IES Cities

Internet-Enabled Services for the Cities across Europe

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D4.4: Final Report on Existing Gaps and Improvements Performed

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1. Executive Summary

IES Cities is the last iteration in a chain of inter-related projects promoting user-centric and user-provided mobile services that exploit open data and user-supplied data. The technical components and achievements of several former European projects will be integrated to assemble an open Linked Data apps-enabling technological platform. Such platform will be deployed in different cities across Europe, allowing the citizens to produce and consume internet-based services (apps) based on their own and external open data related to the cities.

The IES Cities project's main objective is to facilitate the use of an open technological platform in different cities across Europe, allowing the citizens and businesses of those cities to provide and consume internet-based services based on data provided by the citizens themselves and external linked data related to the cities.

One of the main characteristic of the IES Cities project is that no project before has considered so much the extent of the impact that the users may have on improving the open data on which services are usually based. The user-centred approach has been considered since the beginning as a must for the success of the project. During the whole project the target groups have been considered as citizens, SMEs, ICT-Developing companies, local traders or industry and public administration.

IES Cities has adapted and used the technical components and achievements coming from the mentioned previous projects to facilitate the use of a single open technological platform. The technology platform has been unique and ubiquitous for all the cities. The cross border capabilities of the platform have been demonstrated due to the fact that the platform has been unique for the four cities involved in the project, and the services replicated in other cities during the second phase of the project.

To achieve the target outcome and expected impact, the evaluation framework and planning tasks evaluate the progress of pilots and identify gaps and improvements. This deliverable corresponds to the second phase identification of gaps and improvements.

2. Introduction

The aim of the task T4.4 is to report on the gaps identified and the improvements done during the second phase. This deliverable is analogous to the first phase report D4.3 – *Report on the Gaps, Improvements and Exchange of Services* [1], and takes it as an input to some of the improvements made during this second phase. For coherence reasons, the structure of this report is kept very similar to D4.3:

- First, in section 3 general aspects of the methodology followed and the execution plan are presented.
- Section 4 includes a summary of the gaps and improvements from the mentioned D4.3, as some gaps identified in it have been addressed during the second phase, and also some improvements done by then are strongly related to others recently accomplished. This section also updates some contents that were introduced in D4.3 regarding actions that were in a very early stage of their implementation, such as the exchange of services.
- In section 5, the IES Cities project partners have gone through a new iteration of identification of gaps and improvements, focusing on those that took place after the D4.3 submission. The new gaps identified followed the numeration used in D4.3, and also the new improvements reported are matched to all the gaps that address at some extent.
- The project reaches the end of its lifetime but some gaps, however, have not been completely addressed, and some improvements are too ambitious or simply are out of its scope. Thus, in section 6, some improvements and recommendations are included to be taken into consideration for what could be done beyond this project.

The identification of gaps and improvements is performed at different levels as was done in the first phase.

- Users were interviewed via e-questionnaires (WP5), filling predefined polls regarding the use of the applications of the pilots.
- Technology experts: the detection of gaps for the backend system, the overall system performance or the communications among the different existing devices was based on the existence of different try-outs and tests to check the performance.
- Possible improvements were the re-design of user interfaces for easiness of use, modification of certain communication models to avoid real-time connection problems, evaluation of commercial services for pilots including different cities, etc.

3. IES Cities Pilot Plan and Execution

3.1. Project planning for the identification of gaps and improvements

As mentioned in previous reports, during the proposal preparation stage it was decided to divide the IES Cities field trial in two different phases; pilot phase I and pilot phase II. Pilot phase I focused on the provision of specific city services, two per city, and the IES Cities Player, i.e. the common entry point to the IES Cities ecosystem that acts as catalyser of the interactions of a citizen with the set of micro-services (urban apps) available at their council. Pilot Phase II was more or less similar to the first one but, in this case, this trial did not only focus on the provision of two more services but also on the exchange of services among the cities.

As described in D3.1.1 – *Pilots Planning v1* [2] and D3.1.2 – *Pilots Planning v2* [3], both pilot phases followed the same structure (See Figure 1). Both trial phases were split into two further sub-phases: a) pre-pilot phase and b) pilot execution phase. The goal behind this decision was to enable a short internal subphase focusing on the full testing of the IES Cities infrastrucuture and services, involving a controlled and reduced group of stakeholders, before the public launch of the pilot open to all citizens and stakeholders.

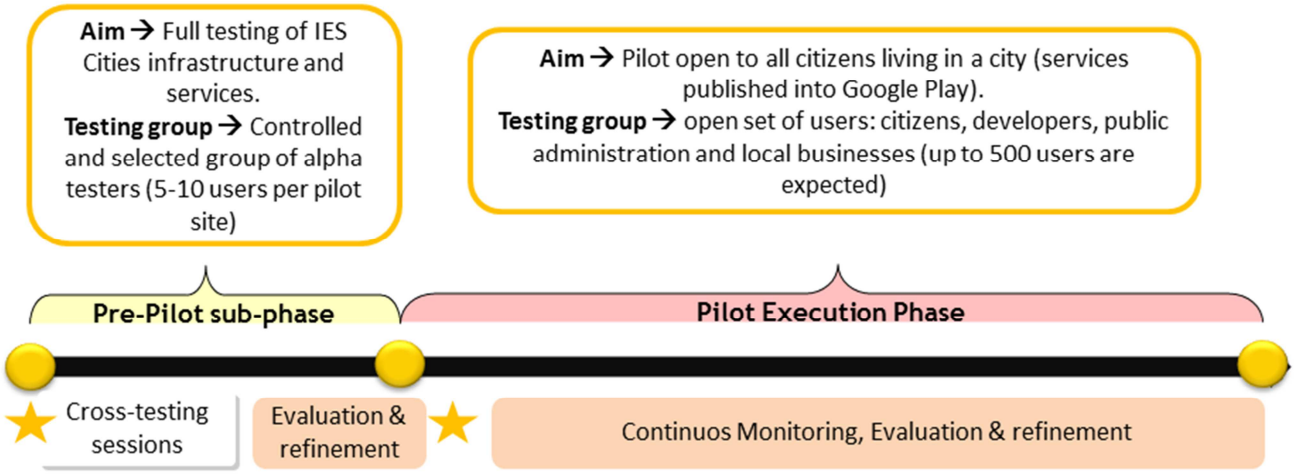

Figure 1 – Pilot phase II sub-phases

In both cases, the purpose of the first sub-phase was to check and review that the new features of the IES Cities infrastructure (back-end and player), but particularly the 4 services (2 old and 2 new ones), i.e. IES Cities-compliant apps, running on top of it are fully tested and mostly bug-free. This is why a controlled, selected and reduced group of alpha testers external to the project were involved and reported about their experience using the services and infrastructure. In addition to this group of external testers, two different three day cross-testing sessions were launched internally during the face to face meetings. In these sessions, each member of IES Cities consortium was assigned two specific services to test.

The feedback from the external and the internal testers was gathered through several means like interviews, alpha test questionnaires and the redmine tool for collecting all the identified technical bugs. This feedback allowed us to:

- apply necessary corrective actions to ensure a smooth execution of the second pilot phase and,
- make sure that all the services to be tested were properly instrumented with execution logs and in-app questionnaires so that the right details about them could be collected to be used then by WP4 in the pilot analysis.

The second sub-phase corresponded to the actual launch of the Pilot. In this subphase, the public release of the apps made all the apps available to anyone through the Google Play store or, alternatively, the IES Cities player. The evaluation and feedback collection was performed throughout this sub-phase by using the different mechanisms specified in the next section.

3.2. Methodology

There are a number of sources of information that the project has reflected on to produce the findings in this document:

- **Monitoring mechanisms: Application Logging and Project KPIs**

  Logs provide detailed information on how the apps are being used. We can extract data on such things as the number of active users apps have, their usage levels, and track how that varies over the months of the pilot, and in response to specific engagement activities or other events in the cities. Whereas logs are generic for all the project apps, KPIs provide more app-specific feedback on how the apps are used. These monitoring mechanisms are thoroughly explained in the D4.2 – *Report on the Monitoring of Results* [4].

- **Internal procedures, issues tracking and meetings**

  During the project execution, some tasks intrinsically deal with issues that have arisen in the pilot cities' apps and the IES Cities platform, and the action taken in response to them: the implementation of new features or improvements to the platform, technical developments, data uploads, performance tests, app cross testing sessions, and meetings (especially internal task-force meetings and the official Quarter Meetings).

  Most of the issues are dumped into the IES Cities issue tracking system site (Redmine). The majority of these relate to particular city apps and to the top level IES Cities Player app. Several relate to issues with the logging and rating system. There have been more than 200 issues reported into Redmine, what demonstrates that it has been a useful tool within the Project.

- **Feedback from stakeholders and Project partners**

  Information provided by the project partners and collaborators ad-hoc for this document, sharing their view on the existing gaps of the project, and feedback retrieved through questionnaires in the engagement campaigns from different stakeholders.

From the users' perspective: cross-testing sessions and alpha testing, (internal), in-app questionnaires, online questionnaires, study cases and in-depth interviews (mainly end users).

From the developers' perspective: internal questionnaire for technical developers (discussed in D4.2), feedback from the engagement of developers, study cases and in-depth interviews.

4. First Phase Gaps and Improvements Identified

4.1. Summary of Gaps identified for the First Phase

After the first phase trial execution, the report on the gaps D4.3 – *Report on the Gaps, Improvements and Exchange of Services* [1] collected the gaps identified by all partners from the users (US), technology developers (TD), City Councils (CC) and SMEs (SME) perspective. This information, dealing with all the project aspects ranging from technical to functional and procedural, can still be relevant, as some of these gaps have been addressed by new features and improvements and also, some of them may remain pending or partially solved, or even may be tackled beyond the project lifetime.

Before proceeding with a new iteration of gaps identification, this introductory section aims to present the summary of all of the gaps identified by the time the previous report was submitted, so the new ones can be clearly distinguished from the "old" ones, and also a global numbering can be followed enabling a global gaps to improvements matching. All these gaps were stated in the following table taken from the report on the gaps identified during the first phase of the project [1]:

Gap ID	Description
GAP-US-1	Users lack awareness of the IES Cities platform
GAP-US-2	Users confused about the function of the two public facing websites, https://iescities.com/IESCities/ and http://iescities.eu/
GAP-US-3	User engagement campaigns often lacked appropriate timing and placement.
GAP-US-4	Users had multiple issues with questionnaires: complex, confusing, tiring, hard to find. Also questionnaires were often irrelevant to local communities.
GAP-US-5	Apps offered only for Android users.
GAP-TD-1	Dataset access methods complexity
GAP-TD-2	Data update mechanism flexibility
GAP-TD-3	Permission management granularity
GAP-TD-4	User data support difficulty
GAP-TD-5	Internationalisation and Localisation
GAP-TD-6	Authentication with OAuth
GAP-TD-7	Insufficient backup measures
GAP-CC-1	Very little response from citizens about usefulness off apps
GAP-CC-2	Rebalance project schedule and deliberative citizen processes
GAP-CC-3	Plan the project for flexible city execution constraints
GAP-CC-4	Adapt project schedule to existing institutional programs and events
GAP-CC-5	Stress complementary platform features

GAP-CC-6	Slow response by end users to using the apps
GAP-CC-7	Slow roll-out of the platform
GAP-CC-8	IES Cities platform is yet another platform where data is hosted – need to keep development platform separate from active data sources
GAP-CC-9	Not enough engagement with end users before designing the platform
GAP-CC-10	Little number of feedbacks despite the large number of downloads
GAP-CC-11	The engagement activities could be enhanced by a more personal contact with the users. This could request a bit more of time in contrast with the strict deadlines of the project.
GAP-CC-12	Need to link the engagement activities to existing institutional programs and events
GAP-CC-13	Need to open to all the operative systems
GAP-CC-14	No downloads if there is no an activity or a contest
GAP-CC-15	Apps were not accomplished when we started to promote them
GAP-CC-16	Need to have an accurate definition of active user
GAP-CC-17	Little number of in-app questionnaires obtained
GAP-CC-18	Need to open apps to all platforms (i.e. not just Android)
GAP-SME-1	Slow roll-out of the platform
GAP-SME-2	Some reliability and stability issues with the platform
GAP-SME-3	Some issues with the platform documentation and announcement of changes
GAP-SME-4	Lack of functionality in the user management API
GAP-SME-5	Increase the number of datasets available for developers
GAP-SME-6	New structured methodology for engagement campaigns dealing with different stakeholders
GAP-SME-7	Redesign the in-app questionnaires' layout, extension and pop-up frequency
GAP-SME-8	In-app and online questionnaires events logging for monitoring via the swagger interface
GAP-SME-9	Swagger interface would benefit from inclusion of samples & tutorial material
GAP-SME-10	Web interface requires improvements in visualization and dataset content
GAP-SME-11	IES Cities API lacks certain services/APIs
GAP-SME-12	No app templates available for developers

Table 1 – Summary of gaps identified (first phase)

4.2. Summary of Improvements implemented after the First Phase

Similarly, deliverable D4.3 – *Report on the Gaps, Improvements and Exchange of Services* [1] reported many improvements that were either done or in progress at the time of D4.3 submission, addressing most of the gaps listed before. The improvements were also presented in a summary table, and were matched to the gaps in which they were supposed to have an

impact on, which were:

Improvement title	Relevant gaps
Dataset Access [IES Cities Platform]	GAP-TD-1
Data Update [IES Cities Platform]	GAP-TD-2
Permission Management [IES Cities Platform]	GAP-TD-3
User Data Management [IES Cities Platform]	GAP-TD-4
Internationalisation and Localisation [IES Cities Platform]	GAP-TD-5
Authentication with OAuth [IES Cities Platform]	GAP-TD-6
Backup Policies [IES Cities Platform]	GAP-TD-7
Reliability & Stability [IES Cities Platform]	GAP-SME-1 & GAP-SME-2
Documentation [IES Cities Platform]	GAP-SME-3
User Management API [IES Cities Platform]	GAP-SME-4
New features added [IES Cities Player]	N/A
Bug fixes [IES Cities Player]	N/A
Simplified Question List [In-app Questionnaires] Star Rating System [In-app Questionnaires] Web-page to display Interim Results [In-app Questionnaires] Target mostly Council and Developers Users [In-app Questionnaires] Improve Results Consistency [In-app Questionnaires]	GAP-US-4 GAP-CC-10 & GAP-CC-17 GAP-SME-7
Re-design Engagements Campaigns [Engagement Activities]	GAP-US-1, 2, 3 GAP-CC-2, 3, 4, 6, 9, 11, 12, 14, 15 GAP-SME-6
Service Availability in Web [IES Cities Services]	GAP-US-5 GAP-CC-13 & GAP-CC-18

Table 2 – Summary of improvements (first phase)

4.3. Results of the exchange of services

In D4.3 – *Report on the Gaps, Improvements and Exchange of Services* [1], it was also presented the exchange of services that have taken place during the second phase of the project.

This section includes the results of the work performed during this last phase in task T4.5 Tuning and Exchange of Services. The goal of this task has been to detect the required technical adjustments on the IES Cities platform and decide how to perform the selection and exchange of city developed services during the second phase of the project.

The first goal of the task was shared with the objectives of the task T4.4 and, therefore, their results were included in Chapter 5 of deliverable D4.3 Report on the Gaps, Improvements and Exchange of Services. That section included the justification for the creation of new services

during the second phase of the project and the exchange among project's participants of those previously developed services.

The name of the services tested during the second phase pilots, for each city, are the following:

- **Zaragoza**
  - Zaragoza App Store
  - Zaragoza Participa (previously planned as *Filling Spaces*)
- **Bristol**
  - Bristol Healthy Office
  - YouDecide (previously known as Bristol Voting)
- **Rovereto**
  - Rovereto Percorsi
  - Rovereto Segnala
- **Majadahonda**
  - Sports4U
  - In-Route (previously known as *Majadahonda Maps*)

Although during the first phase of the project it was planned by Zaragoza's task force to replicate and adapt the work done by Bristol to create the *Democratree* app, it was finally decided that for the second phase the two task forces were going to collaborate to create a common voting application with a shared functionality that will be adapted and particularized for the cities of Bristol an Zaragoza.

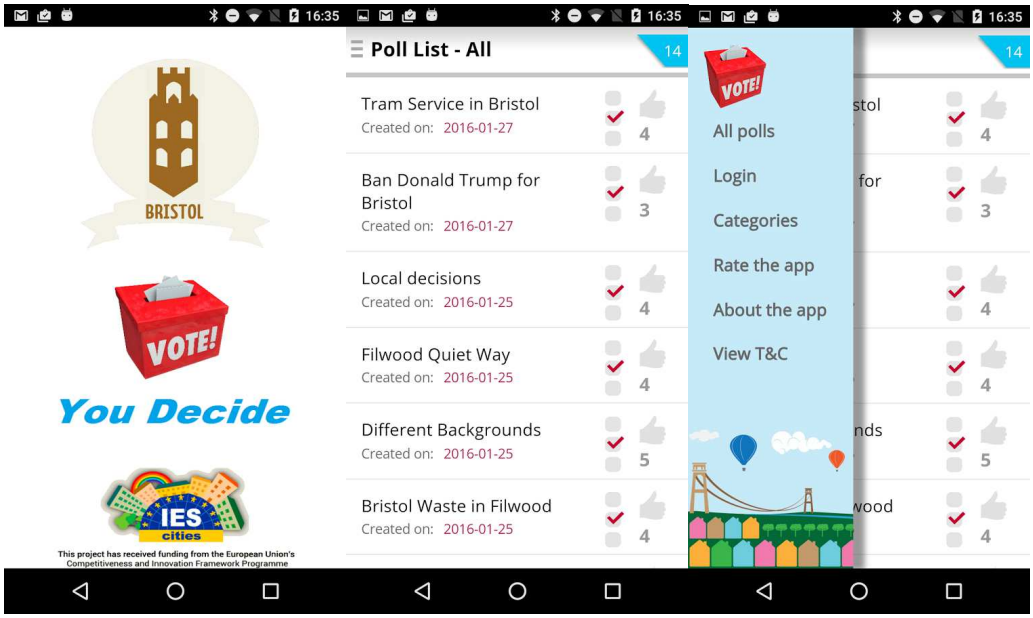

Figure 2 – Example of a customized app template

The efforts applied to the creation of this common application during the second phase have served, in addition, to the creation of a common template that can be used by future application developers to create services with a common Look & Feel and interaction. This application template, which contains a lateral menu and other common options can customized by developers for their particular applications, reducing the development and integration times with the IES Cities platform.

Figure 2 shows the template created for the common voting application, in this case customized for the Bristol's YouDecide application.

4.4. Comments on First Phase Gaps and Improvements

Taking as basis the gaps identified during the first pilot phase of the project and which were detailed in D4.3 several improvements were performed at management level as well as on the engagement methodology before the starting of the second phase of the trial with the aim of facing some of the gaps identified.

- **New methodology for the engagement campaigns:**

  Concerning the engagement methodology, a new approach was defined [5] **[addresses gaps: GAP-US-1, GAP-US-2]**

  The new approach defined a new one more flexible and responsive **[addresses gaps: GAP-US-3, GAP-CC-4, GAP-CC-12 and GAP-SME-6]**

  During the second phase of the engagement campaigns stakeholders were considered separately **[addresses GAP-CC-9, GAP-CC-11]**

  On the other hand feedback was redesigned, and mainly obtained based on active users: **[addresses gaps: GAP-US-4, GAP-CC-1, GAP-CC-6]**

- **Project plan flexibility:**

  Several partners demanded a more flexible and adaptive schedule within the project. The consortium is doing their best to deal with the organisational issues that arise, being also aware of the external constraints, limitations and the changes in the IES Cities city councils strategies due to elections. To cope with this kind of issues, during the whole project duration and mainly in pilot phase I and pilot phase II, as many as possible actions were taken like for example the phase I and II reschedule and extension, and the readjustment of deadlines **[addresses gaps: GAP-CC-2,3,4,12].**

- **New questionnaires:**

  One of the main issues identified after the analysis of the feedback was related to the low number of citizens (end-users) who completed the online and in-app questionnaires. In order to overcome this challenge and after a deep discussion, it was decided to create simplified and reduced versions for both the in-app and on-line questionnaire (both questionnaires are further described in section 5.2.5, or more in depth in D3.1.2 – *Pilots*

Planning v2 [3]). Before its roll-out, both questionnaires were tested during the pre-pilot phase by a set of users external to the project.

- **New datasets:**

  As a result of several hackathons celebrated in the project cities a significant number of datasets has uploaded into the platform. At the time of writing, the total number of datasets available per city is: Bristol (18), Majadahonda (9), Rovereto (10), Zaragoza (24), respectively **[addresses gap: GAP-SME-5].**

- **New app templates:**

  From the different hackathons organised so far the consortium has realised that a good way to foster the creation and publication of new public services by the developers community is by offering them a set of application templates that covers the most common types of screens: main menu, register form, search form… as well as offering a common look & feel for all the applications addressing a specific city council. This improvement will also drive into a reduction of the development time spent by developers. A publicly available template can be found at https://bitbucket.org/IES_Cities/app-zaragoza-voting-public/. The styles (CSS) and views (HTML templates) can be found at folders voting/www/style and voting/www/partials, respectively **[addresses gap: GAP-SME-12].**

5. Second Phase Gaps and Improvements Identified

5.1. Gaps identified by the stakeholder groups

This section of the document reports the gaps that were identified during the second phase of the project, based on input from the various stakeholder groups of the project:

- Users: ALL PARTNERS
- Technology Developers: UD, TECNALIA, EUROHELP, TOSHIBA, FBK, ZIB
- City Councils: ZARAGOZA, BRISTOL, ROVERETO, MAJADAHONDA
- Small Medium-sized Enterprises (SMEs): EUROHELP, GEKO, KWMC, TOSHIBA

At this point it is worth noting that there is a certain overlap between partner roles in the project, as some SMEs are also technology developers for the project. Therefore, there might be a relevant overlap in the reported gaps across some of the gaps subsections.

Before covering these, there is a topic which was reported during the first phase [GAP-US-5, GAP-CC13,18], transversal to all pilot cities and still present, that has been reported by several kind of partners in this phase too: the users demand for having the pilot apps in other mobile operating systems, mainly iOS. This is undoubtedly useful to reach greater audiences, but due to the current project schedule and work plan, it will be one of the recommendations for future improvements.

The gaps enumeration in these subsections will follow that used in Table 1, so each issue has a unique reference along the whole document.

5.1.1 Gaps identified by Users

During the second phase of the project, the partners have identified and collected information about the following gaps from the IES Cities project users' perspective (stakeholders):

- **Unawareness of IES Cities Player:** The analysis of the users´ feedback proves that there is still a lack of awareness of the IES Cities player. This gap is strongly related to GAP-US-1 reported in the first phase, which stressed this issue with the overall platform rather than only IES Player.
- **Login alternatives in both the apps and the web interface:** Users expected to be able to login using their email address instead of their username but, it doesn't work with the email/password combination. Login is neither possible using Facebook/Twitter/Google accounts. These are critical gaps that may be preventing developers from using the IES Cities web interface functionality.
- **Password recovery:** Users frequently forgot their passwords and couldn't find an easy way to reset their password, as some apps did not have the "reset password" functionality implemented. The web interface is also experimenting issues related to this missing feature.

- **Slow response time in apps:** Users sometimes complained about slow response times within the apps, particularly when retrieving data through the apps' online services.
- **Public Administration fully commitment with open data:** Some public services require a high involvement of the public administration in the process of content creation. In the cases either the end-users or any other stakeholder detect that some application contents are not up to date or even not generated in a regular basis, this will result in a low usage of the applications.
- **Open data quality:** In order to foster the creation of an ecosystem of public services addressing citizens´ and other stakeholders´ needs, the developers' community must be engaged. To ease the development process and reduce the development time, datasets publicly available should have a minimum quality and not to be in unstructured formats; e.g. pdf files. Public administrations should make open data available as structured data (Excel, CSV, RDF formats…). This gap is strongly related to [GAP-SME-5].
- **Co-design apps with stakeholders:** Citizens and other stakeholders are willing to be part of the design process of the applications. This will ensure that the public services are designed addressing their needs.
- **Reduce the learning curve of the platform:** From a developer perspective, IES Cities is a useful platform for developing complex apps. However, in the cases of simpler applications, the time to be devoted to understand the platform and how it works is higher than the development time itself. If only some scenarios and examples explaining and proving how to use the platform were provided, the learning curve could be reduced and therefore, the value added, increased. In the first phase, [GAP-SME-10] highlighted the benefits of this measure specifically aimed at the swagger interface.
- **Full integration of Swagger Interface into the web interface:** When you are browsing the swagger, it is sometimes difficult to check at the same time the list of datasets and the fields of each dataset. Besides, when browsing the IES Cities Web interface (www.iescities.com) some of the functionality is not fully integrated giving the sense you are in a different tool.
- **IES Cities web interface friendliness.** Given the feedback received from the participants in several technology workshops organised during the second pilot phase, it may be concluded that a restyling of the current web interface is recommended in order to make it more innovative and contemporary. Developers also suggested to include more information like some screenshots about apps and to indicate somehow the level of trustworthiness of a published app through the web interface. Developers suggested to add a first level check before publishing the application (Public administrations or civil servants should switch application state from "pending" to "approved/published"). Only "approved" applications should be visible and part of the IES Cities ecosystem. Related to the application publication process, the publication form should also be updated to make it more appealing and intuitive.

- **Access and indicators for the developers' services:** As the IES Cities Web Interface allows developers publishing public services, the developers community also expects to have access to a dashboard showing some key performance indicators about their apps.

Gap ID	Description
GAP-US-6	Users lack awareness of the IES Cities Player
GAP-US-7	It is not possible to login with email/password combination neither with social networks credentials in some apps and also in the web interface.
GAP-US-8	Password recovery feature in some apps and also in the web interface is missing or not working.
GAP-US-9	Apps sometime lag while retrieving data from their online service or their response time is too slow.
GAP-US-10	Fully commitment of the public administration is needed to feed the apps with content and keep it up to date.
GAP-US-11	Quality and well-structured open data availability is a must to engage developers.
GAP-US-12	Public administrations should foster the apps co-design with citizens, civil servants and other stakeholders.
GAP-US-13	Improve platform manuals adding usage scenarios to reduce the learning curve.
GAP-US-14	Friendliness of the Swagger and IES Cities web interface should be improved by means of their fully integration.
GAP-US-15	IES Cities web interface should include a specific dashboard for developers' apps.

Table 3 – Gaps identified by users

5.1.2 Gaps identified by Technology Developers

During the second phase of the project, developers and technical partners have identified the following gaps in the IES Cities platform.

- **High memory requirements:** The server users a high quantity of memory resources when processing JSON datasets, which results in a low stability (frequent server crashes) and high response times during requests.
- **Missing ability to translate council and dataset metadata:** In the entity management (account-interface), metadata such as names, descriptions and images of councils and datasets cannot be translated into other languages for e.g. tourists to browse the catalogue.
- **User management API could ideally have more features, such as username reminders or login with email instead of username.** This gap has much in common with [GAP-US-7] and it is related to the enhancement possibilities previously identified in the first phase as [GAP-SME-11].
- **Libraries for native applications:** The libraries are easy to be integrated in hybrid apps but they are missing for native applications.

- **Highly scalable platform:** For large-scale deployments with multiple thousands of active users, an easily deployable, highly scalable variant of the platform was missing.
- **Open-source app templates:** Following the idea behind [GAP-SME-12] and focusing on the exchange of services, in order to reduce the development time, the publication of application templates as open source should be considered.
- **Data queries interrupted during data source update:** When updating information provided by external data sources the system is not capable of returning new queries until the update process is finished.
- **Updates in server & platform resulted in app malfunction:** Some updates in the platform itself or to the hosting server meant that apps were getting unexpected responses from the platform, thus inducing some malfunctions in the apps.
- **Server's availability issues have a negative impact in the users:** A high availability platform should be considered in order to offer a non-stop service.
- **Platform response is very slow:** Even when responding to simple queries, the platform response time is occasionally very long.
- **Social wrapper late implementation:** this functionality was implemented too late in the project to be really useful for the second phase apps.
- **JSON import issues:** The process that should detect the JSON datasets not always imports them properly.
- **Platform deployment process is not very stable:** Deploying the platform to a new server is not always an easy process, as installation error occurs that prevent the proper function of the platform.
- **Simpler methods of backing up and migrating data:** from the platform would ease acceptance of the platform and assist in deploying the platform. [GAP-TD-2,7]
- **Personal data removal and transfer to comply with Data Protection Rule:** for the IES Cities to be fully compliant with the new upcoming European Data Protection Rule two new features should be added into the solution, i.e. a feature to remove personal data (right to forget) from IES Cities platform and another one to allow users to extract and transfer personal data from IES Cities to other solutions.

Gap ID	Description
GAP-TD-8	High memory requirements.
GAP-TD-9	Missing ability to translate council and dataset metadata.
GAP-TD-10	User management functionality lacks features.
GAP-TD-11	Libraries for native applications.
GAP-TD-12	Highly scalable platform

GAP-TD-13	Application templates publication as open source
GAP-TD-14	Data queries interrupted during data source update
GAP-TD-15	Updates in server & platform resulted in app malfunction
GAP-TD-16	Server's availability issues have a negative impact in the users
GAP-TD-17	Slow response from platform at times
GAP-TD-18	Social wrapper functionality not very useful
GAP-TD-19	Auto-detection of JSON datasets not always works.
GAP-TD-20	Platform deployment process is not very stable
GAP-TD-21	Simpler backup and data migration methods
GAP-TD-22	Personal data removal and transfer to comply with Data Protection Rule

Table 4 – Gaps identified by Technology Developers

5.1.3 Gaps identified by City Council Administrators

This section presents the gaps, as identified by the city councils participating in the project.

5.1.3.1 Zaragoza

As it was reported in the first phase, it is extremely important that the project can be more flexible in order to consider institutional processes, like elections that could entail deep changes, with project milestones. In addition to gaps already identified in the previous stage (and persisting in this second phase) [GAPS-CC-1-5], we have identified the following new gaps:

- **Rethink questionnaires as an effective support channel:** Questionnaires have not revealed to be very useful to retrieve user feedback. This may be as a result of the apps being successful and issue free, or more likely, a slow response by end users.
- **Consider more qualitative KPIs**: The set of KPIs could be improved to better reflect the qualitative side and subtleties of citizen's engagement.
- **Keep including more datasets:** The hackathons held proved to be a valuable initiative to gather developers, entrepreneurs and SMEs to experience IES Cities platform and open datasets. The outcomes were really satisfactory; however, the assistants asked that more datasets were added to Zaragoza open catalogue in order to create new innovative apps. This, which at first sight might seem a gap, because we are not providing open data as quickly as developers request, on a second thought it could be described only as an improvement, in the sense of we should keep pace with developers in order to supply new datasets.
- **Apps should be co-designed with citizens:** One of the things we have learnt in this second stage is that counting on citizens from the very beginning of the creation phase of the apps, brings better results in many ways. Users and developers are, obviously, keen

on apps, but they prefer even more feeling part of the process of creating them. “Zaragoza Participa” has been a clear example of this.

Gap ID	Description
GAP-CC-19	Rethink questionnaires as an effective support channel or evaluation method.
GAP-CC-20	Consider more qualitative KPIs.
GAP-CC-21	Keep publishing new open datasets or introducing enhancements in the available ones, if possible, as fast as developers expect.
GAP-CC-22	App design should count on citizens from the beginning of all our apps.

Table 5 – Gaps identified by the Zaragoza City Council

5.1.3.2 Bristol

Bristol City Council has identified the following gaps:

- **Council requires 24/7 security, support, hosting and management:** The IES Cities platform has been part of our learning in the development of Bristol City Council’s open data strategy and has enabled more transparency and app development in existing datasets. However, the key issue we have faced in using the platform is that, as a Council, we require a platform that has the 24/7 security, support, hosting and management that a stand-alone platform cannot provide us with. Within Authorities open data programmes are often the responsibility of teams which are not available 24/7 and do not have a high level of technical expertise (i.e. Democratic Services, Research-Consultation). As a result, a key requirement for these types of teams is that an open data platform is available as a highly useable, secure, hosted and managed service rather than a locally installed and managed instance.
- **Longevity of platform and data sets required for developer confidence:** We are also aware of the implications of the longevity of the IES Cities platform, and wanted to be able to offer developers the confidence that their data sets would be readily available into the future. Because of the required investment of time, significant development of open data based services, particularly commercial services, will only take place once the developer community feel confident that the open data platform is robust, the data is refreshed and the service will continue into the foreseeable future.
- **Lack of flexibility in IES Cities project:** The milestones and project plan for IES Cities did not always tie into the existing plans we had in place as a Council for our open data strategy activities. As our programme developed, it would have been useful to have some flexibility within the project to be able to reflect our Council priorities and plans. As a result, the activities sometimes clashed with existing work we were undertaking, meaning that the opportunities were not always able to be maximised to their full benefit. Despite this, IES Cities has meant that we have been able to develop learning in collaboration with other cities internationally, which has brought a wealth of new

understanding on citizen engagement approaches and app development within a city. This has complemented our work on the open data platform on a UK basis and we will be taking this learning forwards to inform future work streams.

Bristol City Council has an open data strategy in place, and an accompanying open data platform that is a key tool in developing our Government as a Platform approach. This is currently a pilot platform (with Socrata) and we will be procuring a full sophisticated platform in 2016. As part of this procurement, the tender will include the requirement to feed in the existing datasets from the IES Cities platform so that the existing apps can become sustainable into the future. The IES Cities platform has enriched the Council's open data strategy and work and has brought the opportunity to deliver several apps that we may not have developed otherwise. These apps (Healthy Office and YouDecide) have been very useful in our understanding of how data provided by users can be used to direct policy at an organisational level, and also be used to attract and unlock new users to existing exercises that the Council carries out.

Bristol City Council has seen the benefit in the IES Cities project and is planning on taking forwards at least one of the apps (YouDecide). We are hoping to further develop the app and make it sustainable as we have seen the value that a different approach to citizen engagement can enhance our work as a Council. We see this app as a way of using technology to interact with different user groups within the city, which will strengthen our ability to deliver services to our citizens which more directly meets their needs. In this way, the IES Cities platform has been part of our learning and supports the strategy to provide open data based on user needs to enrich and provide for citizens needs within the city of Bristol.

Gap ID	Description
GAP-CC-23	Council requires 24/7 security, support, hosting and management within a platform.
GAP-CC-24	Longevity of platform and data sets required for developer confidence.
GAP-CC-25	Lack of flexibility in IES Cities project plan.

Table 6 – Gaps identified by the Bristol City Council

5.1.3.3 Rovereto

Rovereto City Council has identified some new gaps:

- **Flexible project milestones:** The developing time of a new application and its promotion often are not compatible with the local administration times, especially when there must be integration between the app and already existing systems within the P.A. This means that if the promotion plan cannot be re-scheduled, it can happen that the app is not in a stable version during the promotion, thus not fully engaging the early users of this app. This could be solved with more flexibility in terms of project milestones.
- **Changes in Council strategy due to Elections:** Elections and the change in city government during project lifetime should be taken into account, with flexible milestones

and re-planning possibilities. In Rovereto's case changing council led to a different point of view on one application and on which stakeholders to engage, thus it should have been possible to update KPI target values to align them with the new strategy.

Gap ID	Description
GAP-CC-26	Flexible project milestones.
GAP-CC-27	Changes in Council strategy due to Elections.

Table 7 – Gaps identified by the Rovereto City Council

5.1.3.4 Majadahonda

We keep on finding it difficult to get the users to download the apps if there are no engagement campaigns trying to encourage them by means of prizes or draws [GAP-CC-14]. The apps have a slow increasing trend regarding downloads on their own, but it's far from what is expected to be achieved within the project phase.

Also, Majadahonda City Council has identified some new gaps:

- **Pilot phase effective duration shrunk due to Council incompatibilities:** Similarly to what was reported also in the first phase, it is crucial to have stable versions of the app by the times they are promoted. We have faced the same consequences of [GAP-CC-15] as the apps suffered a slight delay, the government in the city changed after the elections and the cross testing of Majadahonda Sports4U with sport centres was done in a very late stage of the pilot. Thus, many of the features were rearranged or fixed with newer versions of the app, not fully engaging the early users of this app.
- **Involve stakeholders in the apps' design since the very beginning:** Related to the difficulties found to get users engaged, it is crucial for the future to engage and involve end-users and other stakeholders from the very beginning, allowing them to participate actively during the application ideation and design, fostering public services co-definition and co-creation. In this way, public services design will address citizen´s needs and preferences, which will ease the engagement process both in the short and long term. The main purpose of the application and its features has to be fully aligned with these user requirements.
- **City Council departments should collaborate on providing and keeping up to date contents:** From our experience in Majadahonda, one of the main reasons for a low usage of the applications is related to the applications' contents. The public administration should take the role of content generator in order to dynamize the application usage by populating the applications with real-time content. Majadahonda City Council departments should seamlessly and efficiently towards the achievement of a larger and more appealing collection of open data, to be presented in the public services and offered to local developers.

- **Ensure data quality, reliability and integrity of public datasets:** Most of the applications are built on top of the open government data repositories. Then, Public Administration should ensure data reliability and integrity of those repositories where it acts as a manager. The data quality is very important as well in order to engage the developers community and foster the creation of an ecosystem of public services addressing citizens´ and other stakeholders´ needs. Public administrations should make these open data available in a structured, valid format (Excel, CSV, RDF formats…)

Gap ID	Description
GAP-CC-28	Pilot phase effective duration shrunk due to Council incompatibilities.
GAP-CC-29	Involve stakeholders in the apps' design since the very beginning.
GAP-CC-30	City Council departments should collaborate on providing and keeping up to date contents.
GAP-CC-31	Ensure data quality, reliability and integrity of public datasets.

Table 8 – Gaps identified by the Majadahonda City Council

5.1.4 Gaps identified by SMEs

This section presents the gaps, as identified by the SMEs participating in the project.

5.1.4.1 EUROHELP

EUROHELP has identified the following gaps:

- **Tools to help sharing services:** There are not tools in the platform to help in the exchange of services between cities. For instance, to copy datasets structures and app templates.
- **Skilled developers are required to use the services:** The use of platform's tools and services requires some training for developers.
- **More tools to monitor the system:** Lack of integrated tools to monitor the use of datasets (dashboard).

Gap ID	Description
GAP-SME-13	Tools to help sharing services.
GAP-SME-14	Skilled developers are required to use the services.
GAP-SME-15	More tools to monitor the system.

Table 9 – Gaps identified by EUROHELP

5.1.4.2 GEKO

GEKO has identified the following gaps:

- **User data management has been transparent to most partners:** The fact of dealing with users' personal data is a well-known matter along the project, clearly stated - for instance - in the terms and conditions form. However, mainly the City Councils and KWMC are the only partners fully aware of this issue and its practical implications, as they have been in charge of the execution of the engagement campaigns. The rest of us have gone through the project without extracting enough valuable information, and thus, we have missed the opportunity to learn about it, which is a crucial issue for the exploitation of results in this project, and probably, in many others.
- **Lack of a long-term open data roadmap in Majadahonda:** The open data governance is, to our view, a very novel activity within the Majadahonda City Council, and by now, the resources employed and the technical developments achieved are according its level of maturity. IES Cities project has supposed a kind of first contact with a new revolutionary paradigm in which the City Council has been able to learn from the experience of more open data-ready cities, and how to set, launch and promote public services with the help of technical and non-technical partners. However, Majadahonda has still a long way to establishing an open data ecosystem in the city, in which a long-term roadmap definition involving local stakeholders is crucial and urgently needed.
- **Maintenance of IES Cities Services:** Majadahonda Healthy City has faced technical issues and requires sensors' maintenance tasks. Also, the contents in other apps, such as events in Majadahonda Leisure & Events or public maps in In-Route, have to be up to date, renewed or periodically enhanced. The provision of good quality open data content in both the apps and the platform is a key element for engaging users and stakeholders in the project. All in all, this requires some constant "maintenance tasks" from the City Council.
- **Alternative business model not relying only in the Public Administration:** Most of the pilot cities services' maintenance and engagement are dependent on its City Council's budget and effort. This business model poses a risk to the survival of many apps in the market, as they haven't managed to raise enough value to users to pay for them, or to developers to make money from them. Thus, they will be severely affected by the fluctuations and adjustments of the City Council's budget, and the system will not be able to scale. The implementation of the project has considered alternative business models, but they could not have been evaluated in a realistic way so far.

Gap ID	Description
GAP-SME-16	User data management has been transparent to most partners.
GAP-SME-17	Lack of a long-term open data roadmap in Majadahonda.
GAP-SME-18	Maintenance of IES Cities Services.
GAP-SME-19	Alternative business model not relying only in the Public Administration.

Table 10 – Gaps identified by GEKO

5.1.4.3 KWMC

KWMC has identified the following gaps:

- **More iterative, longer and overlapping periods for engagement, development and collaboration:** Having a larger development time to respond to user feedback would have meant a higher increase in use. We also found it difficult to meet the needs of relevant stakeholders, for example One Tree for Democratree, or political and e-democracy teams for YouDecide. Main issues for this audience were robustness of the app, the resources to change the app to suit their needs within the timeframe of the project, and the security guarantee for users. We would suggest longer development and overlapping engagement periods. The co-development of the app for YouDecide could have been more collaborative – we are aware this would have worked better of the timelines had been different, but the opportunity was taken to use an app that rang true with the needs of the city's citizens.
- **Unsustainable engagement of non-Android users and untracked activity:** Many users were unable to engage as they had iOS devices. We managed to engage people through our tablets but this meant no new downloads recorded and users unable to sustain engagement once they left the session. Sharing devices has skewed our numbers of users negatively due to the way logging mechanisms have been designed.
- **Responsiveness and reliability of the apps:** We experienced issues with the response rate and reliability of the apps, sometimes due to the platform and sometimes due to users using our devices on the streets.
- **The Democratree app had many developers involved at different stages** – this slowed down the process and led to complications for Toshiba.
- MyBristol would have benefitted from MyKW and other community apps to be under one umbrella, allowing cross posting and more streamlined and synced processes for users.
- Healthy Office could have integrated sensor data rather than living on a separate platform.

Gap ID	Description
GAP-SME-20	More iterative, longer and overlapping periods for engagement, development and collaboration
GAP-SME-21	Unsustainable engagement of non-Android users and untracked activity
GAP-SME-22	Responsiveness and reliability of the apps
GAP-SME-23	The Democratree app had many developers involved at different stages
GAP-SME-24	MyBristol would have benefitted from MyKW and other community apps to be under one umbrella.
GAP-SME-25	Healthy Office could have integrated sensor data

Table 11 – Gaps identified by KWMC

5.1.4.4 TOSHIBA

Toshiba has identified the following gap:

- **Co-development of shared app lacked some coordination:** The co-development of the Bristol YouDecide service was not as efficient as it could be, as some delays and unplanned changes on one end resulted in significant delay to the other end. Although the end result was eventually very good, more coordination would have proven beneficial.

Gap ID	Description
GAP-SME-26	Co-development of shared app lacked some coordination.

Table 12 – Gaps identified by TOSHIBA

5.1.5 Summary of Gaps identified

During the second phase of the project a number of gaps where identified in various areas of the project and by various stakeholder groups, such as end-users or technology developers. These gaps are briefly summarised in the following table:

Gap ID	Description
GAP-US-6	Users lack awareness of the IES Cities Player
GAP-US-7	It is not possible to login with email/password combination neither with social networks credentials in some apps and also in the web interface.
GAP-US-8	Password recovery feature in some apps and also in the web interface is missing or not working.
GAP-US-9	Apps sometime lag while retrieving data from their online service or their response time is too slow.
GAP-US-10	Fully commitment of the public administration is needed to feed the apps with content and keep it up to date.
GAP-US-11	Quality and well-structured open data availability is a must to engage developers.
GAP-US-12	Public administrations should foster the apps co-design with citizens, civil servants and other stakeholders.
GAP-US-13	Improve platform manuals adding usage scenarios to reduce the learning curve.
GAP-US-14	Friendliness of the Swagger and IES Cities web interface should be improved by means of their fully integration.
GAP-US-15	IES Cities web interface should include a specific dashboard for developers' app.
GAP-TD-8	High memory requirements.
GAP-TD-9	Missing ability to translate council and dataset metadata.
GAP-TD-10	User management functionality lacks features.
GAP-TD-11	Libraries for native applications.

GAP-TD-12	Highly scalable platform
GAP-TD-13	Application templates publication as open source
GAP-TD-14	Data queries interrupted during data source update
GAP-TD-15	Updates in server & platform resulted in app malfunction
GAP-TD-16	Server's availability issues have a negative impact in the users
GAP-TD-17	Slow response from platform at times
GAP-TD-18	Social wrapper functionality not very useful
GAP-TD-19	Auto-detection of JSON datasets not always works.
GAP-TD-20	Platform deployment process is not very stable
GAP-TD-21	Simpler backup and data migration methods
GAP-TD-22	Personal data removal and transfer to comply with Data Protection Rule
GAP-CC-19	Rethink questionnaires as an effective support channel or evaluation method.
GAP-CC-20	Consider more qualitative KPIs.
GAP-CC-21	Keep publishing new open datasets or introducing enhancements in the available ones, if possible, as fast as developers expect.
GAP-CC-22	App design should count on citizens from the beginning of all our apps.
GAP-CC-23	Council requires 24/7 security, support, hosting and management within a platform.
GAP-CC-24	Longevity of platform and data sets required for developer confidence.
GAP-CC-25	Lack of flexibility in IES Cities project plan.
GAP-CC-26	Flexible project milestones.
GAP-CC-27	Changes in Council strategy due to Elections.
GAP-CC-28	Pilot phase effective duration shrunk due to Council incompatibilities.
GAP-CC-29	Involve stakeholders in the apps' design since the very beginning.
GAP-CC-30	City Council departments should collaborate on providing and keeping up to date contents.
GAP-CC-31	Ensure data quality, reliability and integrity of public datasets.
GAP-SME-13	Tools to help sharing services.
GAP-SME-14	Skilled developers are required to use the services.
GAP-SME-15	More tools to monitor the system.
GAP-SME-16	User data management has been transparent to most partners.
GAP-SME-17	Lack of a long-term open data roadmap in Majadahonda.
GAP-SME-18	Maintenance of IES Cities Services.

GAP-SME-19	Alternative business model not relying only in the Public Administration.
GAP-SME-20	More iterative, longer and overlapping periods for engagement, development and collaboration
GAP-SME-21	Unsustainable engagement of non-Android users and untracked activity
GAP-SME-22	Responsiveness and reliability of the apps
GAP-SME-23	The Democratree app had many developers involved at different stages
GAP-SME-24	MyBristol would have benefitted from MyKW and other community apps to be under one umbrella,
GAP-SME-25	Healthy Office could have integrated sensor data
GAP-SME-26	Co-development of shared app lacked some coordination.

Table 13 – Summary of gaps identified (second phase)

5.2. Improvements Implemented

This section reports on the improvements that were made to the various components of the project, after the second phase gaps were identified. The improvements are presented in the following subsections, with each subsection representing a different component category:

- IES Cities Platform
- IES Cities Web Interface
- IES Cities Services
- IES Cities Player
- Questionnaires

Where relevant, each improvement is associated with the appropriate gap (e.g. GAP-TD-x). It is worth noting though, that not all improvements reported below are directly associated with a particular gap; several improvements have resulted as a natural outcome of the development progress.

5.2.1 Improvements to the IES Cities platform

Taking into account the gaps identified during the first and second phases of the project, as summarised in section 5.1.5, the final version of the IES Cities Platform has been improved in the following areas:

- **Event based data processing mechanism:** the problem with data processing, especially for JSON data sources, has been solved by using an event based processing mechanism instead of loading the data to memory before processing it. This change has reduced the memory consumption of the solution and has reduced significantly the number of server crashes produced due to this cause. **[addresses gap: GAP-TD-8].**
- **Support for translating more metadata types:** The 'i18n' branch of the IES Cities platform git repository contains an updated version of the platform including the ability to

provide translated version of the remaining entities. Support for translating applications has already been integrated into a previous version of the platform. **[addresses gap: GAP-TD-9]**

- **New Scalaris back-end support:** The 'scalaris' branch of the IES Cities platform git repository contains updated example configuration files and pom.xml dependencies to run the whole platform with the transactional key-value store Scalaris as its data back-end. This back-end does not only allow a scalable platform solution for but also replicates stored data among four Scalaris nodes and may thus also increase data persistence. **[addresses gap: GAP-TD-12]**
- **Data queries no longer interrupted during update.** The current implementation of the update mechanism uses a temporal storage mechanism that allows responding to queries while the data is being updated. This way the system is capable of answering queries without blocking. **[addresses gap: GAP-TD-14].**
- **Query mapper data source management improved:** The Query mapper has been improved to be more robust and to detect problems in mapping files. Incorrect mappings and errors during data extraction are stored into an internal database that can be used by administrators to detect problems in data management. **[addresses gap: GAP-TD-19].**
- **Bugs resolved in log query mechanism.** The unit tests exposed a couple of bugs. One was an infinite loop caused by a function rename and the second related to a newer version of one of the frameworks that rejected a particular variable name. Both were resolved, but the second not deployed in the production system due to a risk in corrupting the existing databases **[addresses gap: GAP-TD-10].**

5.2.2 Improvements to the Web Interface

Taking into consideration the gaps identified during the 1st and 2nd phases of the project, as summarised in section 5.1.5, the final version of the Web Interface has been improved in the following areas:

KPIs dashboard displays live data visualisations from the IES logging mechanism. All types of logs can be analysed, including the in-app questionnaires. This is very useful in giving immediate feedback on how well an app might be performing, and what users think about it. This effectively removes significant delays when needing to view this type of information.

Engagement Campaigns dashboard also brought immediate live visualisations of data, this time of engagement activities being performed by each city. Behind the visualisations are on-line shareable spreadsheets where engagement activities are recorded each month. This process was a valuable method of interactively monitoring the campaigns and how well they are proceeding. Once again, this effectively removes significant delays when needing to see this type of information **[addresses gaps: GAP-US-14; GAP-CC-20; GAP-SME-6,10,15].**

5.2.3 Improvements to the Services

- **Password recovery:** Some apps were modified to include an easy to spot “Forgot password” button, so that users can reset their forgotten passwords. **[addresses gap: GAP-US-8]**
- **Login with email:** since logging in with email instead of password is not supported, some apps were modified to make it clear to users that username is required to login (many users would try to login with their email and failed) **[addresses gap: GAP-US-7]**
- **Slow response times:** Bristol apps were modified to handle network delays more efficiently and in a more user-friendly manner. **[addresses gap: GAP-US-9]**
- **Apps usability:** the usability of the apps was improved by adding more navigation options (explicitly exit the app, back button,…) **[addresses gaps: GAP-TD-10]**
- **Asynchronous requests:** some requests are made now asynchronously in order to mitigate long response times from server. **[addresses gaps: GAP-US-9; GAP-TD-17; GAP-CC-7; GAP-SME-1]**
- **New In-app questionnaires:** simpler questionnaires were integrated into apps in order to improve the number of people answering them. More details are given along section 5.2.5. **[addresses gaps: GAP-US-1,2,4; GAP-CC-1,10,17; GAP-SME-7]**
- **Security:** input data validation was improved in order to avoid malicious attacks. **[addresses gaps: N/A]**
- **Social API upgraded:** the social API has been upgraded with Facebook and Twitter accounts. Using these API the developer can get public resources as events, places and media. **[addresses gaps: GAP-TD-18]**

5.2.4 Improvements to the IES Cities Player

During the second phase of the project, the IES Cities player has been continuously improved in response to the problems detected internally by other project members and external users.

The following list reports the most relevant improvements that have been implemented in the last months:

- Layout problems solved in devices with different screen sizes.
- Information rendering for application and datasets has been updated to be easier to read in different mobile devices.
- Location based information has been improved.
- User interaction has been improved in different ways: button interaction has been improved; the user is able to return to the main menu, etc.
- Rendering and refresh glitches have been solved by changing the way that the app window is updated.

As seen, during this second phase, the work has focused on solving bugs and creating a more stable application that into adding new features to the IES Cities Player. **[addresses gaps:**

GAP-TD-10]

5.2.5 Improvements to the Questionnaires

Much was learned from the 1st phase questionnaires. The main feedback was around the length of questionnaires, how easy they could be found or how users were prompted, and the relevance of the questions to the users. This was highly improved in 2nd phase.

The in-app questionnaires were much more streamlined, with a simple one-page interface and a graphical star rating system. The categories were decided with all the partners and were based on feedback from the previous questionnaires. This was reflected in a significantly improved higher response rate in 2nd phase.

A further improvement related to the questionnaires is the creation and publication of a new web page into the IES Cities Web Interface (new option within the "Council Management" menu named "In-App Questionnaires Results") which allows consortium members to look up in-app questionnaires results on real-time and in a friendly way. This improvement simplifies the process of results analysis being carried out by consortium partners preventing them to wait until the end of the pilot phase and speeding up the analysis of the collected results. In addition, the collected results are also available to be downloaded as CSV file which in the future could be available as a new open dataset.

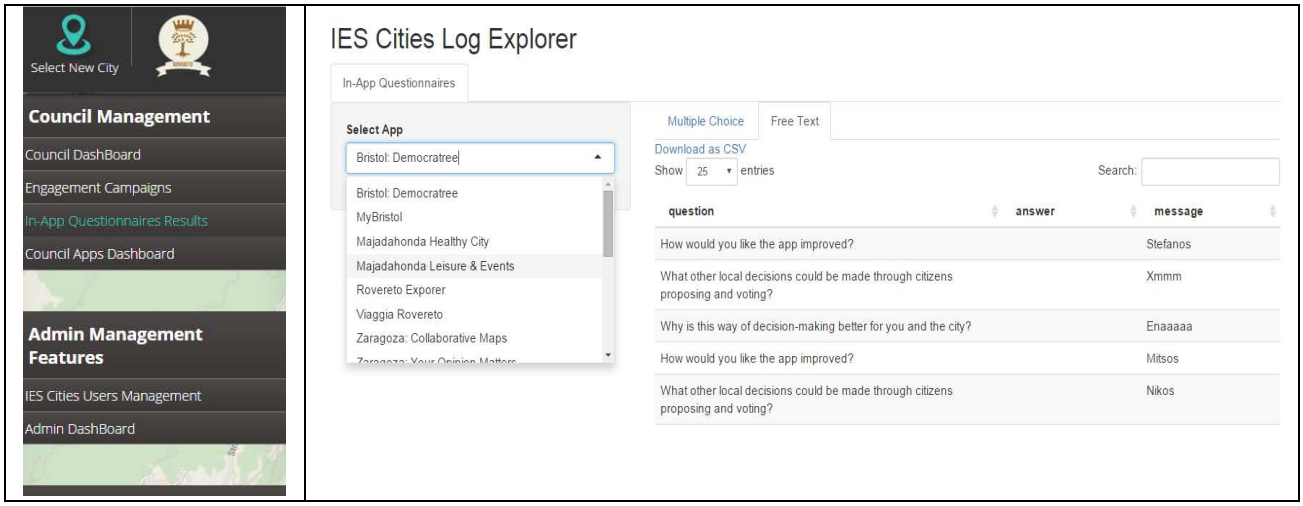

Figure 3 – In-app questionnaires results dashboard

The online questionnaires went through a similar process. The questions were halved in number. The focus of the questionnaire was also improved, removing all questions concerning the design and functionality of the app itself, these remaining only on the in-app questionnaire. The underlying data collecting spreadsheets were rebuilt to improve data consistency and clarity. There was an improved higher response rate in 2nd phase, although not as marked as the in-app questionnaire responses. **[addresses gaps: GAP-US-1,2,4 GAP-CC-1,10,17, GAP-SME-7].**

5.2.6 Summary of Improvements

As it was done in section 4, the improvements done during the second phase are now

presented in the following summary table, so their impact on gaps can be evaluated at a glance:

Improvement title	Relevant gaps
Event based data processing mechanism	GAP-TD-8
Support for translating applications	GAP-TD-9
Updated Scalaris configuration procedures and examples	GAP-TD-12
Data queries no longer interrupted during update	GAP-TD-14
Query mapper data source management improved	GAP-TD-19
Bugs resolved in log query mechanism	GAP-TD-10
Improvements to the Web Interface	GAP-US-14; GAP-CC-20; GAP-SME-6,10,15
Password recovery	GAP-US-8
Login with email	GAP-US-7
Slow response times	GAP-US-9
Apps usability	N/A
Asynchronous requests	GAP-US-9; GAP-TD-17; GAP-CC-7; GAP-SME-1
Security	N/A
Social API upgraded	GAP-TD-18
Improvements to the IES Cities Player	N/A
New In-app and online questionnaires. In-app questionnaires result dashboard.	GAP-US-1,2,4; GAP-CC-1,10,17; GAP-SME-7

Table 14 – Summary of improvements (second phase)

6. Recommendations for improvement beyond the IES Cities Project

Taking into account all the gaps identified (Sections 4.1 and 5.1.6) and the improvements carried out (Sections 4.2 and 5.2.6), some recommendations on how to improve IES Cities project in the future (after the end of the project) have been considered.

This section is focused on major issues not completely tackled or pending during the previous sections, willing to give an answer to a hypothetical IES Cities 2.0 project, or just to provide the guidelines to technical developers or city councils willing adopt or integrate IES Cities features into their own smart city strategy or infrastructure.

In this section gaps have been grouped into thematic blocks instead of performing a gap-by-gap approach. The suggested structure has considered the next items: platform (technical), web and docs (support, usability and project coordination), apps development (a bit technical), app services co-design (engagement), open data (contents in apps, datasets...), engagement and feedback (engagement lessons learnt, etc.).

Gaps have been classified according to these blocks. The main objective of this section is to give recommendations, referring to the gaps when possible.

6.1. Platform sustainability and scalability

In order to define what should be done to foster the platform usage, sustainability and scalability, the gaps from GAP-TD-1 to 21, GAP-CC-5,8,23,24, and GAP-SME-1-4,11,13 and the improvements done have been analysed. This subsection includes the main outcomes from this analysis.

The IES Cities platform has been continuously improved during the first and second phases of the project in order to cope with the problems and gaps detected not only by final users but also by internal partners. However, there are some aspects related with sustainability and scalability of the platform that should be tackled after the project finalization in order to achieve a more robust platform.

- **IES Cities platform hosting.** During the pilots the IES Cities platform has been hosted by one of the partners of the project (Tecnalia), resulting in stability issues during the project development and pilot testing due to internal network issues and server maintenance problems. The platform deployment could achieve a greater stability and provide better response times if deployed/moved into a cloud platform (e.g. www.linode.com). Anyway, once the project is concluded, each city council or even partner will have the chance to decide where to install and deploy the server. **[Gaps addressed: GAP-TD-16, GAP-TD-17, GAP-CC-23].**
- **Dataset type support.** The query mapper enables to map data sources in multiple different formats (JSON, SPARQL, CSV and relational). However, during the usage of these IES Cities component in other application domains, it has been detected that it could be also required to support other formats such as XML or KML. The introduction of

these new formats, which are already provided by some existing city's data portals, could increase the interest of the platform for final users and data publishers. **[Gaps addressed: GAP-CC-8, GAP-TD-19].**

- **Data life-cycle management.** The current state of the platform tackles with aspects related with data publication, access and update, including support for validation assessment. However, the platform could be extended to include a more detailed data management cycle through the inclusion of versioning. This feature will allow users to propose changes that will be tracked by the system in a way similar to source code versioning systems. Administrator could accept and integrate those changes into their datasets or discard them, allowing data consumers and other publishers to participate in the process of data improvement and maintenance. **[Gaps addressed: GAP-US-11, GAP-CC-24].**
- **Dataset validation and quality.** IES Cities currently provides two quality assurance mechanisms for datasets: "quality level" and "verified by". Quality level is a numeric property that provides the dataset conformance with one of the levels of the five star system for open data (http://5stardata.info/). Verified by tells consumers if the dataset and its data have been verified to fulfil the quality standards defined by its publisher or administrator. **[Gaps addressed: GAP-US-11].** In order to automatically validate datasets published within IES Cities, we have defined the following process:
    - Dataset publishers need to define a validation schema for its dataset. We have selected JSON Schema (http://json-schema.org/) as all the datasets can be retrieved in JSON format and, therefore, they can be validated with this mechanism.
    - In addition, they define some query that is used to retrieve the data stored in the dataset in JSON format. This query could retrieve all the dataset's data or only a part of it for validation, allowing for more flexibility the process.
    - An automatic tool, for example a script developed in Python using the json schema[1] library for this language, executes the query, obtains the data and validates it applying the defined schema.
    - If the data passes the validation process, the dataset's "Verified by" property can be updated accordingly, i.e. providing the name of the user that has validated the currently published dataset's data.
    - If some data does not comply with the specified data validation schema, the administrator validating the data will need to apply some correction procedures: fix erroneous data (executing manual SQL update sentences) or removing that data (executing SQL deletes) against the dataset.

[1] https://pypi.python.org/pypi/jsonschema

  - The validation process can be executed multiple times in order to assure the quality of the data after any change.

- **Third-party authentication.** The inclusion of OAUTH support could improve its sustainability as it will ease the entrance of new users which already have an account on a third party authorization platform (Google, Facebook, etc.). Currently, the platform uses basic authentication, but this new feature could be introduced without breaking the compatibility with the current release of the project. **[Gaps addressed: GAP-TD-6].**
- **Database scalability.** From the results of D4.2, we can see that the platform performs quite well in the level of concurrency we required during the project. For platform instances with higher traffic and concurrency however, there could be improvements. Using the alternative Scalaris back-end helps with certain queries but both back-ends would require further optimisations to be suitable for large deployments with higher numbers of (active) users. We expect that those optimisations are indeed possible and will further broaden the operative range of the platform. **[Gaps addressed: GAP-TD-12, GAP-TD-17].**

6.2. IES Cities Web interface and documentation

When considering the IES Cities Web as an entry point, but also considering other issues related with manuals and tutorials or even the usage of the swagger interface the gaps GAP-US-2,6,13,14,15, GAP-TD-9,13, GAP-CC-19,20 and GAP-SME-13,14,15,16 have been analysed, and the next conclusions have been identified:

- **Further documentation improvement.** Documentation has been extended and maintained during the project development to explain not only the platform installation process but also its usage from different points of view: data consumers, data publishers, councils, developers, final users, etc. However, the documentation could be greatly extended to include a tutorial section covering typical uses cases with more detailed examples, which could allow platform users to discover its functionalities more easily. **[Gaps addressed: GAP-US-13, GAP-CC-31].**
- **Compliance with upcoming Data Protection Rule.** In order for the IES Cities platform to comply with the new upcoming European Data Protection Rule, two new features should be added to the web interface with regards to User Management. Firstly, a feature to allow a user to remove his/her personal data and usage tracks from the IES Cities solution. Secondly, another feature to enable a user to extract his/her personal data from IES Cities platform in order to back it up or transfer it into another solution. **[Gaps addressed: GAP-TD-22].**

6.3. Multiplatform City Services and app templates

The analysis of GAP-US-5 and GAP-CC-13 to18 and the improvements accomplished have resulted into the definition of recommendations for the future. One of the main issues has been defined as the necessity to enable the implementation of Apps in other OS.

For the first and second pilot stages, several citizen-centric services (in total 16 services) have

been developed and deployed in each city taking into account the end-users requirements and needs identified for each pilot site at the beginning of the IES Cities project. The IES Cities-compliant applications were developed for Android mobile devices following the decision made at the proposal preparation stage. However, this has bene shown as a big constraint of the IES Cities system since many different stakeholders participating in the pilot stages have demanded other operating system, e.g. iOS. This gap should not be ignored and should be tackled after the project ending in order to achieve a higher engagement of end-users:

- **IES Cities-compliant apps should also be available for iOS mobile devices.** As a recommendation for the further usage of the IES Cities platform, current IES Cities services could be ported to iOS mobile devices. This is not a tremendous complicated task since most of the current IES Cities services have been implemented by using multiplatform HTML5 frameworks like PhoneGap which eases the porting process. In some cases, the IES Cities services programming code are offered as open source so that external developers could take it and adapt the already made available IES Cities services, e.g. the source code of Zaragoza apps has been publicly released at https://bitbucket.org/IES_Cities/. (As described in the Description of the Work, current IES Cities urban apps are owned by the developers; thus, it is up to developers to decide whether to offer the services programming code as open source or not). In other cases, the city council in charge of managing IES Cities Platform and services could also encourage the porting of IES Cities applications through contests, tournament based collaboration (hackathons, living labs…) or even traditional public procurements.
- **IES Cities-compliant services templates.** Related to the previous recommendation and with the purpose of easing and accelerating the development process, it is recommended that the future IES Cities platform manager enriches the platform by adding new application templates that cover the most common type of screens: main menu, register form, search form, list of results, map of locations, detailed information of an item, etc. By following this recommendation, external developers will be encouraged to create new IES Cities-compliant applications following the city's council Look & Feel and reducing the time spent. For example, the styles (CSS) and views (HTML templates) of Zaragoza apps can be found at folders voting/www/style and voting/www/partials, respectively at repository https://bitbucket.org/IES_Cities/app-zaragoza-voting-public/.

6.4. App co-design and collaboration models.

When considering gaps like GAP-US-12, GAP-CC-22,29 or GAP-SME-26, some general conclusions and recommendations like the next ones may be underlined:

- Develop early relationships with key stakeholders, agree their involvement before the app is chosen and developed, to avoid hurdles later on (allow more funds for their time to invest in this process).
- Allow more time and resource for building relationships, and interactive responsive development.

- City engagement needs to be the focus from the beginning.

Going deeper and after the analysis of the engagement numbers and the feedback received from citizens and other stakeholders during the pilot phase I and II, it may be concluded that one of the most difficult tasks faced during the whole project is related to the end-users continuous engagement. Engagement activities and collected numbers have probed that the "occasional" end-users engagement is not a tricky task since citizens and stakeholders are opened to participate in pilots and to trial new and innovative tools that address their needs. However, we have faced difficulties when trying to get continuous citizens' engagement along the time trying to transform them into active users of the IES Cities platform and services. In order to try to overcome this situation, there are some aspects related to the engagement campaigns that may be tackled after the project ending by the different city councils to achieve a continuous and active use of the system:

- **Raise interest and motivation from the citizenship and other stakeholders.** In some cases the active use of the services is not achieved because end-users think that these services are not actually addressing the citizens´ and other stakeholders´ needs. There is still a wide gap between citizens´ needs/preferences and public administration strategy and activities. The new set of public services (IES Cities-compliant apps) should be built following a citizen-centric approach instead of an administration-centric approach. It is crucial for the future to engage and involve end-users and other stakeholders from the very beginning, allowing them to participate actively during the application ideation and design, fostering public services co-definition and co-creation.
- **Fostering openness and collaboration.** IES Cities project results have proved that there is a need to move towards a more open model of design, production and delivery of public services leveraging on the collaboration between citizens, local businesses, entrepreneurs and public administrations. What it is called as the quadruple-helix approach should be fostered in those city councils which would like to reduce the existing gap between citizens´ needs and the public administration strategy.
- **Raise awareness about the existence of new tools and services.** Even though current engagement numbers have reached the IES Cities project expectations, a major obstacle preventing citizens from using innovative tools and services is the lack of awareness. Citizens in many public administrations are often unaware about the existence of these kind of solutions. Besides, in case that these solutions exist, in most of the cases it is really difficult to find them. In general, there is not a common easily browsable and searchable place where all the new public services related to a specific city or territory may be found. To face this issue, it was decided in IES Cities to implement the IES Cities Player that may be seen as the common entry point to the IES Cities ecosystem where all IES Cities-compliant applications may be easily reachable. A future recommendation to public administrations is related to the creation and promotion of a similar tool to the IES Cities Player as well as carrying out promotion activities to raise awareness of this kind of ecosystems.

6.5. Open data

When analysing gaps like GAP-US-10,11, GAP-CC-21,24,30,31 and GAP-SME-5,17,18,25 the next recommendations must be considered to get the best value from the experience resulted from the IES Cities project:

- **The public administration must be fully committed with the implementation of the Smart City strategy and infrastructure** but mainly with the need to feed the apps with content and keep it up to date. There is a huge necessity to get availability to the best quality and well-structured open data in order to engage developers. City Council departments should collaborate on providing and keeping up to date contents. It is mandatory to ensure data quality, reliability and integrity of public datasets.
- On the other hand it is also important to **keep publishing new open datasets or introducing enhancements in the available ones**, if possible, as fast as developers expect.
- The **maintenance of the IES Cities services**, but also the longevity of platform and data sets is required to obtain and keep the confidence from developers.

6.6. Stakeholders' engagement and feedback retrieval

The analysis of gaps like GAP-US-1,3,4,6,10,12, GAP-CC-1,6,9,10,11,12,14,17,19,22,29,30; and GAP SME-18,19,20,21,22 have been done in order to extract the next recommendations:

- The analysis of the users´ feedback proves that there is still a **lack of awareness of the IES Cities components**, like the IES Cities player. So far a huge effort must be done in order to create awareness material so the stakeholders may have a clear understanding of all the different items that compose the IES Cities project.
- **Some public services require a high involvement of the public administration in the process of content creation.** In the cases either the end-users or any other stakeholder detect that some application contents are not up to date or even not generated in a regular basis, this will result in a low usage of the applications. It is mandatory to get fully commitment of the Public Administration with the provision and management of open data
- **Citizens and other stakeholders are willing to be part of the design process of the applications.** This will ensure that the public services are designed addressing their needs. It is important to allow co-design of the apps with stake holders. One of the things we have learnt in this second stage is that counting on citizens from the very beginning of the creation phase of the apps, brings better results in many ways. Users and developers are, obviously, keen on apps, but they prefer even more feeling part of the process of creating them.
- **Questionnaires have not revealed to be very useful to retrieve user feedback.** This may be as a result of the apps being successful and issue free, or more likely, a slow

response by end users. It is recommended to rethink questionnaires as far as those are a valuable channel to get information and provide support.

- Related to the difficulties found to get users engaged, it is crucial for the future to **engage and involve end-users and other stakeholders from the very beginning**, allowing them to participate actively during the application ideation and design, fostering public services co-definition and co-creation. In this way, public services design will address citizen´s needs and preferences, which will ease the engagement process both in the short and long term. The main purpose of the application and its features has to be fully aligned with these user requirements.
- From our experience one of the main reasons for a low usage of the applications is related to the applications' contents. The **public administration should take the role of content generator** in order to dynamize the application usage by populating the applications with real-time content. The City Council departments should seamlessly and efficiently towards the achievement of a larger and more appealing collection of open data, to be presented in the public services and offered to local developers.
- **Most of the pilot cities services' maintenance and engagement are dependent on its City Council's budget and effort**. This business model poses a risk to the survival of many apps in the market, as they have not managed to raise enough value to users to pay for them, or to developers to make money from them. Thus, they will be severely affected by the fluctuations and adjustments of the City Council's budget, and the system will not be able to scale. The implementation of the project has considered alternative business models, but they could not have been evaluated in a realistic way so far. The analysis of alternative business models that could come from stakeholders, like SMEs or Developers, could give an answer to the sustainability of the project.
- **Innovation in public administrations.** Related to some of the recommendations given above, it is necessary to say that there is still a need to push innovation within public administrations. In some cases there is still a low priority given to Open Government innovation by top managers and civil servants. To make that a project like IES Cities success, it is critical not only to engage end-users but also to reach the public administration engagement supporting those groups within the public administration more open to innovate.

7. Conclusions

The IES Cities project represents a whole ecosystem composed by items, inter-relationships, and external environment. The main items that composed the IES Cities ecosystems are technical components (like the service platform, the user website, the apps, etc.), specific contents (like the datasets, contents coming third parties, etc.), and stakeholders (like the city council representatives, developers, local traders, prescribers, SMEs, etc.). The relationships are those ones that allow a direct or indirect interaction between the different items (for instance a developer with datasets, user with apps, etc.).The external environment represents all the different conditions that affect the items and its relationship. To find a proper environment may be crucial for the proper implementations of the actions during the project, and may affect also the interaction with third parties or even the survival of the project.

Considering this, many different gaps and improvements may be considered when talking about the best implementation of the project, but also the possibility to keep the project in the future or to get valuable results that may contribute to define the best smart cities strategy.

In this document a preliminary review of the status of the gaps identified during the first phase has been done. A new analysis of the IES Cities Ecosystems during the implementation for the second phase has allowed identifying new sets of gaps. Most of the gaps identified during the second phase of the project have been solved during the implementation of this second phase.

But the IES Cities project aims to give value as it is, or as a possible tool to be integrated within the strategy or technical infrastructure of the city councils or even companies involved in the development of the smart cities concept. So far this deliverable aims to set some guidelines that must be addressed in order to get as much values as possible from the results obtained during the project.

Specific gaps talking about technical issues or specific items must be considered. Also the environment has had a real impact in the implementation of the project. But one of the most valuable results from the IES Cities project must be stabilised when talking about relationships as far as the smart cities strategy and survival depends on the right integration of the different items involved in this equation. So far the main focus may be set in those gaps identifying those things that have worked right or wrong when talking about relationships between the different items.

8. Comments from External Reviewers

8.1. Reviewer 1 – TOSHIBA

Date: March 23rd, 2016

Issue	Yes	No	Score (1=low to 5=high)	Comments
Is the architecture of the document correct?	X		5	
Does the architecture of the document meet the objectives of the work done?	X		5	
Does the index of the document collect precisely the tasks and issues that need to be reported?	X		5	
Is the content of the document clear and well described?	X		5	
Does the content of each section describe the advance done during the task development?	X		4	The "Executive Summary" could be extended to more completely summarizing the content of the whole document. The "Conclusions" section should give a broader perspective of the gaps and improvements, focusing on the more important ones.
Does the content have sufficient technical description to make clear the research and development performed?	X			
Are all the figures and tables numerated and described?		X	4	The following figure and tables do not appear to be directly referenced in the text of the document. Figure: 3 Tables: 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Are the indexes correct?		X	4	The table of contents is largely correct apart from: • Section 3.1 refers to partner "TECNALIA" • Section 5.1.4 "Majadahonda" should be a subsection of the previous section.
Is the written English correct?	X		4	There are a number of language glitches in the text,

				but it does not affect understanding.
Main technical terms are correctly referenced?		X	4	
Glossary present in the document?	X		5	There is a table of Abbreviations present that is largely complete.

This document is very comprehensive in collecting together the identified gaps, addressed improvements and potential improvements from a wide variety of stakeholders. More carefully constructed “Executive Summary” and “Conclusions” sections could make this level of detail much more approachable.

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8.2. Reviewer 2 – UD

Date: March 23rd, 2016

Issue	Yes	No	Score (1=low to 5=high)	Comments
Is the architecture of the document correct?	X		5	
Does the architecture of the document meet the objectives of the work done?	X		5	
Does the index of the document collect precisely the tasks and issues that need to be reported?	X		5	
Is the content of the document clear and well described?	X		5	
Does the content of each section describe the advance done during the task development?	X		5	
Does the content have sufficient technical description to make clear the research and development performed?	X		5	
Are all the figures and tables numerated and described?	X		5	
Are the indexes correct?	X		4	Check that all references and indexes are updated before final submission
Is the written English correct?	X		4	Good quality for no native speakers. Some minor spells problems corrected.
Main technical terms are correctly referenced?	X		5	
Glossary present in the document?	X		5	

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9. Abbreviations

API	Application Programming Interface
CC	City Council
CSS	Cascading Style Sheets
CSV	Comma-Separated Values
HTML	HyperText Markup Language
IES Cities	Internet Enabled Services for the Cities Across Europe
JSON	JavaScript Object Notation
NA	Not Applicable
OAuth	Open Standard for Authorization
OS	Operating System
PA	Public Administration
PDF	Portable Document Format
RDF	Resource Description Framework
SME	Small and Medium Enterprises
SQL	Structured Query Language
TD	Technical Developer
TOC	Table of Contents
US	User
WP	Work Package

10. References

[1]	CIP ICT-PSP IES CITIES project deliverable D4.3 “Report on the Gaps, Improvements and Exchange of Services” accepted version, IES Cities consortium, July 2015
[2]	CIP ICT-PSP IES CITIES project deliverable D3.1.1 “Pilots Planning v1” accepted version, IES Cities consortium, July 2014
[3]	CIP ICT-PSP IES CITIES project deliverable D3.1.2 “Pilots Planning v2” accepted version, IES Cities consortium, July 2015
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[5]	CIP ICT-PSP IES CITIES project deliverable D5.1.2 “Global Engagement Plan v2” accepted version, IES Cities consortium, May 2015