Deliverable D 1.5

Monitoring for progress tracking and updating of scenarios
DISCLAIMER

The opinion stated in this report reflects the opinion of the authors and not the opinion of the European Commission.

All intellectual property rights are owned by the ECODISTR-ICT consortium members and are protected by the applicable laws. Except where otherwise specified, all document contents are: “© ECODISTR-ICT project - All rights reserved”. Reproduction is not authorised without prior written agreement.

The commercial use of any information contained in this document may require a license from the owner of that information.

All ECODISTR-ICT consortium members are also committed to publish accurate and up to date information and take the greatest care to do so. However, the ECODISTR-ICT consortium members cannot accept liability for any
inaccuracies or omissions nor do they accept liability for any direct, indirect, special, consequential or other losses or damages of any kind arising out of the use of this information.

ACKNOWLEDGEMENT

This document is a deliverable of the ECODISTR-ICT project, which has received funding from the European Union’s Seventh Programme for research, technological development and demonstration under grant agreement No 608913.
## PROJECT DATA

<table>
<thead>
<tr>
<th>Project Acronym</th>
<th>ECODISTR-ICT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Full Title</td>
<td>Integrated decision support tool for retrofit and renewal towards sustainable districts</td>
</tr>
<tr>
<td>Call Identifier</td>
<td>FP7-2013-NMP-ENV-EeB</td>
</tr>
<tr>
<td>Grant Agreement</td>
<td>608913</td>
</tr>
<tr>
<td>Coordinator</td>
<td>VITO (BE) Vlaamse Instelling voor Technologisch Onderzoek NV</td>
</tr>
</tbody>
</table>
| Consortium partners   | SP (SE) Sveriges Tekniska Forskningsinstitut ab  
|                       | CSTB (FR) Centre Scientifique et Technique du Batiment  
|                       | TNO (NL) Nederlandse organisatie voor Toegepast Natuurwetenschappelijk Onderzoek  
|                       | VABI (NL) Vabi Software BV  
|                       | STRUSOFT (SE) Structural Design Software in Europe ab  
|                       | WHITE (SE) White Arkitekter Aktiebolag  
|                       | OMGEVING(BE) Multiprofessionele Ontwerpers- en Architectenvennootschap cvba  
|                       | BIPOLAIRE (ES) Bipolaire Arquitectos slp  
|                       | ARUP (NL) Arup BV                    |
| Funding Scheme        | Collaborative Project               |
| Project Duration      | 36 months                            |
| Starting Date         | 01/12/2013                           |
| Website               | http://ecodistr-ict.eu/             |
## DELIVERABLE DATA

<table>
<thead>
<tr>
<th>Title</th>
<th>Monitoring for progress tracking and updating of scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Deliverable D 1.5 from WP1 – Stakeholders and scenarios</td>
</tr>
<tr>
<td>Lead Beneficiary</td>
<td>VITO</td>
</tr>
<tr>
<td>Main author(s)</td>
<td>Michalis Kanellis (VITO)</td>
</tr>
</tbody>
</table>
| Contributor(s) | Stijn Verbeke (VITO)  
Igor Van de Vyver (VITO)  
Karel Styns (VITO)  
Kristof Dhallé (VITO) |
| Reviewer(s) | Carl-Magnus Capener (SP)  
Wim Plokker (VABI) |
| Deliverable Nature | R – Report |
| Dissemination level | RE – Restricted to a group specified by the consortium (including the Commission Services) |
| Submission date | 31st August 2016 |
| Status | Delivered |

## ABSTRACT
Deliverable D1.5 contains the description of the method that was developed as part of the Ecodistr-ICT project to enable monitoring the redevelopment process of a district. For the monitoring methodology “crowdsourcing” was chosen as the most appropriate method, developing thus the crowdsourcing tool which will monitor the actual uptake of measures within the district, by comparing static snapshots with the direct input of the inhabitants. It also serves as a means to collect hard to get data earlier in the process, and as such answers to a need expressed by stakeholders while using the Integrated Decision Support Tool created during the ECODISTR-ICT project.
EXECUTIVE SUMMARY

The objective of the ECODISTR-ICT project is to develop an Integrated Decision Support System for supporting stakeholders with their decision making in sustainable redevelopment projects of urban districts, both on building and on district level.

Deliverable 1.5 describes the method that was chosen and developed as part of the project with regard to monitoring the progress of the redevelopment during the different stages of every project, the Crowdsourcing Tool.

This report elaborates on the complete set of functions that the Crowdsourcing tool fulfils for the Integrated Decision Support System, the technical aspects behind its development and the user-system interaction both from the inhabitants’ as well as the stakeholders’ and facilitators’ perspective. The tool was designed so that it is flexible enough for monitoring projects with different characteristics and requirements and easy enough for users (inhabitants and project facilitators) without IT expertise to operate.
TABLE OF CONTENTS

EXECUTIVE SUMMARY .......................................................................................................................6
TABLE OF CONTENTS ..........................................................................................................................7
LIST OF FIGURES .................................................................................................................................8
INTRODUCTION........................................................................................................................................9
  1.1 PURPOSE, INTENDED AUDIENCE AND SCOPE .........................................................................9
  1.2 APPLICABLE DOCUMENTS ...........................................................................................................9
  1.3 CONTEXT ECODISTR-ICT ...........................................................................................................9
  1.4 READING GUIDE .........................................................................................................................10
2 FUNCTIONAL REQUIREMENTS OF CROWDSOURCING TOOL .........................................................12
  2.1 DATA GATHERING NEEDS ...........................................................................................................12
  2.2 INTENDED USERS .......................................................................................................................12
  2.3 THE OVERALL ROLE OF THE TOOL IN THE PROCESS .................................................................13
3 TECHNICAL ASPECTS .......................................................................................................................15
4 USER EXPERIENCE – PROCESS DESCRIPTION ............................................................................17
5 CROWDSOURCING TOOL BACKEND ............................................................................................21
6 CONCLUSIONS ..................................................................................................................................24
6 BIBLIOGRAPHY ..................................................................................................................................25
LIST OF FIGURES

Figure 1: The ECODISTR-ICT work package structure as described in the DoW.......................... 10
Figure 2: Diagram describing the development and operation of the ECODISTR-ICT Crowdsourcing tool .......................................................... 15
Figure 3: ECODISTR-ICT Crowdsourcing Tool initial screen ....................................................... 17
Figure 4: ECODISTR-ICT Crowdsourcing Tool questions, example of Antwerp case - part 1 .......... 18
Figure 5: ECODISTR-ICT Crowdsourcing Tool questions, example of Antwerp case - part 2 ......... 19
Figure 6: ECODISTR-ICT Crowdsourcing Tool questions, example of Antwerp case - part 3 ........ 19
Figure 7: ECODISTR-ICT Crowdsourcing Tool questions, example of Antwerp case - part 4 .......... 20
Figure 8: Initial screen of the tool’s backend, where the content can be modified ...................... 21
Figure 9: Crowdsourcing Tool Editor Part 1 ..................................................................................... 22
Figure 10: Crowdsourcing Tool Editor Part 2 .................................................................................. 23
INTRODUCTION

1.1 PURPOSE, INTENDED AUDIENCE AND SCOPE

The purpose of deliverable 1.5 is to deliver a method for monitoring the progress of the area in redevelopment. The choice was a software module to “crowd source” data for filling the database of an ECODISTR-ICT case study project with information that is not publicly available, which will contribute in monitoring the state of the district before and after the decided measures are applied to it.

This report describes the concept behind the tool, the functional requirements in order to be a suitable monitoring tool for the IDSS, some technical details regarding its development as well as the way that the software can be operated both by the district inhabitants and the project facilitators (city planners, architects, urban developers etc.).

Primary intended audience of this report are the partners of the ECODISTR-ICT project, as well as all the parties and stakeholders that have been involved in the development of the project and its case studies, especially in the process of monitoring the situation before and after district renovation.

The scope of this Deliverable is the design and operation of a software module that will be used in collecting information useful for monitoring the state of a district that is being transformed with the use of the Integrated Decision Support System developed in this project.

1.2 APPLICABLE DOCUMENTS

- ECODISTR-ICT Description of Work (DoW December 2012; amendment January 2016)
- ECODISTR-ICT Deliverable D1.1 List of specifications for the decision tool in function of stakeholder input

The main documents can be found on http://ecodistr-ict.eu/ [1].

1.3 CONTEXT ECODISTR-ICT

This deliverable is the fifth result of work package 1 (WP1), “Stakeholders and scenarios” of the ECODISTR-ICT project. Figure 1 shows the work package structure of ECODISTR-ICT, in which WP1 functions as input for WP4 Integrated Decision Support System. The structure of the ECODISTR-ICT work packages is shown in Figure 1 below.
WP1, Stakeholders and scenarios, contains 5 tasks:
1. Stakeholders: assessing needs
2. Actor-institutional analysis (OMG)
3. Building blocks for context scenarios
4. Model decision making process of individual building owners
5. Monitoring for progress tracking and updating of scenarios

The deliverable of this task will result in collecting all the relevant data before and after the renovations in order to compare and eventually monitor the progress achieved in the renovated district for the different measures and scenarios. During the development of the tool, the scope has been widened to also be appropriate for collection of data that is difficult to obtain and can only be retrieved directly from the district’s inhabitants.

1.4 READING GUIDE

This document should be read completely by the ECODISTR-ICT participants. Others should start with the Executive Summary and this Introduction, and from there select those Sections that are relevant to them.

Chapter 1 introduces the document.
Chapter 2 describes the functional requirements that were set for the tool during the design and implementation phase.

Chapter 3 describes the user experience when inputting the data in the crowdsourcing tool in order to use them for the progress monitoring.

Chapter 4 describes how the facilitators of every different project can alter the content of the crowdsourcing tool depending on the different stages and the particular needs of every case.

Chapter 5 finally, summarizes the conclusions of this report.
2 FUNCTIONAL REQUIREMENTS OF CROWDSOURCING TOOL

2.1 DATA GATHERING NEEDS

The ECODISTR-ICT Integrated Decision Support System aims at offering useful insights to the stakeholders involved in district planning by making it easier for them to understand their relations and interests and therefore optimize the decision making process for the potential redevelopment scenarios, always depending on the specific conditions and requirements of every redevelopment project. It is therefore imperative to be able to monitor the situation both before and after the redevelopment for tracking the progress of every project.

This means that the tool designed for the monitoring will have to be versatile in order to meet the specific requirements of every project in line with the modular structure of the IDSS as the different modules connected to the IDSS, depending on the project, have different needs in data input. It also has to be simple for the average users to operate and modify according to their needs as well as the requirements and looks of the city administration that participates in the district renovation project.

With clever selection of the variants (design proposal within a context) the IDSS will be able to show a previous state and a current state of the district in the dashboard, recalculate all the KPI’s related to the project and give stakeholders the ability to track closely the effectiveness of their plans.

Some of the data required for monitoring can be directly obtained from external GIS datasets in city administrations or can be received from the stakeholders. However, monitoring the uptake of renovation measures by individual houseowners is a challenging task as the relevant data is not available by the aforementioned sources. Consequently, we need a tool that will contribute to this gap in data required for monitoring, which is going to retrieve those data by the inhabitants.

Together with the data for monitoring the redevelopment process, the tool will be used for collecting additional data which is very difficult to obtain from already existing databases. Data such as building related properties, uptake of renovation measures, ownership status, etc. which are very useful for making more accurate calculations, can only be retrieved directly by the inhabitants of the district in redevelopment.

2.2 INTENDED USERS

Due to the technical nature and inherent complexity of district retrofit projects, the Ecodistr-ICT IDSS primary targets city planners, architects, urban planners and district inhabitants as it main users.
The facilitators managing the process with the means of the IDSS will be experts who are aware of its structure, requirements and method of operation. This means that it would not be wise to operate the crowdsourcing tool in such an environment for fear of deterring users without technical expertise. Therefore, it had to be designed as a separate platform with a very-friendly user interface in order to encourage broad citizen participation.

Monitoring requires data collection and as explained previously not all data can be easily obtained by existing databases; some data can only be obtained from the inhabitants and stakeholders. So the monitoring tool is developed in the form of a questionnaire for the involved stakeholders and inhabitants to provide the relevant data. Even though the Inspire Directive, which was voted in 2007 by the European Commission, is supposed to have established an infrastructure on open data for supporting the environment related policies [2], in reality a lot of data necessary for a redevelopment project is not always available: for example EPC scores are not available for every country or they are restricted due to privacy issues, renovations like additional insulation or replacement of boilers are unknown to authorities unless there has been a subsidy scheme involved etc. Therefore, several of those missing data can be found by asking simple questions to the related district inhabitants by providing them a comprehensive and user-friendly environment.

The content of the questions are defined by the facilitator of the project, which most of the time is a person without IT background (e.g. an architect, city-planner etc.). Therefore, the tool needs to offer ease of altering the questions in terms of content and nature (qualitative, quantitative), to be able to collect all sorts of data relevant for the project. All collected data will be georeferenced pointing to a specific object in the ECODISTR-ICT database. By storing the data to an appropriate database it is possible for the facilitator to make the necessary comparisons and draw the desired outcomes for the district redevelopment.

Finally, for filling information into the tool no login credentials are required. This was a deliberate decision by the project partners aiming at the maximisation of the participants who might have been scared away if the information collected was too much personalised or required to much effort. On the other hand this might affect the quality of the collected data, however the overall function of the tool is believed to be quite accurate.

2.3 THE OVERALL ROLE OF THE TOOL IN THE PROCESS

The tool is initially conceived as a monitoring tool, which especially focuses on collecting data that is very difficult to obtain from authorities or existing databases, but can be found by asking the inhabitants directly. Apart from the monitoring role, we foresee a multitude of potential uses of the crowdsourcing tool in other phases of a district renovation process.

A second use for the Crowdsourcing tool is the gathering of data for calculation modules in order to make more accurate predictions for the effect of the different measures to be applied (in paragraph 4 the data collection feature is illustrated for the Affordability module).
A third use of the Crowdsourcing Tool is to gather KPI scores directly: the project facilitators will be able to set quantitative KPI’s related to the inhabitants’ opinion of the applied measures and therefore be able to monitor the effect of the different measures and variants when the use of ECODISTR-ICT calculation modules is not possible.

Finally, a fourth use could be to introduce a voting session at the end of a stakeholder process: the tool also gives the possibility to the project facilitators to ask for the inhabitants’ opinion on the different measures applied in the form of voting if e.g. they consider the addition of more green spaces to affect their mood in a positive way or not.
3 TECHNICAL ASPECTS

The ECODISTR-ICT Crowdsourcing tool is written in Ruby on Rails programming language and is derived from VITO’s “Demando” platform. The tool is connected to a MySQL database and is running on a Linux server. The following diagram on Figure 2 describes the workflow of the tool:

Figure 2: Diagram describing the development and operation of the ECODISTR-ICT Crowdsourcing tool.
The Crowdsourcing tool is designed to run as a stand-alone application, not directly connected to the IDSS. It was also designed to have a user-friendly interface which will attract people to complete the questions, making sure that the environment of the tool will not be a deterrent factor for average users.

Additionally, the application is designed with the capability to export the data in csv format which is suitable for making the crowdsourced data usable for the IDSS. Finally, the whole application is uploaded on GitHub in order to be able to track its versions and development.
The crowdsourcing tool is currently located in the URL: https://ecodistrict.vito.be. Initially the user inputs the location of the district that is investigated which is visualized on a map, as shown on Figure 1. Then it is possible for the user to select his/her house on the map in order to register to the project database the relevant data collected by the tool. User profile settings and project data will be saved for every different user so that the user can complete the questions in every step of the redevelopment process.

On the same page, the user starts filling in the required data. The questions that appear on the screenshots on Figure 4 below are a demonstration of the tool’s capabilities and show an example of how the questions can look like. The facilitator has the ability to access the backend of the tool and modify the questions depending on the data requirements of a specific case. This feature of the tool will be discussed in the following chapter.
In the example provided, data is sourced as input for a calculation module on affordability of deep energy retrofits. This set of data, which can only be obtained directly by the inhabitants of the investigated district, will be used as input for the Affordability Module which is explained in Work Package 3.

All the questions are validation proof, meaning that the tool will not stop working in case there is omission or wrongful insertion of data (e.g. not filling in the income range or filling in text instead of numbers in the age fields) but instead it will show to the user a relevant message asking from him/her to check the missing or incorrect data and fill them in appropriately.

Then, the questionnaire asks more specific questions regarding basic information about the house construction itself, such as building construction year and building type (Figure 5).
The questions that follow on Figure 6 are related to the energy aspects of the house and more specifically they are about the existence of an EPC certificate or not, as well as the gas and electricity consumption.

The gas and electricity consumptions are going to be of the major indicators for monitoring the effect of the renovation measures within the district, showing to the stakeholders a clear indication about the effectiveness of the different scenarios and the predictions. These questions
can also be expanded to consumption of other fuels such as fuel oil, wood, wood pellets, biomass etc. depending on the case study and the applied measures.

![Ecodistrict crowdsourcing tool](image)

**Figure 7: ECODISTR-ICT Crowdsourcing Tool questions, example of Antwerp case - part 4**

On Figure 7 there are questions that relate to the user’s willingness to apply renovation measures to his house. In this example there are some simple questions in the initial state of a property, where the user is asked if he would be willing to apply certain measures related to solar energy. However, when certain measures have already been applied, the questions here can be altered and in direct relation to the stakeholders’ choice of KPI’s, they can collect information about the results of every measure with regard to the user satisfaction, aesthetics, finances etc. This type of flexibility that the crowdsourcing tool offers is demonstrated and explained in the following chapter.

Finally, the data collected from the users filling in the questions, is stored into the database in the form of a CSV or GeoJSON file, in order to be processed in the normal workflow of the IDSS.
5 Crowdsourcing Tool Backend

Collecting user input for monitoring the progress of the redevelopment in its different stages is vital for the stakeholders. Depending on the different stage of the redevelopment project, different kind of data are needed for monitoring the effect of different measures applied. As a result, the content of the questions might have to be altered to be able to assess the new situation to be monitored.

This chapter describes the editor in the backend of the application. This questionnaire-creating tool is suitable for facilitators without IT skills, so that they can modify with minimal effort the content of the questions. In order to do so, the facilitator has to go to the URL: https://ecodistrict.vito.be/demando/admin and user the proper login credentials. Figure 8 below, shows the start screen of the editor.

![Initial screen of the tool's backend, where the content can be modified.](image)

Here the facilitators can add, edit or duplicate a questionnaire by clicking on the buttons next to it. The structure of a questionnaire is as follows:

- A questionnaire consists of one or more pages.
- A page consists of one or more containers.
- A container consists of questions and/or other containers. This makes nesting of questions possible.

The different questions should always be placed inside a container. These containers are used to group questions of different information groups (e.g. personal information, energy consumption information, building information etc.).

As the following figures show, the facilitators can add pages, containers and questions by clicking on the buttons at the top of the “Edit questionnaire” page. It is also possible to edit or remove the
already existing items by clicking on the “Actions” button which appears a dropdown menu next to the item. Moreover, the actual content of the questions can be modified in terms of input (numbers or text, units, sequence of the questions, range of validation, if a question is required or optional for the user to answer, help text for the user to understand the questions, etc.)

Figure 9: Crowdsourcing Tool Editor Part 1.
Overall, the facilitators have the freedom to make any modifications they think are necessary for collecting the appropriate data for monitoring progress, especially data and KPI’s that are qualitative e.g. user or expert input that cannot be calculated by the modules. This way the project facilitators can setup appropriate KPI’s which would function as a voting system for the users to evaluate certain variants of the redevelopment (such as user appreciation of the measures, aesthetics, environment etc.). This means that the facilitators would have the ability to monitor the non-quantitative indicators of the project, compare the user inputs at the different stages of the project, this way giving them a more spherical view of the effect of measures applied.
6 CONCLUSIONS

The objective of the ECODISTR-ICT project is to develop an Integrated Decision Support System (IDSS) for sustainable retrofitting of urban districts with a focus on energy efficiency. This report on deliverable D1.5 describes the tool that was developed by VITO with the aim of collecting the necessary data for monitoring the progress of every redevelopment project for which the IDSS is used, but also data that are very difficult to obtain and can only be provided by the district inhabitants. The designed tool is very simple for users without very technical background to operate as well as to modify according to the specific needs of every project. The crowdsourcing tool is currently being used in the preparation of the Antwerp case study which is scheduled for the end of September – beginning of October 2016.
6 Bibliography