Small or medium-scale focused research project (STREP)

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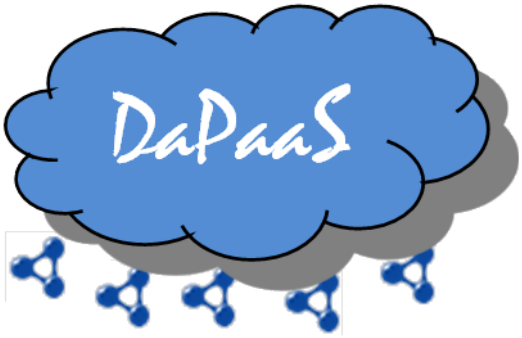
Data Publishing through the Cloud: A Data- and Platform-as-a-Service Approach to Efficient Open Data Publication and Consumption

DaPaaS



Deliverable D5.1:

Use case definition and requirements analysis

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Executive Summary

This report represents Deliverable D5.1 "Use case definition and requirements analysis" of the DaPaaS project. The DaPaaS project goal is to develop an integrated Data-as-a-Service (DaaS) and Platform-as-a-Service (PaaS) platform for open data applications. Explicit definition of a DaPaaS use case is important to understand the direction of the DaPaaS project and to demonstrate the capability and business feasibility of the platform.

This document provides:

- An overview of the proposed DaPaaS use case to streamline the direction and the scope of development;
- Market expectation and evaluation metrics for selecting the best use case;
- Definition of the DaPaaS use case including detailed features and target users;
- Case studies related to the DaPaaS use case;
- Specification of use case requirements and the architecture design of the use case prototype.

The proposed use case involves creation of PLUQI (Personalized and Localized Urban Quality Index), a customizable index model and mobile/Web application that can represent and visualise the level of well-being and sustainability for given cities based on individual preferences. It will cover and demonstrate several use case scenarios including destination evaluation for business and leisure travellers, informing citizens about their surroundings, assisting local government in prioritisation of services and promoting and informing environmental management. This use case will be used to assess the requirements that have been defined for the DaPaaS Platform.

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1 Overview

This report represents Deliverable D5.1 "Use case definition and requirements analysis" of the DaPaaS project. This deliverable is a result of Task T5.1 "Use case definition and requirements specification".

The objectives of this deliverable are to:

1. Understand the target market and potential users of the DaPaaS Platform by defining the DaPaaS use case scenario and its requirements;
2. Provide a detailed concept and requirements specification for successful development of the DaPaaS use case prototype;
3. Understand the business feasibility of the DaPaaS Platform by comparing platform requirements and use case requirements.

This report consists of five sections:

- Section 1 “Overview” introduces the goal and scope of use case development, market expectation and customer benefits of DaPaaS, and value positioning for selecting the DaPaaS use case;
- Section 2 “Definition of the DaPaaS Use Case” introduces the concept of the proposed DaPaaS use case including user scenarios and business models;
- Section 3 “Feasibility Study of the DaPaaS Use Case” provides an overview of related relevant development cases to understand the feasibility of the proposed use case, as well as its relevance from a business and technical perspective;
- Section 4 “Requirements Analysis” covers four different requirements aspects - user requirements, functional requirements, system requirements and data requirements.
- Section 5. “Summary and Outlook” summarizes this deliverable and outlines direction for future work.

1.1 Goal and Scope of Use Case Development

The DaPaaS project goal is to develop an integrated Data-as-a-Service (DaaS) and Platform-as-a-Service (PaaS) platform for open data applications. The proposed DaPaaS architecture will support unified accessibility to heterogeneous open datasets by using semantic technologies. The DaPaaS use case should demonstrate the concept of integrated DaaS and PaaS and the strength of the DaPaaS architecture. The goals for DaPaaS use case development are to:

- Demonstrate the strength of DaPaaS: the use case should demonstrate unified accessibility and semantic integration of heterogeneous open data;
- Prove the concept of integrated DaaS and PaaS: the use case should demonstrate full platform functionality and accessibility of various datasets;
- Show feasible business models: the use case should be a showcase to understand the feasibility of potential business models.

The objectives and scope of Work Package 5, a use case development working on the DaPaaS Platform are to:

- Define a high impact real life use case to ensure the DaPaaS approach is directed to meet real needs;
- Generate detailed requirements for the technical work packages (WP1 – WP4);
- Define methods and plans for validation, and perform the validation of the DaPaaS infrastructure;
- Implement a pilot use case system and validate the DaPaaS architecture and infrastructure;
- Collect potential use cases from various domains where DaPaaS will be applicable.

1.2 Market expectation and value positioning

We need to have a good understanding of the market expectations and customer benefits of the DaPaaS Platform to select and design a high impact use case for real life applications. We have surveyed existing research about open data and the open big data market. Figure 1 below shows a summary of the survey and the result of discussions relating to market expectations driven by Delphi methodology[1].

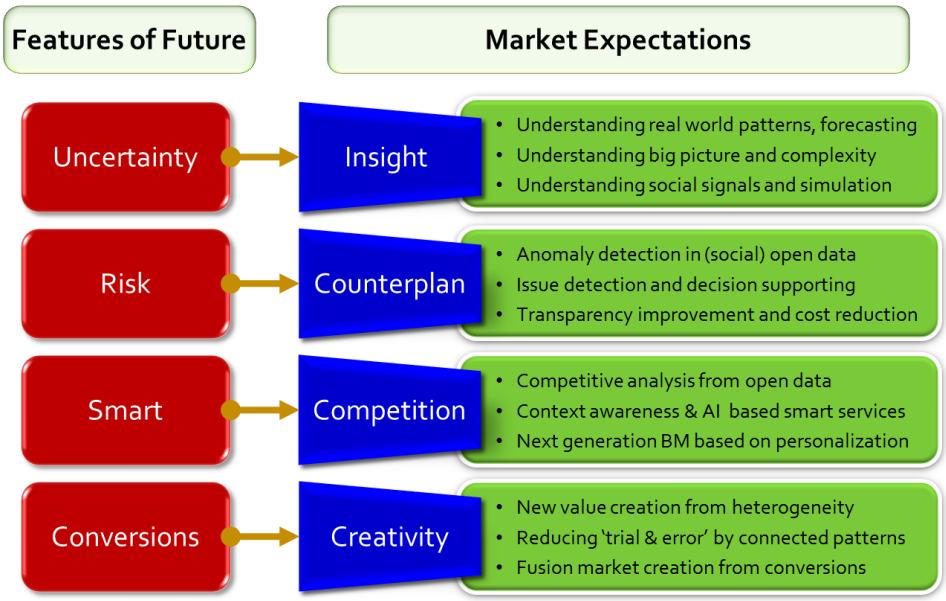


Figure 1. Features of future and market expectations on open big data applications

Lessons learned from this study and discussion:

- Pattern discovery: analysis and discovery of patterns of behaviour and patterns in measures of the real world are important;
- Data driven value creation: the DaPaaS use case should create new value from heterogeneous data;
- Smart service: use of real time data and personalization to improve the traditional business model would be attractive;
- Cost reduction: the DaPaaS use case should demonstrate how the DaPaaS platform could reduce the total cost of operations compared to existing business processes;
- Decision support: the use case should impact the process of decision making for national government, local government and individual people as well.

Figure 2 depicts the value classification of the DaPaaS platform related to its potential applications.

There are only three main values in empirical economics: quality, speed and cost. All organizations such as commercial companies, non-profit organizations and government agencies can survive in the market if they are able to create one competitive value from among the three main values. If an organization can create and maintain its competitiveness in two of these values, that organization could rise to the top and dominate the market. Since it is not possible to achieve all three values at the same time, we need to concentrate our efforts on selecting the two values appropriate to our strengths to achieve success.

In this task, T5.1, we have added one more value - 'Sustainability' - which is a desirable orthogonal value to set alongside Quality, Speed and Cost. We can define the term sustainability as 'the potential for the long-term maintenance of well-being, having ecological, economic, political and cultural dimensions. Sustainability requires the reconciliation of environmental, social equity and economic

[1] http://en.wikipedia.org/wiki/Delphi_method

demands'. Nowadays urban and environmental sustainability has become one of the crucial values for maintaining quality of life.

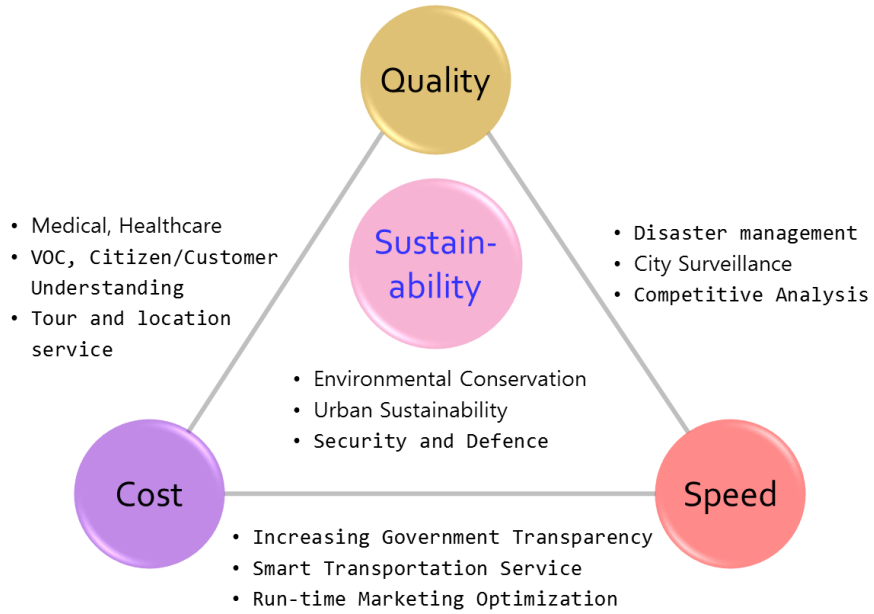


Figure 2. Value classification and potential applications of the DaPaaS platform

Table 1. Value classification and composition for DaPaaS use cases

Value composition	Description	Applications
QC: Quality and Cost	Increasing the quality of service including decision making and reducing the cost of operation simultaneously	• Medical, Healthcare Service • Voice of Citizen/Customer Understanding • Area profiling for residents and visitors
CS: Cost and Speed	Reducing the cost of operation and increasing the speed of service including decision making simultaneously	• Increasing Government Transparency • Smart Transportation Service • Run-time Marketing Optimization
SQ: Speed and Quality	Increasing the speed and quality of service and decision making simultaneously	• Disaster Management • City Surveillance • Competitive Analysis
Sustainability and {QC or CS or SQ}	Increasing cultural, environmental, political, economic or well-being sustainability together with improvement of QC, CS or SQ values	• Environmental Conservation • Urban Sustainability • Security and Defence

In task T5.1, there was a consensus to target Sustainability and QC (Quality and Cost) values for DaPaaS use case considering the goal of use case development and lessons learned from market observation. This will be discussed in detail in the next section.

1.3 Evaluation Metrics for Use Case Selection

We designed the evaluation metrics below to select the best use case for the DaPaaS project. There are 10 success factors and 12 potential applications in the evaluation table. Location and tour service was selected as having one of the best potential DaPaaS applications. Voice of Citizen (VOC), smart transportation, environmental conservation and urban sustainability would be good applications as well. We had a brainstorming session and decided to focus on the Sustainability + QC value position, because of the related evaluation results. To demonstrate and evaluate these potential applications on the DaPaaS platform, we are proposing an integrated use-case named 'Personalized and Localized Urban Quality Index'. It is described in detail in the next section.

Table 2. Use-case evaluation metrics

Aspect	Success Factor	Quality and Cost			Cost and Speed			Speed and Quality			Sustainability		
		Medical, Healthcare	Voice of Citizen	Location, Tour Service	Government Transparency	Smart Transport	Marketing Optimization	Disaster Management	City Surveillance	Competitive Analysis	Environ. Conservation	Urban Sustainability	Security, Defence
Use-case goal and objectives	Demonstrate strength of DaPaaS	★★	★★★★	★★★★	★★★	★★	★	★★	★★★	★	★★★	★★★★	★
	Prove the concept of DaaS + PaaS	★★★	★★★★	★★★★	★★★★	★★★	★★★	★★★	★★	★★	★★★★	★★★★	★★
	Show feasible business models	★★	★★★	★★★★★	★	★★★	★★★	★	★★	★★	★★	★★	★★★
	High-impact real-life use-case	★★★	★★★	★★★★	★★	★★★★	★★	★★	★★	★	★★	★★★	★★
	Easy to evaluate	★	★★	★★★	★	★★★	★★	★	★★	★	★★	★★	★
Lessons learned from Market expectation	Real world pattern discovery	★	★★★★	★★★★	★★	★★★	★★★	★	★★★	★★	★★★	★★★	★★
	Data driven value creation	★★★★	★★★	★★★	★★★	★★★★	★★★	★★	★★	★★	★★★★	★★★	★★★
	Smart service provisioning	★★★	★★★	★★★★	★★★	★★★★	★★	★★★	★★	★	★★	★★	★
	Demonstrate cost reduction	★★	★★★★	★★★★	★★★	★★★★	★★★	★★	★★	★★	★★	★★	★
	Decision supporting application	★★	★★★	★★★	★★	★★★	★★★	★★★★	★★★	★★★	★★★★	★★★★	★★★
Overall Evaluation		★★★	★★★★	★★★★★	★★★	★★★★	★★	★★	★★	★	★★★★	★★★★	★★

2 Definition of the DaPaaS Use Case

In Section 1 we described the goal and objectives of the DaPaaS use case and market expectation analysis to select the best use case for the DaPaaS project. We have decided to focus on a Sustainability and QC (Quality-Cost) value position like the area profiling, VOC, environmental conservation and urban sustainability applications. We are proposing a new use case concept called the 'Personalized and Localized Urban Quality Index' to cover those potential applications working on the DaPaaS platform.

2.1 Use Case Definition

We can define '*Personalized and Localized and Localized Urban Quality Index (PLUQI)*' as:

> A customizable index model and mobile/Web application that can represent and visualize the level of well-being and sustainability for given cities based on individual preferences.

This index model will represent:

- *Daily life satisfaction*: weather, transportation, community, living density, social sentiments, shopping space, entertainment venues, etc.;
- *Healthcare level:* number of doctors, hospitals, suicide statistics, average working hours, etc.;
- *Safety and security:* number of police stations, fire stations, crimes per capita, etc.;
- *Financial satisfaction:* prices, incomes, housing, savings, debt, insurance, pension, etc.;
- *Level of opportunity*: jobs, unemployment, education, re-education, economic dynamics, etc.;
- *Environmental needs and efficiency:* green space, water and electricity consumption, air quality, etc.;
- *Political satisfaction*: civic engagement, NGO, voter turnout, etc.;
- *Cultural satisfaction*: number of theatres, museums, art centres , etc.;

A composite index of urban quality derived from all sub-indices will be represented for cities. It is impossible to represent a composite index based on a single model to cover all aspects of different applications and individual preferences, and this is the reason for introducing personalization and model customization capability for PLUQI. An individual user or organization can apply their preferences and rate the importance of each sub-index to re-analyse a PLUQI composite index and determine city ranking. This will demonstrate the value of the DaPaaS approach for combining data from multiple sources for a variety of applications.

The DaPaaS PLUQI use case is not only an index model but also an application deployed and hosted in the DaPaaS platform, and made accessible to end users on the Web and via smart phones. PLUQI should demonstrate the power of integrating DaaS and PaaS. Here is how PLUQI can demonstrate this:

- DaaS: PLUQI will access that DaPaaS platform as a unified data provider. PLUQI will use more than 30 different types of open data to analyse a composite index for each city and each user. DaPaaS will also feed social data from the Saltlux <O2>[2] platform and environmental data from the CITI-SENSE [3] platform to PLUQI. PLUQI will demonstrate full functionality of data marshalling, data access and data analytics.

[2] http://saltlux.com/en/o2-platform/
[3] http://www.citi-sense.eu/

- PaaS: PLUQI will also demonstrate how different applications could be developed and run together on the DaPaaS platform. Each application could customize the standard PLUQI model for its own purposes such as travel planning, commercial impact analysis, real estate, etc.

The PLUQI DaPaaS use case has interesting characteristics in data analytics such as:

- Hyper local analysis: PLUQI will analyse and publish geo-context data with time variation. We will build an analysis system from city level and narrow it down to district or small village level. PLUQI will also handle personal GPS data and local buzz from social media.
- Real-time analysis: Some of the raw data sets for PLUQI could be real-time streams like data streams from environmental (incl. weather) sensors, traffic data and social data. PLUQI will analyse such real-time data sets to re-rank and recommend best places based on personal objectives, preferences and contexts like weather and traffic.
- Social intent analysis: the PLUQI index will include social analytics to understand VOC. The DaPaaS platform will access <O2> as a social data source to collect buzz and issues for each city and district.
- Personalized analysis: an individual user or organization could apply their preferences and priorities to calculate their personalized PLUQI composite index and rank for given cities. This would greatly assist the process of finding a place to live or travel to.

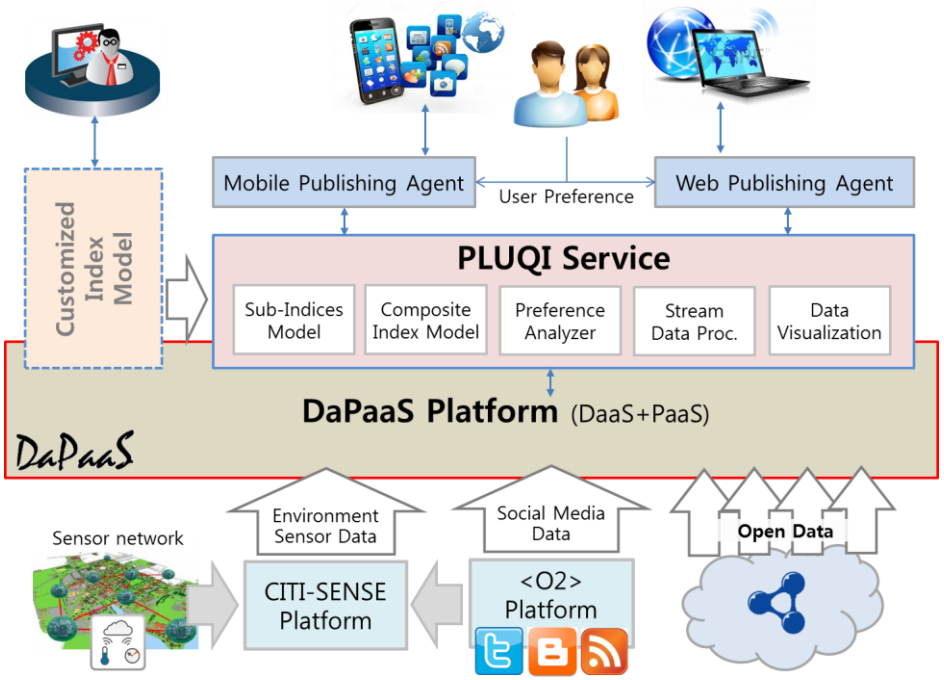


Figure 3. Conceptual Diagram for the DaPaaS Use Case

2.2 Target Users

PLUQI is an index model and also a meta-application of the DaPaaS platform that could also be a sub-platform to provide possibilities for development of other applications. There are several interesting PLUQI applications and target users:

- *Policy analysis and optimization for government and local government*: government officers could better understand citizen's demands and requests, and they optimize or redirect their policies to improve citizen satisfaction comparing with other cities;
- *Understanding the citizen's voice and demands regarding environmental conservation*: an NGO or government agency could understand VOC about environmental matters, and communicate together through data publishing on social networking services;

- *Place recommendation for travel agency or traveller*: a travel agency or traveller could list and rank the best places to visit under his/her preferences and real-time situations like weather;
- *Commercial impact analysis for retailer and franchises*: when a retailer or franchise wants to open a new shop, PLUQI could recommend an appropriate location for business development;
- *Location recommendation and understanding local issues for real estate*: for those wishing to move house, a real estate company could recommend a suitable place based on searcher preferences. Users could better understand the living issues and satisfaction of future neighbours;
- *Risk analysis and management for insurance and financial companies*: insurance companies could detect potential risks relating to their clients when the client moves or travels to riskier areas;
- *Local marketing and sales force optimization for marketers*: marketers could use PLUQI for their local marketing and for supporting their regional sales forces

2.3 Potential Business Models

There are several potential business models:

- *Local Advertisement*: PLUQI or applications based on PLUQI could have a mobile and Web advertisement business model. PLUQI provisions hyper-local information which a user may be interested in. Local advertisement business model will be attractive. We can consider linking AdMob or iAd for mobile users.
- *Monthly subscription:* a monthly subscription business model can be considered for governments, local government agencies or NGOs. They can use PLUQI to understand citizen's voice, issues and the level of living satisfaction in comparison to other cities.
- *Cloud business model:* we can operate cloud-service-like business model and offer 3rd party service providers to pay per query, data set or CPU times.
- *Customization service:* if an organization (e.g. government agency) has an intention to customize standard PLUQI index and application for their own purposes, then we can provide consulting, customization and IT services.
- *Enhancing the value of open data for data publishers:* the PLUQI index and application offers a way of enhancing the usefulness of open data publishing for a number of user groups. This provides evidence for the business case for public sector open data publishing and so will encourage public sector data owners to publish more data. For business models based on charging data owners, but allowing free use of open data, PLUQI can increase the size of the data publishing market.

We will consider assessing one or more of these business models of PLUQI and DaPaaS in WP5.

3 Feasibility Study of the DaPaaS Use Case

This section describes some case studies (Section 3.1) related to the DaPaaS use case, and the data sources (Section 3.2) to fulfil those case studies. This will demonstrate the feasibility of the use case.

3.1 Case studies

3.1.1 OECD Better Life Index

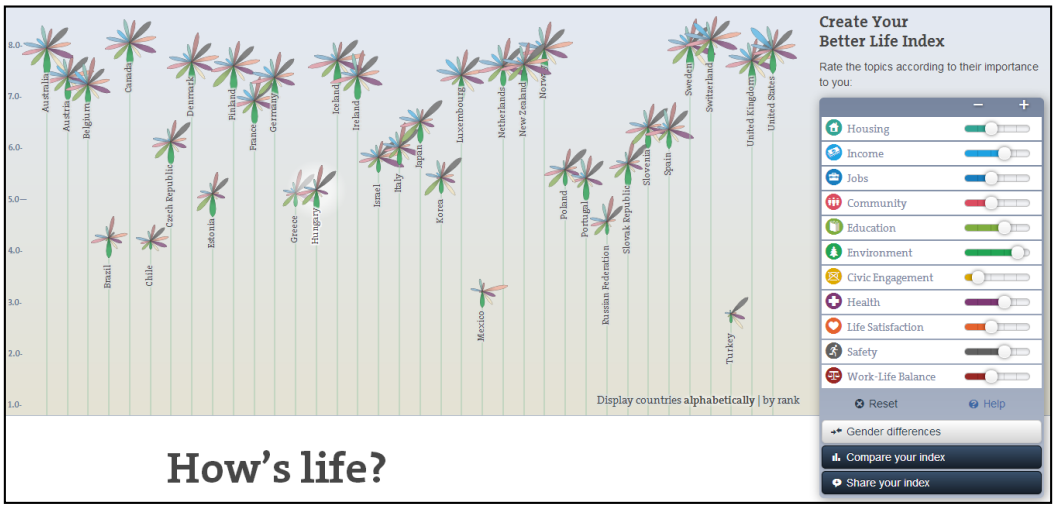


Figure 4. Better Life Index - http://www.oecdbetterlifeindex.org

The OECD's Better Life Initiative tries to answer what matters most to people's well-being by painting a broad picture of people's lives using 11 key dimensions essential to well-being. These range from traditional measures such as income and jobs, health, education and the local environment, to personal safety and overall satisfaction with life.

But well-being varies between individuals and thus cannot be captured only by measures at the national level. So the OECD has also focused on measuring inequality between groups in society for different well-being outcomes. This shows how well-being, whether in terms of income, education, health or general satisfaction with life is shared across society, for instance what difference gender makes.

The wide range of comparable well-being indicators in 'How's Life?' makes it possible to identify relative strengths and weaknesses in a country's well-being. This, in turn, can help governments when drawing up their policy agenda.

Each of the 11 key dimensions of the Index is currently based on one to four indicators. Within each topic, the indicators are averaged with equal weights. The indicators have been chosen in consultation with OECD member countries on the basis of a number of statistical criteria such as relevance (face-validity, depth, policy relevance) and data quality (predictive validity, coverage, timeliness, cross-country comparability etc.) These indicators are good measures of the concepts of well-being, in particular in the context of a country comparative exercise. Other indicators will gradually be added to each topic.

The data mostly come from official sources such as the OECD or National Accounts, United Nations Statistics, National Statistics Offices. A couple of indicators are based on data from the Gallup World Poll, a division of the Gallup Organization that regularly conducts public opinion polls in more than 140 countries around the world. More than 80% of the indicators in Your Better Life Index have already been published by the OECD.

Measure	Value																			
Inequality	Total																			
BLI edition	2013																			
	Housing			Income		Jobs				Community	Education			Environment		Civic engagement		Health		S
Indicator	Dwellings without basic facilities	Housing expenditure	Rooms per person	Household net adjusted disposable income	Household net financial wealth	Employment rate	Job security	Long-term unemployment rate	Personal earnings	Quality of support network	Educational attainment	Student skills	Years in education	Air pollution	Water quality	Consultation on rule-making	Voter turnout	Life expectancy	Self-reported health	s
Country																				
Australia	(E) 1.2	19	(E) 2.3	28 884	32 178	73	12.4	0.96	43 908	94	73	519	18.5	14	91	10.5	93	82	85	
Austria	1.2	21	1.7	28 852	47 458	72	9.5	1.07	43 688	94	82	487	16.9	27	96	7.1	82	81.1	69	
Belgium	1.4	20	2.2	26 874	74 007	62	7.4	3.45	44 321	92	70	509	18.7	21	80	4.5	89	80.5	73	
Canada	0.2	22	2.6	28 194	63 852	72	11.3	1	42 253	94	88	527	17	16	89	10.5	61	81	88	
Chile	9.4	18	1.3	11 039	16 972	61	(E) 10.5	(E) 2.94	15 820	82	71	439	16.2	53	77	2	88	78.3	59	
Czech Republic	0.7	25	1.4	16 957	14 749	66	6.7	2.8	19 312	89	92	490	17.8	17	84	6.8	63	78	59	

Figure 5. Data for measuring Better Life Index

3.1.2 Gallup-Healthways Well-Being Index (WBI)

The Gallup-Healthways Well-Being Index (WBI) provides an in-depth, real-time view of Americans' well-being, giving governments, communities, employers and health plans unmatched insight into the health of their populations. The Well-Being Index includes topics such as life evaluation, physical and emotional health, health behaviours, work environment, and basic access. The research and methodology underlying the WBI and the Community, State and Congressional District Well-Being Reports are based on the World Health Organization definition of health, which is, "...not only the absence of infirmity and disease but also a state of physical, mental and social well-being"; following this definition, Gallup and Healthways have developed a source of well-being measurement called the Gallup-Healthways Well-Being 5. This scientific survey instrument and reporting experience measures, tracks and reports on the well-being of individuals and organizations. The five essential elements of well-being are:

- Purpose: Liking what you do each day and being motivated to achieve your goals;
- Social: Having supportive relationships and love in your life;
- Financial: Managing your economic life to reduce stress and increase security;
- Community: Liking where you live, feeling safe and having pride in your community;
- Physical: Having good health and enough energy to get things done daily.

The Well-Being 5 survey measures these elements using a process developed by Healthways and Gallup scientists. The survey represents the combined expertise of both organizations as well as decades of well-being research and published peer-reviewed findings.

Gallup and Healthways have built a dataset on well-being, with 1.9 million completed surveys to date, to support their mutual goals of understanding and improving the well-being of individuals and populations. In 2013, Gallup and Healthways extended the reach of the Well-Being Index beyond the United States. Now, Gallup and Healthways measure well-being in almost every major country in the world. With results to be released in early 2014, global leaders will have an opportunity to benchmark the well-being of their country against the results of roughly 140 countries around the world.

2012 Rank		2011	2010	2009	2008
1	Hawaii	1	1	1	2
2	Colorado	6	5	10	8
3	Minnesota	3	6	4	5
4	Utah	5	8	2	1
5	Vermont	12	17	6	27
6	Montana	10	14	3	3
7	Nebraska	8	10	24	20
8	New Hampshire	9	15	14	16
9	Iowa	16	19	7	26
10	Massachusetts	14	11	18	12
11	Maryland	13	13	15	15
12	South Dakota	11	7	19	31
13	Wyoming	21	2	12	4
14	Virginia	15	21	13	17
15	Washington	17	12	17	6
16	Connecticut	19	9	20	18
17	Kansas	7	16	11	13
18	California	18	18	21	9
19	North Dakota	2	3	8	21
20	Wisconsin	22	22	26	28
21	Maine	25	25	16	24
22	Idaho	23	20	9	10
23	Arizona	26	29	22	14
24	Oregon	20	28	27	19
25	New Mexico	24	23	31	7
26	Delaware	47	44	37	35
27	Texas	27	27	23	22
28	Illinois	32	26	28	30
29	Pennsylvania	31	30	30	34
30	New York	34	32	33	37
31	Alaska	4	4	5	11
32	New Jersey	29	24	29	25
33	Georgia	28	31	25	23
34	Florida	42	37	36	29
35	North Carolina	30	36	32	38
36	Michigan	37	41	34	41
37	Rhode Island	35	33	40	33
38	Missouri	43	34	38	40
39	Nevada	40	43	46	44
40	South Carolina	33	35	35	32
41	Oklahoma	39	38	39	36
42	Indiana	38	39	43	45
43	Louisiana	36	42	41	42
44	Ohio	46	45	47	46
45	Alabama	45	46	44	39
46	Arkansas	44	47	48	47
47	Tennessee	41	40	42	43
48	Mississippi	48	48	45	50
49	Kentucky	49	49	49	48
50	West Virginia	50	50	50	49

Figure 6. States Composite Rankings, 2012

3.1.3 The Urban Sustainability Index

The Urban Sustainability Index[4] was created to fill a gap in current analysis of sustainable development. In recent years, there have been many efforts designed to compare economic growth and environmental sustainability. The World Bank, the United Nations, Yale and Columbia universities and others have all added to a growing fact base around this important issue.

The Urban Sustainability Index is designed to measure relative performance over time of Chinese cities across a common set of sustainability categories. It is composed of a comprehensive five-part definition of sustainable development encompassing 18 individual indicators to gauge not only the environmental sustainability of the cities being analysed, but also the level of services required to handle a growing urban population and each city's resource efficiency. We believe these indicators represent the best set of data for commonly accepted indicators that are available in China from both national and local sources.

The Index measures a city's performance against five aspects we believe are critical to sustainable development:

- Basic Needs: Access to safe water, sufficient living space, and adequate healthcare and education are priority needs that help sustain an urban population.
- Resource Efficiency: Efficient use of water and energy and effective waste recycling contribute to functional resource management, providing benefits in both urban and rural areas.
- Environmental Health: Lessening exposure to harmful pollutants and improving waste management efficiency helps produce cleaner urban environments.
- Built Environment: Increased liveability and efficiency of communities comes with equitable access to green space and public transportation, as well as dense and efficient buildings.

[4] http://urbanchinainitiative.typepad.com/files/usi.pdf

- Commitment to Sustainability: More staff and financial resources brought to bear on sustainability challenges suggests how vigorously city governments are meeting their commitments to implement national and local policies and standards.

Categories	Definition	Indicators	Description of the indicators
Basic needs	▪ Access to safe water, living conditions, education and health services	▪ Water supply ▪ Housing ▪ Health ▪ Education	▪ Water access rate (%) ▪ Living space (sq.m per capita) ▪ Doctors per capita ▪ Student teacher ratio (primary school)
Resource efficiency	▪ Efficient use of energy, power and water; waste recycling	▪ Power ▪ Water demand ▪ Waste recycling ▪ % GDP from heavy industry	▪ Total electricity consumption (kwh per GDP) ▪ Water consumption (Liters per capita) ▪ Rate of industrial waste recycled and utilized (%) ▪ Heavy industry GDP/ Total GDP (bln RMB)
Environmental cleanliness	▪ Clean air and water ▪ Waste management	▪ Air pollution ▪ Industrial pollution ▪ Waste water treatment ▪ Waste management	▪ Concentration of SOx, NOx, PM10 (mg/cu.m) ▪ Industrial SO2 discharged per GDP (T/ RMB) ▪ Wastewater treatment rate (%) ▪ Domestic waste collected & transported (10,000 T per capita)
Built environment	▪ Dense, transit-oriented, green, efficient design	▪ Urban density ▪ Mass transit usage ▪ Public green space ▪ Building efficiency	▪ Persons per square kilometer of urban area ▪ Passengers using public transit (bus, trolley) ▪ Public green space per capita (sq.m per capita) ▪ Building heating efficiency
Commitment to future sustainability	▪ Investment in human and physical assets	▪ Green jobs ▪ Investment on environmental protection	▪ # of environmental professionals per capita ▪ Amount of environmental sanitation funds per GDP

SOURCE: Team analysis

Figure 7. Indicators of urban sustainability and the data (taken from http://urbanchinainitiative.typepad.com/files/usi.pdf)

3.1.4 UK Sustainable Cities Index

Forum for the Future is the UK's sustainable development NGO. 'The sustainable cities index 2010' report[5] tracks progress on sustainability in Britain's 20 largest cities, ranking them across three broad categories: environmental performance, quality of life, and future-proofing. And each category has several indicators:

- Environmental Performance: air quality, biodiversity, household waste, ecological footprint.
- Quality of Life: employment, transport, education, health, green space.
- Future-Proofing: climate change, local food, economy, recycling.

5 http://www.forumforthefuture.org/sites/default/files/images/Forum/Projects/Sustainable_Cities_Index/Sustainable_Cities_Index_2010_FINAL_15-10-10.pdf

overall ranking				
	2010	2009	2008	2007
Newcastle	1	1	4	8
Leicester	2	4	8	14
Brighton	3	3	2	1
Bristol	4	2	1	3
London	5	5	9	10
Leeds	6	6	13	5
Coventry	7	11	14	17
Plymouth	8	12	3	4
Edinburgh	9	7	6	2
Sheffield	10	9	7	7
Cardiff	11	10	5	6
Nottingham	12	8	10=	11
Manchester	13	14	15	12
Liverpool	14	15	17	20
Birmingham	15	17	19	19
Sunderland	16	13	12	13
Derby	17	*	*	*
Bradford	18	16	10=	9
Glasgow	19	19	18	15
Hull	20	20	20	18

Figure 8. Overall Ranking from 'The sustainable cities index 2010' report

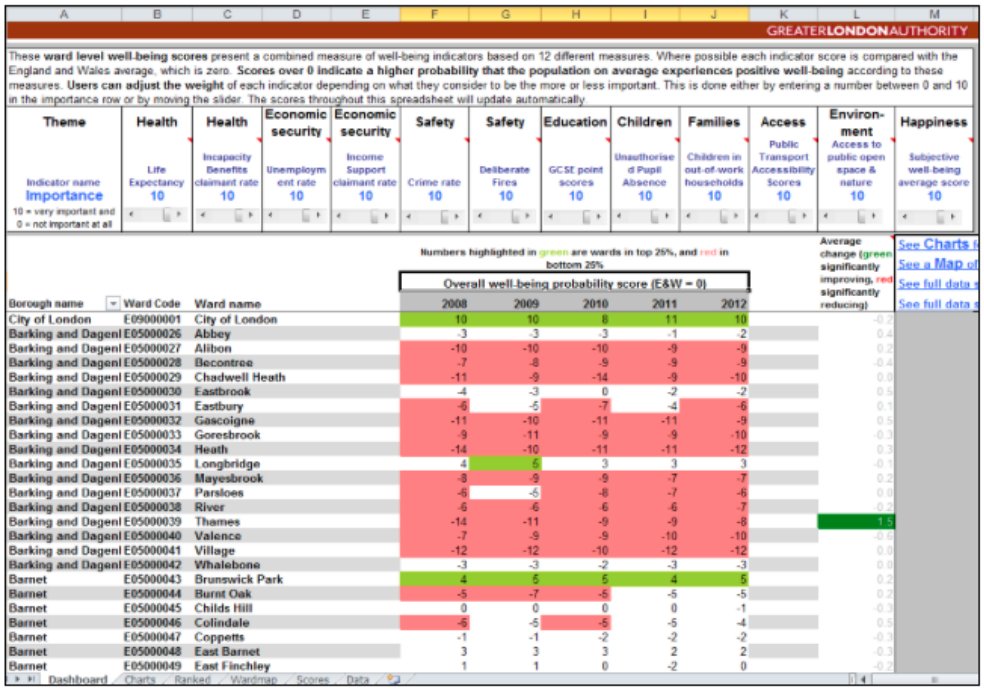
3.1.5 London Ward Well-Being Scores

These ward level well-being scores[6] present a combined measure of well-being indicators of the resident population based on 12 different indicators. Where possible each indicator score is compared with the England and Wales average, which is zero. Scores over 0 indicate a higher probability that the population on average will experience better well-being according to these measures.

Users can adjust the weight of each indicator depending on what they consider to be the more or less important, thus generating bespoke scores. This is done either by entering a number between 0 and 10 in the importance row or by moving the slider (each indicator is set to 10 by default). The scores throughout the spreadsheet will update automatically.

The tool combines data across a range of themes for the last five years of available data (2008-2012). The well-being scores are then presented in a bar chart for each borough, and a map of London. The spreadsheet highlights wards in the top and bottom 25 per cent in London. Wards that have shown significant improvement or reduction in their scores relative to the average over the five year period are also highlighted. Borough figures are also provided underneath to assist with comparisons.

[6] http://data.london.gov.uk/datastore/package/london-ward-well-being-scores



GREATER LONDON AUTHORITY

These **ward level well-being scores** present a combined measure of well-being indicators based on 12 different measures. Where possible each indicator score is compared with the England and Wales average, which is zero. **Scores over 0 indicate a higher probability that the population on average experiences positive well-being** according to these measures. **Users can adjust the weight** of each indicator depending on what they consider to be the more or less important. This is done either by entering a number between 0 and 10 in the importance row or by moving the slider. The scores throughout this spreadsheet will update automatically.

Theme	Health	Health	Economic security	Economic security	Safety	Safety	Education	Children	Families	Access	Environ-ment	Happiness
Indicator name	Life Expectancy	Incapacity Benefits claimant rate	Unemployment rate	Income Support claimant rate	Crime rate	Deliberate Fires	GCSE point scores	Unauthorised Pupil Absence	Children in out-of-work households	Public Transport Accessibility Scores	Access to public open space & nature	Subjective well-being average score
Importance	10	10	10	10	10	10	10	10	10	10	10	10
10 = very important and 0 = not important at all												

Numbers highlighted in green are wards in top 25%, and red in bottom 25%

Average change (green significantly improving, red significantly reducing)

See Charts | See a Map of | See full data | See full data

Borough name	Ward Code	Ward name	Overall well-being probability score (E&W = 0) 2008	2009	2010	2011	2012
City of London	E09000001	City of London	10	10	8	11	10
Barking and Dagenl	E05000026	Abbey	-3	-3	-3	-1	-2
Barking and Dagenl	E05000027	Alibon	-10	-10	-10	-9	-9
Barking and Dagenl	E05000028	Becontree	-7	-8	-9	-9	-9
Barking and Dagenl	E05000029	Chadwell Heath	-11	-9	-14	-9	-10
Barking and Dagenl	E05000030	Eastbrook	-4	-3	0	-2	-2
Barking and Dagenl	E05000031	Eastbury	-6	-5	-7	-4	-6
Barking and Dagenl	E05000032	Gascoigne	-11	-10	-11	-11	-9
Barking and Dagenl	E05000033	Goresbrook	-9	-11	-9	-9	-10
Barking and Dagenl	E05000034	Heath	-14	-10	-11	-11	-12
Barking and Dagenl	E05000035	Longbridge	4	6	3	3	3
Barking and Dagenl	E05000036	Mayesbrook	-8	-9	-9	-7	-7
Barking and Dagenl	E05000037	Parsloes	-6	-6	-8	-7	-6
Barking and Dagenl	E05000038	River	-6	-6	-6	-6	-7
Barking and Dagenl	E05000039	Thames	-14	-11	-9	-9	-8
Barking and Dagenl	E05000040	Valence	-7	-9	-9	-10	-10
Barking and Dagenl	E05000041	Village	-12	-12	-10	-12	-12
Barking and Dagenl	E05000042	Whalebone	-3	-3	-2	-3	-3
Barnet	E05000043	Brunswick Park	4	5	5	4	5
Barnet	E05000044	Burnt Oak	-5	-7	-5	-5	-5
Barnet	E05000045	Childs Hill	0	0	0	0	-1
Barnet	E05000046	Colindale	-6	-5	-5	-5	-4
Barnet	E05000047	Coppetts	-1	-1	-2	-2	-2
Barnet	E05000048	East Barnet	3	3	3	2	2
Barnet	E05000049	East Finchley	1	1	0	-2	0

Dashboard / Charts / Ranked / Wardmap / Scores / Data

Figure 9. London Ward Well-being Scores Spreadsheet (taken from data.london.gov.uk)

The 12 measures included are:

- Health: Life Expectancy, Incapacity Benefits claimant rate;
- Economic security: Unemployment rate, Income Support claimant rate;
- Safety: Crime rate, Deliberate Fires;
- Education: GCSE point scores;
- Children: Unauthorised Pupil Absence;
- Families: Children in out-of-work households;
- Transport: Public Transport Accessibility Scores (PTALs);
- Environment: Access to public open space & nature;
- Happiness: Composite Subjective Well-being Score (Life Satisfaction, Worthwhileness, Anxiety, and Happiness).

3.1.6 UK Experimental Subjective Well-being Estimates

The Office for National Statistics (ONS)[7] collects subjective well-being estimates to complement existing socio-economic indicators to allow a fuller statistical picture of the nation's well-being. Overall estimates of people's views about their own well-being are provided for different geographic areas and countries within the UK, aspects which are considered important for measuring national well-being.

[7] http://www.ons.gov.uk/

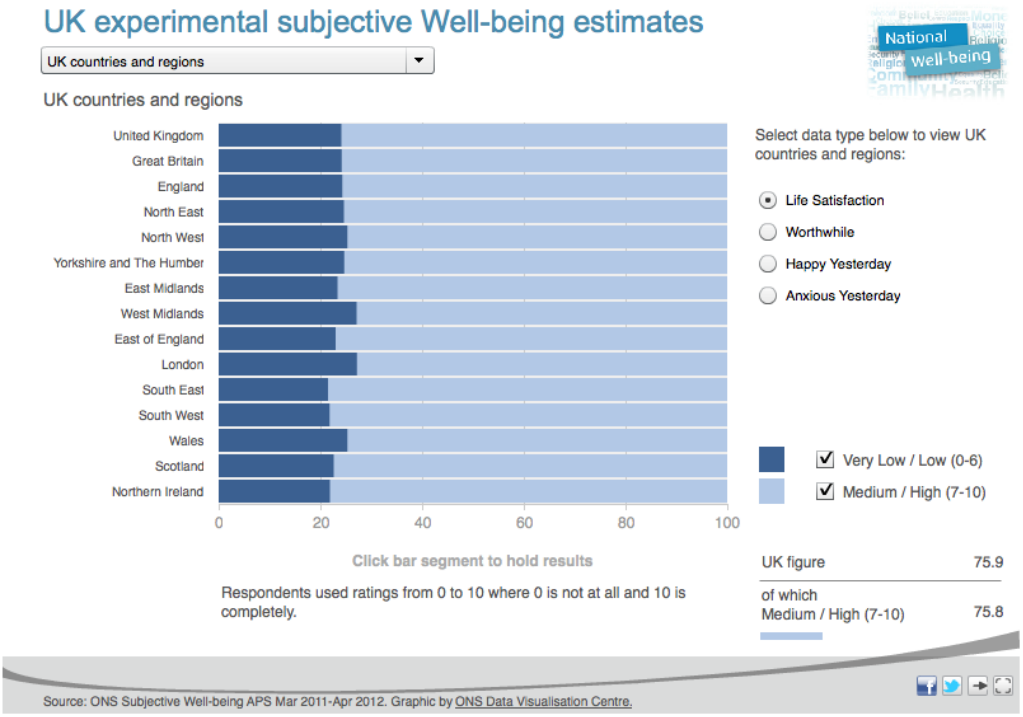


Figure 10. Interactive bar chart for UK experimental subjective Well-being estimates

The above bar chart presents experimental estimates from the first annual Subjective Well-being Annual Population Survey (APS) dataset, April 2011 to March 2012.

3.1.7 UK Index of Multiple Deprivation

In the UK, the 'Index of Multiple Deprivation' is widely used. It is calculated from approximately 30 underlying datasets under seven headings: crime, income, health, employment, education, environment and housing. (The English, Welsh and Scottish indices of multiple deprivation have small differences between them but are very similar in most respects). This index is published every 3 years in England and every 2 years in Scotland. It is calculated against small geographical areas derived from census data. Each area ('lower layer super output area' in England or 'data zone' in Scotland) is designed to include the homes of approximately 1000-1500 people. So the areas are small in cities and larger in rural areas.

It is used by local government to assist in targeting investment and services, by charities, by academic researchers and by private companies.

3.2 Data Sources for the DaPaaS Use Case

Table 3 lists data sources that could be used for the DaPaaS use case, taking London as an example (see Appendix A for a listing of the actual datasets).

Table 3. Data sources for DaPaaS use case in London

Data Source	URL
data.gov.uk	http://data.gov.uk
UK Data Service	http://ukdataservice.ac.uk
Office for National Statistics	http://www.ons.gov.uk/ons/index.html

london.gov.uk	http://data.london.gov.uk
Eurostat	http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/
public data.eu	http://publicdata.eu
OECD stat	http://www.oecd-ilibrary.org/statistics
data catalogue	http://datacatalogs.org
data market	http://datamarket.com
British Geological Survey	http://data.bgs.ac.uk/home.html
data.police.uk	http://data.police.uk
Index of Multiple Deprivation	https://www.gov.uk/government/collections/english-indices-of-deprivation
Housing and homelessness	http://opendatacommunities.org/themes/homelessness , http://opendatacommunities.org/themes/housing-market

The datasets from these data sources can be mapped to the five categories and indicators that are based on the '5 indicators of urban sustainability' and link the 'UK sustainability cities index' with the 'OECD better life index'.

Table 4. Categories and indicators to measure urban life quality

Category	Indicator	Examples of Available Data sets
Basic Needs	• Water supply • Housing • Health • Education • Transport • Green space • Safety • Community • Jobs • Income	• Better Environment, Better Health • Census housing • Official labour market statistics • London's Economic Outlook Forecast • data.police.uk • Annual Business Survey • Index of Multiple Deprivation • Housing statistics
Resource efficiency	• Power • Water demand • Waste recycling • % GDP from heavy industry	• Local Authority Collected Waste Management, London • Household Waste (kg) • Household Waste Recycling Rates, Borough
Environmental Cleanliness	• Air pollution • Industrial pollution • Waste water treatment	• Love Clean London • Airtext • London Average Air Quality Levels

	• Waste management	• Air Quality Focus Areas • State of the Environment report for London
Built Environment	• Urban density • Mass transit usage • Public green space • Building efficiency	• Land Area and Population Density, Ward and Borough • Dwelling Numbers on Valuation List, Borough
Commitment to future sustainability	• Green jobs • Investment in environmental protection • Local food • Economy • Recycling • Climate change	• London's Economy Today • Climate Change Mitigation and Energy Strategy Model Data

4 Requirements Analysis

This section outlines the requirements needed for the implementation of the use case. They include a mixture of requirements for the DaPaaS platform (from the perspective of the use case) and requirements for the application that will be developed and deployed on the platform as part of the use case, Requirements listed here that overlap with the requirements outlined in deliverables D1.1, D2.1, and D3.1 will be addressed as part of the DaPaaS core capabilities, while the rest of the requirements will be implemented as part of the use case in WP5.

4.1 User Requirements

This section lists the requirements from a user/role point of view.

Table 5. Use case requirements from the perspective of the users / key roles

ID	User Type / Role	Description
UR-01	All	User shall be able to access data by Web and mobile devices.
UR-02	All	User can register to the DaPaaS platform.
UR-03	All	User can use a previous existing social account (Google, Facebook, Twitter, LinkedIn…) to register to the DaPaas platform.
UR-04	All	User can login to the DaPaaS platform.
UR-05	Data Publisher	Data Publisher shall be able to upload data to the DaPaaS platform. Can upload a single file or bulk files or specify a local directory containing files they need to be uploaded.
UR-06	Data Publisher	Data Publisher shall be able to upload data by connecting to existing legacy systems (RDBMS, EDMS, CRM, Search Engines etc.).
UR-07	Data Publisher	Uploading datasets should be secure and fast.
UR-08	Data Publisher	Data Publisher shall be able to upload data by connecting to other already published data from other Open Data platforms (C-KAN, D-KAN, Socrat, etc.).
UR-09	Data Publisher	Data Publisher shall be able to store large sets of data to appropriate Storage.
UR-10	Data Publisher	Data Publisher shall be able to upload real-time data like Twitter Streaming/Search API, RSS etc.
UR-11	Data Publisher	Data Publisher shall be able to upload various formats of data (Excel, CSV, TSV, text, RDF).
UR-12	Data Publisher	In case of real-time or frequently changing data, Data Publisher shall be able to set a refresh time interval for the dataset/s.
UR-13	Data Publisher	Data Publisher shall have support for cleaning, refining, linking, transforming his datasets.
UR-14	Data Publisher	Data Publisher shall be able to add metadata for describing the published datasets.
UR-15	Data Publisher / End-User Data Consumer	Data Publisher/User can view (pre-view) datasets with an adapted visualization.
UR-16	Data Publisher	Data Publisher can create a community/group of users for the published datasets.

UR-17	Data Publisher	Data Publisher shall be able to set fine grained permissions for access (All, Group, Individual) and modifying/adding new entries to datasets (Read-only, Read/Write permissions)
UR-18	Data Publisher	Data Publisher shall be able to publish links of the datasets to various social services/communities.
UR-19	Data Publisher	Data Publisher shall be able to see the access stream activity and get statistics about access to datasets they publish.
UR-20	Data Publisher / End-User Data Consumer	Data Publisher/User shall be notified of changes in datasets.
UR-21	End-User Data Consumer	User shall be able to search and/or discover datasets.
UR-22	End-User Data Consumer	User should able to link/aggregate several datasets.
UR-23	End-User Data Consumer	User shall be able to save datasets to their local h/w (desktop).
UR-24	End-User Data Consumer	Download of datasets should be fast and secure.
UR-25	End-User Data Consumer	User shall be able to export data in various formats.
UR-26	End-User Data Consumer	Following & voting for datasets.
UR-27	End-User Data Consumer	User shall be able to comment on datasets.
UR-28	End-User Data Consumer	User shall able to add/update datasets when she has permission.
UR-29	Application Developer	User shall have help functionalities for easily deploying an application.
UR-30	Application Developer	All functionalities should be accessible by RESTful APIs.
UR-31	Application Developer	Developer can register their application and make configuration settings for their application.
UR-32	Application Developer	All functionalities should be accessible by Clients APIs for well/established programming languages.
UR-33	Application Developer	Developer shall have processing functionalities like mining, statistical functionalities for data manipulations.
UR-34	Instance Operator	Instance Operator should be able to monitor resources usage (CPU, Memory, Network traffic etc.) and have statistics about datasets access.

4.2 Functional Requirements

Table 6 presents the functional requirements mapped to the previously defined user requirements.

Table 6. Functional requirements

ID	Functionality	Description	User Requirements	Priority
FU-01	User Management	System shall provide functionalities for managing user information (CRUD operations on users).	UR-02	Core
FU-02	User Management	System shall support authentication from other Services like Facebook, Google, Twitter, LinkedIn etc.	UR-03	Optional
FU-03	Import Dataset	System shall support various connectors/adapters for importing datasets of various types (textual, tabular or RDF data) and formats (e.g. txt, html, rdf, csv, xls).	UR-11	Core
FU-04	Import Dataset	System shall support import for single or multiple files.	UR-05	Optional
FU-05	Import Dataset	System shall support import for a directory of files.	UR-05	Optional
FU-06	Import Dataset	System should provide support to bulk upload in parallel.	UR-05, UR-07	Optional
FU-07	Import Dataset	System should provide support to resume upload in case of interruption (temporary network or system failure).	UR-07	Optional
FU-08	Import Dataset	System shall support various connections to Open API Services like Twitter Streaming/Search API, RSS etc.	UR-10	Core
FU-09	Import Dataset	System shall support various connections to Legacy Systems like RDMS/EDMS/CRM/Search Engine.	UR-06	Optional
FU-10	Import Dataset	System shall support connections to other already published data from other Open data platforms (C-KAN, D-KAN, Socrata).	UR-08	Core
FU-11	Refresh Dataset	System shall be able to refresh/update data for sources of real-time datasets (like Twitter, Sensors data) or frequently changing datasets (RSS).	UR-12	Core
FU-12	Dataset Aggregation	System shall provide functionalities for aggregating several datasets.	UR-13	Core
FU-01	Dataset Mashup	System shall provide functionalities to link to other datasets.	UR-13	Core
FU-13	Data Manipulation	System shall provide functionalities to clean/refine datasets.	UR-13	Core

FU-14	Data Storage	System shall support various storage repositories depending on properties of datasets (Triple Store, RDBMS, NoSQL, Search Engine).	UR-05, UR-06, UR-08, UR-09	Core
FU-15	Dataset Management	System shall offer functionalities for managing metadata of datasets.	UR-14	Core
FU-16	Dataset Management	System shall offer functionalities for managing access (read/write permissions) depending on user permissions (individual, group, universal).	UR-17	Optional
FU-17	Export Dataset	System shall export to various formats (RSS/Atom, text, CSV, RDF, etc) and provide a URL for remote access.	UR-18, UR25, UR30	Core
FU-18	Sociality	System should provide functionalities for creating and managing communities of users.	UR-16	Optional
FU-19	Sociality	System should allow user to follow and/or vote for datasets.	UR-26	Optional
FU-20	Sociality	System should provide connectivity to other social services (Google+, Twitter, Facebook, E-mail) for sharing datasets links.	UR-18	Optional
FU-21	Management	System should provide notifications (e.g. change in datasets).	UR-20	Core
FU-22	Notification	System should provide notification in case of change in datasets.	UR-20	Core
FU-23	Curation & Management	System should provide functionalities for adding/modifying data in datasets when allowed.	UR-28	Core
FU-24	Management	System should provide statistics of usage/access of published datasets.	UR-19	Core
FU-25	Visualization	System should provide functionalities for viewing full datasets or previewing parts of datasets with adapted visualizations.	UR-15	Core
	Visualization	Visualization should provide support for tabular form, charts (line, plot, histograms etc.) for displaying 2D data, time series, plotting data on a map for geo-spatial data.	UR-15	Core
FU-26	Search	System should provide federated search to repositories by providing adapted repository querying (Search Engine, RDF-Store, SQL etc.).	UR-21	Core
FU-27	Discovering	System should provide filter results by tags/criteria (faceted search).	UR-21	Optional
FU-28	API	System should provide RESTful Open API for all functionalities.	UR-30	Core

4.3 Non-functional Requirements

Table 7 provides non-functional requirements.

Table 7. Non-functional requirements

ID	Type	Description
NF-01	Scalability	The system should scale to large data volumes.
NF-02	Availability	The system should scale to a large number of simultaneous connected users.
NF-03	Availability	The system should include mechanisms to provide high availability of data and limited downtime.
NF-04	Availability	The visualization components should be characterized by a good response time.
NF-05	Hardware	Web client shall be supported by major browsers.
NF-06	Hardware	Mobile client shall be supported by major device OS.
NF-07	Portability	Platform Server side should be supported by major versions of Linux on commodity servers/PC.
NF-08	Availability	The system should offer back-up of data and be able to restore data from back-up.

4.4 Data Requirements

Table 8 provides examples of datasets needed in the use case. Basically the data needed will cover Social Data, Real-time data from sensors and other already available Open Data.

Table 8. Data requirements

ID	Description
DA-01	System should support importing Twitter Search Results (Static result from Search Result).
DA-02	System should support importing Twitter Stream Data (Real-time update from stream).
DA-03	System should support Sensor Stream Data (Real-time update from sensors).
DA-04	System should support importing Indicators from various perspectives (Air Quality, Bio-diversity, Household waste) given by Open Data Providers.
DA-05	System should support importing Personal data from Social Networks (Twitter, Facebook, FourSquare, etc.).

5 Summary and Outlook

In this deliverable we introduced the goals and objectives for the DaPaaS use case development which aim to provide an example of applications that can be developed and hosted in the DaPaaS platform. Market expectation and value positioning analysis were performed to understand and select the best use case for the project. We decided to target sustainability and QC (Quality and Cost) values. The evaluation metrics with 10 success factors and 12 potential applications were designed to select the best use case for the DaPaaS project. Location and tour service, VOC and environmental conservation applications were selected as having the best potential applications. Based on this analysis, we proposed an integrated use-case named 'Personalized and Localized Urban Quality Index (PLUQI)'. We defined PLUQI as 'a customizable index model and mobile/web application that can represent and visualize the level of well-being and sustainability for given cities based on individual preferences'. We introduced target users of PLUQI and potential business models in Section 2. In Section 3, we introduced some case studies and candidates of data sources to show feasibility of the use case including OECD Better Life Index, Gallup-Healthways Well-Being Index, The Urban Sustainability Index, etc. In Section 4 we provided 34 user requirements, 28 functional requirements, 8 non-functional requirements and 5 data requirements from the perspective of the use case.

Future activities around the use case will include:

- Identifying relevant open datasets (examples are included in Appendix A) and checking their suitability for the use case;
- Designing index models and evaluating them manually;
- Designing the architecture and user interface for the PLUQI application;
- Developing POC application on pilot DaPaaS platform;
- Test and evaluation of POC application.

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21. http://data.bgs.ac.uk
22. http://data.police.uk

Appendix A: Examples of Relevant Datasets for the Use Case

Table 9. Examples of available data sets

Data Set	Type	URL
Better Environment, Better Health	Excel	http://data.london.gov.uk/datastore/package/better-environment-better-health-guides-london-boroughs
Census housing	Excel	http://data.london.gov.uk/census/themes/housing
Official labour market statistics	Excel	https://www.nomisweb.co.uk
London's Economic Outlook Forecast	CSV, Excel	http://data.london.gov.uk/datastore/package/londons-economic-outlook-forecast
data.police.uk	CSV, API	http://data.police.uk
Annual Business Survey	PDF	http://www.ons.gov.uk/ons/rel/abs/annual-business-survey/2012-provisional-results/stb-abs-2012.html
Local Authority Collected Waste Management, London	Excel	http://data.london.gov.uk/datastore/package/local-authority-collected-waste-management-london
Household Waste (kg)	Excel	http://data.london.gov.uk/datastore/package/local-authority-collected-waste-management-london
Household Waste Recycling Rates, Borough	Excel	http://data.london.gov.uk/datastore/package/household-waste-recycling-rates-borough
Love Clean London	Map	http://lovecleanlondon.org/Reports/Home
Airtext	Map	http://www.airtext.info
London Average Air Quality Levels	Excel	http://data.london.gov.uk/datastore/package/london-average-air-quality-levels
Air Quality Focus Areas	GIS, Excel	http://data.london.gov.uk/datastore/package/air-quality-focus-areas
State of the Environment report for London	PDF, Excel	http://data.london.gov.uk/datastore/package/state-environment-report-london
Land Area and Population Density, Ward and Borough	Excel	http://data.london.gov.uk/datastore/package/land-area-and-population-density-ward-and-borough
Dwellings Numbers on Valuation List, Borough	Excel	http://data.london.gov.uk/datastore/package/dwellings-numbers-valuation-list-borough
London's Economy Today	PDF	http://www.london.gov.uk/priorities/business-economy/publications/londons-economy-today-archive
Climate Change Mitigation and Energy Strategy Model Data	Excel	http://data.london.gov.uk/datastore/package/climate-change-mitigation-and-energy-strategy-model-data
Transport for London	Open API	http://www.tfl.gov.uk/businessandpartners/syndication/16492.aspx
Bathing water quality	Open API (RDF)	http://environment.data.gov.uk/bwq/