data Officer* and position, who is the primary point-of-contact for city data, if applicable. ○ Please name *Open Data Evangelists*, if any, in your city.
Ongoing Data Provision Activities	● Please specify existing (or planned) open data activities, if any, in your city. Do you have a roadmap (timetable) for open data activities? If so, please provide a brief statement regarding the roadmap. ● Additional comments concerning data provision activities.
City Government Plans	○ Please indicate the planned classes of data to be rolled out for the Open Cities project. (1) ○ Will the city host services for *raw data* access? ○ Will the city host services for *linked data* access?
Motivation & Technological Assistance	● Please indicate your reasons for pursuing open data. Please select all those that are applicable. (2) ● What possible advantages does the city see in terms of international / EU collaboration in the field of Open Data? ● What kind of help would cities need, in terms of

	platforms, technologies consultancy or otherwise that would facilitate the availability of open data in the city?

Table 3 General Information requested in a text document

(1) Possible answers: Arts and Recreation / Business Enterprise , Economics, and Trade / City Budget: Revenues & Expenditures / City Portal Web Statistics / Construction, Housing, and Public Works / Crime and Community Safety / Demographics / Education and Public Libraries / Elections / Emergency Services / Energy and Utilities / Environment , Geography and Meteorological / Health, Disability, and Elderly Care / Labor Force and Employment Market / Law Enforcement, Courts, and Prisons / Political / Research&Innovation / Tourism / Urban Transport / Others (please specify below)

(2) Possible answers: / Transparency / Efficiency / Quality / Innovation / Trust / Media Feedback / Public Feedback / Crowdsourcing / Participation/Outreach / Local Budgetary Earmarks / Reuse/Free Data Access / Economic Stimulus / Legal Purposes / Verifiability / Cross-disciplinary Studies / Longitudinal Studies / Planning / Return on Investment (ROI) / Enable Data Discoverability / Data Exploration / Improve Data Fusion Efforts / Other

3.4.2 Spreadsheet Survey: Specific Information

Once cities had fulfilled their general information survey, they were asked to proceed with the specific data. This survey was formatted as a spreadsheet where cities could specify all details related to each one of their own data sets, divided into different business areas. Data sets attributes are listed in a summary table below:

Dataset Attribute	Definition
Dataset Class	Enter a possible class: Arts and Recreation / Business Enterprise, Economics, and Trade / City Budget: Revenues & Expenditures / City Portal Web Statistics / Construction, Housing, and Public Works / Crime and Community Safety / Demographics / Education / Elections / Emergency Services / Energy and Utilities / Environment, Geography and Meteorological / Health and Disability / Labor Force and Employment Market / Law Enforcement, Courts, and Prisons / Political / Tourism / Urban Transport / Others
Dataset Name	Enter an identifier for the dataset (e.g., filename, document name, etc.).
Data Manager Name and Contact Info	Enter the name and contact information (e.g., phone number, email, …) for the data manager (i.e., the primary person responsible for the data, who may or may not be the owner or creator of the data). This information will be needed in the event there are questions arising when reviewing the dataset.
Description	Write a short description that accurately reflects the contents in the dataset.
Data Formats	List the specific data formats that are supported. Possible answers include html, csv, kml/kmz, pdf, shapefile, txt, xls, xml.
Data Handling Rules	Describe the particular data handling rules/policies, if any, that must be followed. Possible answers include none or restricted (e.g., some special data handling policies apply). If restricted was selected, please specify the particular data handling conditions. Ideally, datasets will have a license, such as the Creative Commons CC0 1.0 Universal (http://creativecommons.org/publicdomain/zero/1.0/).
Listing of Factors	List the names of the factors in the dataset. For example, year, square

	meter, time.
Data Timeperiod	Indicate the time period for the data (e.g., data for 2009, data between 2005-2010, etc.).
Dataset Size	Indicate an estimate of the dataset size (e.g., less than 1 MB, 1 MB or greater, 1 GB or greater, etc.). If the exact size is known, please specify it (or in the case of a database, enter the number of records).
Data Access	Indicate whether one can gain access to the data via a URL (if known, please specify), an API (if relevant, please specify the API, possible answers include web-service SOAP, web-service REST), and/or a database (if relevant, please indicate the database product & version, possible answers include MySQL Workbench 5.2, Oracle Database 11g Release 2, ...).
Data Freshness	Indicate how often the dataset is updated. That is, does it get updated hourly, daily, monthly, annually, etc. If it is real-time data, please include the average data rate (e.g., expressed as 100 kbps, 1 Mbps).
Data Collection and Interpretation	Indicate the difficulty that may exist when collecting, and/or interpreting the data by users. Possible answers include easy, semi-challenging, and challenging. By easy, we mean data that is structured, expressed in a digital format, and available online via a URL. By semi-challenging, we mean data that is semi-structured, and expressed in a digital format. By challenging, we mean data that is unstructured, and/or unavailable in digital form.
Availability	Indicate whether the dataset already exists and is available. If not, indicate when it will be made available.
Language(s)	Indicate whether the dataset exists in only one language (or more than one language). Please specify the particular language(s).

Table 4 Specific Information requested in a text document

4. RESULTS

This chapter includes all the data received before the end of April. This means that this document is going to be continued and enlarged when data from other city councils are received. Some problems have been detected to fulfil all the data on time. One is that some city councils are involved in electoral period and some departments have been paralyzed. This problem is added to the well-known problem of departments and subsections inside city councils that create some problems in their internal distribution and information gathering.

With the exception of reception delays, city councils have endeavoured to fill up the surveys and they have provided a large amount of information about Open Data and the Open Sensor Networks they own.

4.1 GENERAL RESULTS

After collecting the data received from City Councils, it can be concluded that they have contributed with lots of information about contact persons, departments involved in Open Data issues, on-going and future plans about Open Data initiatives and the inventory of the owned Sensor Networks.

The WP6 is mainly interested in the inventory of the Wireless Sensor Networks of each city and we have received a large variety of networks from different business sectors, with different interfaces and communication protocols. This information will help us define the second Task of the WP6 and define a proper database that will allow developing Open Data applications fed by data from those Sensor Networks.

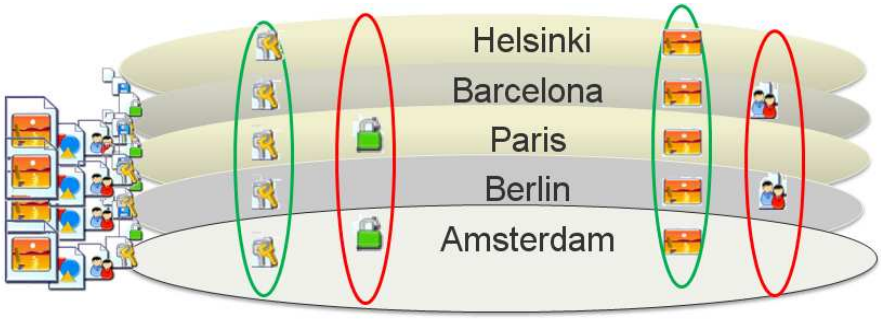

Figure 2 Data sets correlation from the Open Cities participants

4.2 SYNERGIES FROM ALL PARTICIPANTS

In the following table a summary with the results of the Open Data surveys is shown. The table presents the number of data sets of each business area provided by each city.. As it can be seen in the table, cities have provided a large amount of information about their Open Data initiatives. However, not all data sets are

suitable to be managed by an OSN platform. Most of them are not eligible because their information is not originated from a sensor. Therefore, we will only focus on the data sets which accomplish this condition.

In the table the most common Sensor Networks among the different cities are enlightened. Those networks are the best options to implement a common database that will allow "one" application to show five cities data. From all the city councils we have received feedback that will allow inhabitants to compare their services, pollution, traffic, etc. with other cities in Europe and to be more aware about what their city councils are working in. The table bellow shows that all the cities have nearly one dataset per area or that will be open in the future. This information provides a quick view about where are the synergies from those cities placed.

	Helsinki	Amsterdam	Berlin	Barcelona	Paris	TOTAL
Arts and Recreation		1	-	2		3
City Budget: Revenues & Expenditure		1	7	-		8
Business Enterprise, Economics, and Trade		3	18	22		43
Crime and Safety		2	1	-		3
Elections		1	6	3	1	11
Emergency Services		1	-	1		2
Demographics		1	12	105		118
Education and Libraries		2	13	9	1	25
Energy & Utilities		1	9	2	1	13
Health & Disability		2	9	6		17
Mobility & Urban Transport	**3**	**2**	**10**	**5**		20
Labour Force and Employment Market		3	5	-		8
Law Enforcement		-	3	-		3
Environment, Geography and Meteorological	**2**	**4**	**9**	**17**	**1**	33
Tourism		**2**	**2**	**1**		5
Political		1	1	3		5
Construction, Housing, and Public Works		2	4	48	1	55
Others		2	3	45		50
TOTAL	5	31	112	269	5	422

Table 5 Datasets extracted from city councils surveys

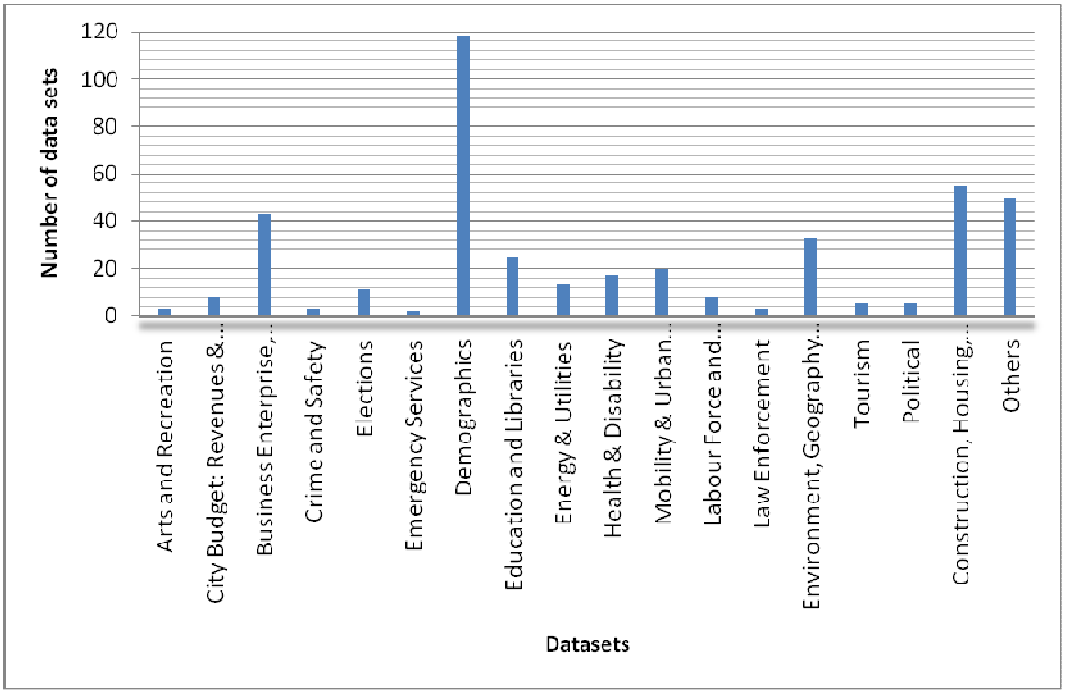

Figure 3 Data sets collected from all the Open Cities participants

4.3 SELECTION OF THE BUSINESS AREAS FOR THE OSN

Once the data sets from the different cities were collected, we have to identify which are the most representative business areas to design an Open Sensor Network. After a first evaluation, it can be concluded that the most representative business areas for an OSN development are Mobility & Transport, Environment, Geography & Meteorological and Tourism. These sectors will provide different sensor networks and many Open Data mobile applications could be implemented to satisfy the end-user (the citizen).

In the following lines we will describe how each selected sector fits with the Open Sensor Network that is planned to be implemented:

Business Area	Description
Mobility & Urban Transport	Most of the cities have sensors that detect traffic density and some initiatives to monitor the arrivals of the public transports. These sensors provide the opportunity to implement applications that help citizens to move in the cities. All the mobility sensor networks could be interconnected with the OSN platform in order to provide to external parties a single point to consume this data.
Environment, Geography and Meteorological	Most of the cities have sensors that monitor the environmental conditions of the city in different

	locations. In the cities are installed pollution, temperature, humidity and light sensors that provide information that could be used to develop info applications to the citizens or to be added to other applications as a mashups. All the environmental sensor networks could be interconnected with the OSN platform in order to provide external parties a single point to consume this data.
Tourism	Some cities have lots of sensors in tourist sites that can be used to implement applications that improve the user experience of the tourist. All the tourist sensor networks will be interconnected with the OSN platform in order to provide external parties a single point to consume this data.

Table 6 Selection of business areas for Open Sensor Network

It is important to show how many of the data sets collected in the survey are classified as Sensor ones. On the next table can be seen that Tourism is not well represented but we know that city councils are providing new Wifi networks and platforms that will allow in further stages of the project to implement tourists and users mobility around a city.

	Helsinki	Amsterdam	Berlin	Barcelona	Paris	TOTAL
Energy & Utilities				1		1
Mobility & Urban Transport	**3**	**2**	**3**	**2**		10
Environment, Geography and Meteorological	**2**		**3**	**17**		22
Tourism		**1**				1
Others		2				2
TOTAL	5	5	6	20	0	36

Table 7 Selection of business areas for Open Sensor Network

As it can be seen in Figure 4, Environmental, Geography and Meteorological data sets have the higher number among the cities. We know, from colloquial talks, that Paris and Amsterdam have datasets in this area. Currently, they are deciding if it is good to open some of them and in which way. We expect that this area, joined with Mobility, are going to be the first correlation areas among cities, and we are going to work in a first step with those two networks, mobility and environment.

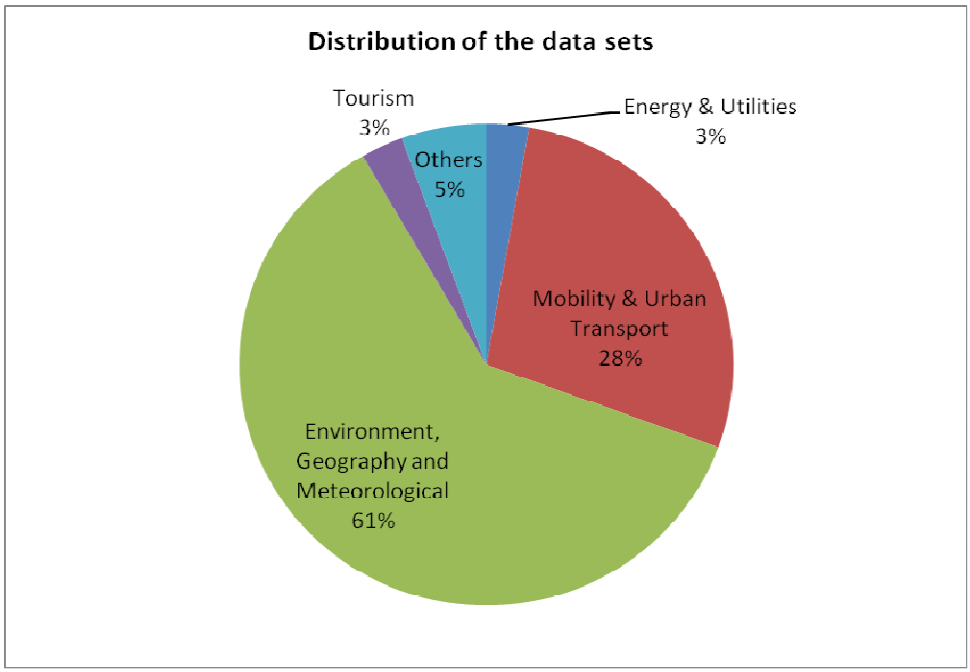

Figure 4 Data sets that allow sensors to be detected

The main objective of the OSN platform is to join all the Sensor Networks providing a single point of connection. The OSN platform will store the information and will provide the interfaces and the mechanisms to wrap the information using Open Data formats. The consumers will connect to the OSN platform and, using standard interfaces, they will obtain the Open Data information.

5. CONCLUSIONS

Cities have the responsibility of gathering, storing and publishing information about citizens and their own city. City councils face a great challenge when they publish these Open Data in order to make it possible for third entities to create new services using this public information. These new services will create a new market that will encourage the economy of the city. Sensor networks are part of the city and they are continuously gathering information that could help create new services to manage the city in a better way if well processed.

This deliverable has faced the first step before creating a new Open Sensor Network (OSN) that offers an Open Data platform to the citizens. Firstly, the deliverable defines a survey to gather information about the data sets that own the different cities. The definition of the survey has been made following the Living Labs methodology. Living Labs have offered us the possibility of involving the different city councils and participants in the correct definition of the survey. Secondly, the deliverable discusses the obtained results of the surveys. Finally the deliverable selects the most suitable data sets in order to develop a new OSN platform.

We can conclude that the methodology used to define the surveys has been defined correctly, since we have obtained the desired results from the different participant cities. The surveys aimed at covering all the main business areas that the European cities have. We have been capable to extract the data sets related to sensor networks and we have selected the most interesting business areas. In order to deploy a new Open Sensor Network that manages information from different kind of sensor networks, we have considered that the best business areas are:

- Mobility & Transport
- Environment
- Geography & Meteorological
- Tourism.

These selected areas provide a large variety of sensor networks and they can be considered to offer infinite possibilities for developing mobile applications (Apps) which would be fed by Open Data from the OSN.

5.1 PARTICIPATION OF OTHER CITIES IN OPENCITIES

There are many cities interested in participating in initiatives like Open Cities. The main objective of the Open Data and OSN platforms is to provide an infrastructure where cities can be connected to share public

information. The Open Data and ONS platforms will be designed to hold thousands of data entries assuring a high degree of scalability. Therefore, the platforms will be prepared for including data from new cities. The participation of new cities in the Open Cities project could increase the diversity and quantity of data and this fact could lead to new possibilities for developing new mobile applications.

The city of Rome has expressed a strong interest in participating in the Open Cities Consortium and it will probably be a new member soon. On the other hand, many Catalan towns have heard about the Open Cities initiative and they have also demonstrated their interest in making similar efforts along the lines marked by Open Cities. In the same line, we can mention another European initiative called Eurocities that has contacted with WP4 and WP6 in order to find similarities between both projects and to request some information about the Open Cities methodology.

5.2 FUTURE WORK

In the following months WP6 will present the deliverables with the design and the implementation of the OSN platform. The design of the OSN platform will be performed in collaboration with WP4 due to the necessity of interconnection with the Open Data system. Once the OSN is created and interconnected with the Open Data system, the services that consume the data will be implemented. In the following lines the next steps that will be done by WP6 are listed.

- Contact the sensor network managers of the different cities to know the entire technical requirements to gather sensor data.
- Definition of the OSN platform requirements: to define the software and hardware requirements in order to develop the platform.
- Design of the OSN platform: to define in detail the different components that will form the OSN platform
- Definition of the OSN interfaces in collaboration with WP4: these interfaces will facilitate the interconnection with the WP4 Open Data system and with the external users.
- Implementation of the OSN platform: to program and to configure the software and hardware equipments.
- Interconnection of the sensor networks with the OSN platform.
- Integration of the OSN platform with the Open Data system in order to enhance the possibilities of the WP4 Open Data platform
- Test and launch of the integrated environment: to test the integrated system during a test period in order to debug and solve errors. Once, the system passes the test period, it will be launched and published to be used to create new applications
- Mobile Applications challenges: to develop new mobile applications and to encourage citizens and third parties to create new city services using Open Data from the OSN platform

5.3 STANDARDIZATION

One of the challenges of any Open Data platform is the standardization of the data that is going to be published. The standardization can be understood in two ways: one way is the usage of standard format files such as XML or RDF and the second way is the representation structure of the information using new formatting methods or using standard methods such as XML Schema.

WP6 encourages the use of standard format files and the use of standard representation structures for the publication of the data in the Open Data Web sites of the cities. With the standardization, developers have more facilities to implement new applications. This fact means that applications are easier to be developed and quicker to be published on Apps Web sites to be used by the citizens.

"The aim of the standardization: We all understand better if we speak the same language."

The OSN platform will provide standard interfaces and standard formats for the consumption of Open Data. Therefore, we will put a great effort dealing with this issue.

5.4 APPS 4 OSN

The implementation of an OSN only makes full sense if the data generated are correctly operated. OSNs require consumers to use the large amount of data they generate. We live in a moment where mobile applications market is increasing and Open Data initiatives must profit from this opportunity.

WP6 proposes different use cases for developing mobile applications fed by data from the Open Sensor Network architecture that is interconnected with the Open Data platform of the WP4. We call this concept: **Apps 4 OSN**.

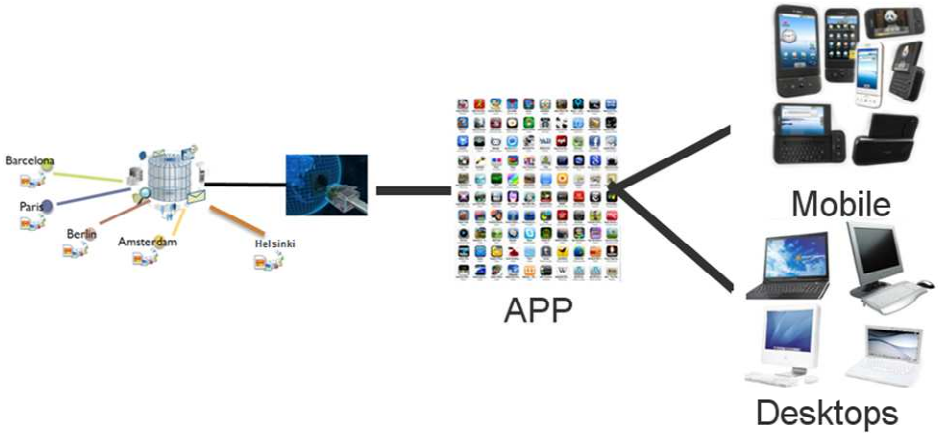

Figure 5 Apps 4 OSN concept

In the following table some possible applications that can be implemented using the Open Data from the OSN are explained, so that new services can be offered to the citizens.

Application	Description
Augmented reality with Urban transport	This mobile application will show the user where are located the bus and metro stations. When the buses and metros are expected to arrive (timetables). It also generates real-time travel simulations with the best and quickest route based on the sensors of the buses.
Augmented reality with Tourism	This mobile application will show the user where are located the different tourism sites, museums, buildings and when they arrive to the site, the application runs as an online-guide that offers information about the site. Using geopositioning, the user can receive detailed information of some selected parts of the building, museum. This application could be sponsored by the museums and private sites that offer through the application an online ticket store (with discount of course!). This application will improve the user-experience of the tourist and will make them to return to the city due to the quality and innovation of the city.
Events in the city	This mobile application will show the user where are located the different events that are celebrated in the city and information about them. It must offer extra information about how to arrive and which is the best urban transport to arrive and the timetables. This application could be sponsored by a company that participates in the organization of the event.

Table 8 Possible applications for OSN

6. WORK PLAN

The confection of this deliverable has followed the foreseen work plan:

D6.1	Report on Living Lab activities for Data Set selection & definition on Sensor Networks	ESADE	Barcelona	Amsterdam	Dutch	Cap Digital	Institut Telecom	Berlin	Fraunhofer	Atos Origin	UPF	DotOpen
D6.1.1	Open Cities Kick-off meeting - Calendar established	x	x	x	x	x	x	x	x	x	x	x
D6.1.2	Open Data Barcelona	x	x	x	x	x	x	x	x	x	x	x
D6.1.3	Smart Cities meeting (Ghent)	x	x	x	x	x	x	x	x	x	x	x
D6.1.4	Questionnaires preparation								x		x	
D6.1.5	Questionnaires dissemination								x		x	
D6.1.6	Barcelona Living Lab Meeting	x	x	x	x	x	x	x	x	x	x	x
D6.1.7	ESADE Open Data meeting	x	x	x	x	x	x	x	x	x	x	x
D6.1.8	Questionnaires received								x		x	
D6.1.9	Data processing										x	
D6.1.10	Compose deliverable report	x									x	

		Nov 10	Dec 10	Jan 11	Feb 11	Mar 11	Apr 11	May 11	Jun 11
D6.1	Report on Living Lab activities for Data Set selection & definition on Sensor Networks	M1	M2	M3	M4	M5	M6	M7	M8
D6.1.1	Open Cities Kick-off meeting - Calendar established								
D6.1.2	Open Data Barcelona								
D6.1.3	Smart Cities meeting (Ghent)								
D6.1.4	Questionnaires preparation								
D6.1.5	Questionnaires dissemination								
D6.1.6	Barcelona Living Lab Meeting								
D6.1.7	ESADE Open Data meeting								
D6.1.8	Questionnaires received								
D6.1.9	Data processing								
D6.1.10	Compose deliverable report								

Table 9 Deliverable 6.1 Work plan description