

Attractive, Acceptable and Affordable deep Renovation by a consumers oriented and performance evidence-based approach

Contract No.: 784972

Report: D5.4 Report on overall evaluation of the TripleA-reno Open Gamified Platform

Work Package: WP5 – Task 5.4 Report on overall evaluation of the TripleA-reno Open Gamified Platform



Prepared for:

European Commission

CINEA

Project Advisor: Rebecca Kanellea

Prepared by:

Geckotech: Matthijs Bierman

IVE: Ana Sanchis Huertas

31/10/2021

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S H2020 FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION UNDER GRANT AGREEMENT NO 784972.

The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained therein.

Revision and history chart:

VERSION	DATE	EDITORS	COMMENT
Version 0.1	25/10/2021	GT	First version provided
Version 0.2	31/10/2021	IVE	First version fully revised
Version 1.0	31/10/2021	GT	Submission

Table of contents

Glossary of terms4

0 Executive summary5

1 Introduction6

2 Methodology7

2.1 Internal testing7

2.2 Internal evaluation7

2.2.1 Feedback form7

2.2.2 Direct Feedback9

2.3 External evaluation9

2.3.1 Evaluation form9

2.3.2 Indirect Evaluation10

3 Implementation11

3.1 Gamification engine11

3.1.1 Internal testing11

3.1.2 Internal evaluation11

3.1.3 External evaluation11

3.2 Project portal12

3.2.1 Internal testing12

3.2.2 Internal evaluation12

3.2.3 External evaluation12

3.3 Morphological design wizard13

3.3.1 Internal testing13

3.3.2 Internal evaluation13

3.3.3 External evaluation13

3.4 Labelling wizard14

3.4.1 Internal testing14

3.4.2 Internal evaluation15

3.4.3 External evaluation15

3.5 Professional comfort label15

3.5.1 Internal testing15

3.5.2 Internal evaluation16

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S H2020 FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION UNDER GRANT AGREEMENT NO 784972.

The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained therein.

3.5.3 External evaluation16

3.6 BuildUpSkills Advisor app (inspections, find craftsman)17

3.6.1 Internal testing17

3.6.2 Internal evaluation17

3.6.3 External evaluation17

4 Conclusions18

4.1 Lessons learned18

4.2 Future work19

Appendix: Feedback TripleA-reno applications20

Glossary of terms

API

Application Programming Interface. This is used to query separate databases in a secure way.

BUILD UP Skills

The BUILD UP Skills initiative is an initiative from the EU commission for accelerating massive upskilling of the workforce required for sustaining the Built environment

CI

Continuous integration. Approach to automatically test every code change to an application saved in the version control system.

CD

Continuous deployment. Automatically releasing software after the automated tests have passed.

CO-creator platform

A digital environment in which stakeholders and the building sector cooperate in creating successful nZEB concepts

Gamification engine

Application which makes it possible to keep track of various “gamification” elements across multiple applications, such as players, teams and their achievements.

REST

Representational state transfer. A method to exchange data between computer applications.

UI

User Interface

0 Executive summary

TripleA-reno project is focused on overcoming market barriers for deep renovation. The overall aim is to make acceptance and decision making on deep and nZE renovation attractive for consumers and end-users. TripleA-reno project achieves this aim by developing an open end-user centred gamified platform that:

- foster new consumer and end-user centered business models, using evidence-based performances that facilitate decision-making.
- improve performances of deep renovation by enhanced quality control, supported by targeted CPD and training.
- provide consumers and end-users of deep renovation projects with attractive, understandable, and personalized information of realized real performance; and
- demonstrate the benefits and evidence-based solutions in live demonstration cases.

WP5 is focused on the practical applications of the open gamified platform, the tools, apps, and information/communication services, demonstrating their usefulness, validity, and practicability in real environments. The methodologies, tools, business and exploitation models will be demonstrated in real life operating conditions, in 6 cases with following main objectives: the demonstration and the illustration of the approach and methodologies that are used to develop the ICT-tools and services; the demonstration and validation of the usefulness and acceptance of the platform, tools and services; and the demonstration of the additional value of offering combined decision tools, information services and community building.

Therefore, TripleA-reno project objectives addressed by WP5 are:

- - New consumer and end-user centered business models and decision support tools (objective 1).
- - Improving performances of deep renovation by enhanced quality control, supported by targeted CPD and training (objective 2).
- - Providing consumers and end-users of deep renovation projects with attractive, understandable, and personalized information of realized real performance (objective 3).

The work is subdivided in 2 phases. The first phase aimed at developing the platform by feeding it with real inputs. The second phase, which is reported in this deliverable, focuses on evaluating and fine-tuning the platform based on the feedback provided by the users involved.

1 Introduction

This activity focuses interest on the overall evaluation of the TripleA-reno Open Gamified Platform ensuring an end-user-oriented platform. The evaluation through common protocols (D5.3) provides the opportunity to evaluate and rate the tools with respect to characteristics that can make a tool successful: reliability, usefulness, applicability, acceptance, user-friendliness, and transferability, etc. Final conclusions are provided to the platform developers in the form of suggestion of improvements regarding functionalities and ergonomics for further versions, ensuring that the platform is end-user oriented.

The D5.3 protocols offer information about how to develop the evaluation of the platform by indicating the specific steps to be followed, the tools and methods that may be used and the results expected to get homogenous information from the different demonstrators. The methods to be used during the campaigns with end-users are surveys, workshops, competitions, etc.

Nevertheless, it is to be noted that COVID-19 crisis modified this approach, and a contingency plan was set to contain drawbacks caused to the research by social distance and confinement measures implemented in the different participating countries. This situation also affected the IT development process, with respect to the validation of versions with partners involved in the functional requirements and use cases definition, and even when the tools are available at the time of project finalization, testing and evaluation have suffered, not only COVID restrictions, but time restrictions. Therefore, evaluation and discussion sessions have changed into feedback questionnaires and reporting forms, to retrieve the most information possible in the shortest time frame.

This document is divided into 3 parts. First one on defining the methodology used for testing and evaluation, from the closest to IT development partners, to the completely external users; a second part, addressing each specific implementation of this methodology into the different tools; and a third one, compiling lessons learnt and recommendations.

2 Methodology

This section describes the incremental steps taken from the closest to IT development testing to the completely external evaluation of the tools deployed by the TripleA-reno project at the time of its finalization.

2.1 Internal testing

The development of the open gamified platform consisted of 5 new applications, and additional features in the existing Build Upskills platform.

Using a CI platform to automatically test software during development and when making changes to the software provides a high degree of confidence that the software will work as intended. Geckotech set up CI using GitLab for all components that were developed for the TripleA-reno gamified platform.

2.2 Internal evaluation

Most applications have been available for internal evaluation by the consortium.

2.2.1 Feedback form

A Google Form was set up to collect feedback, which could either be a bug or an improvement.

The feedback form would require the reporter to fill out the following information:

- Email address (for providing feedback)
- Application for which a bug was filed:
 - Project portal
 - Co-design /morphological design
 - Labelling wizard / end-user comfort label
 - Professional comfort label
 - BuildUpSkills app / inspections
- Type of feedback:
 - Bug/problem
 - Suggestion/improvement
- Short description of question or suggestion
- What is the URL?
- What is the problem?
- What did you expect, or do you suggest?
- Do you have an image to clarify? (Optional)

By providing making most of these questions mandatory, the feedback received was of high quality and directly actionable.

In total 65 reports were made, divided over COMFORT, ISSO, ICLEI, IVE, GT and UIPI.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S H2020 FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION UNDER GRANT AGREEMENT NO 784972.

The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained therein.

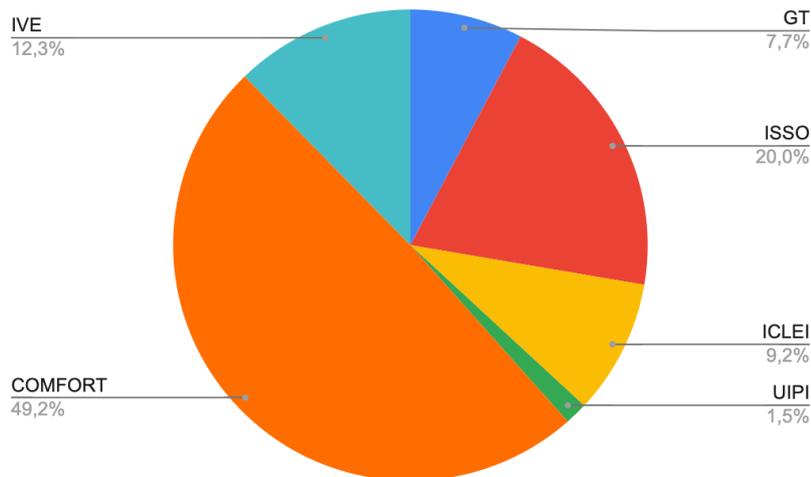


Figure 1.- number of responses provided by each partner

As is often the case, most reports were for improvements rather than bugs:

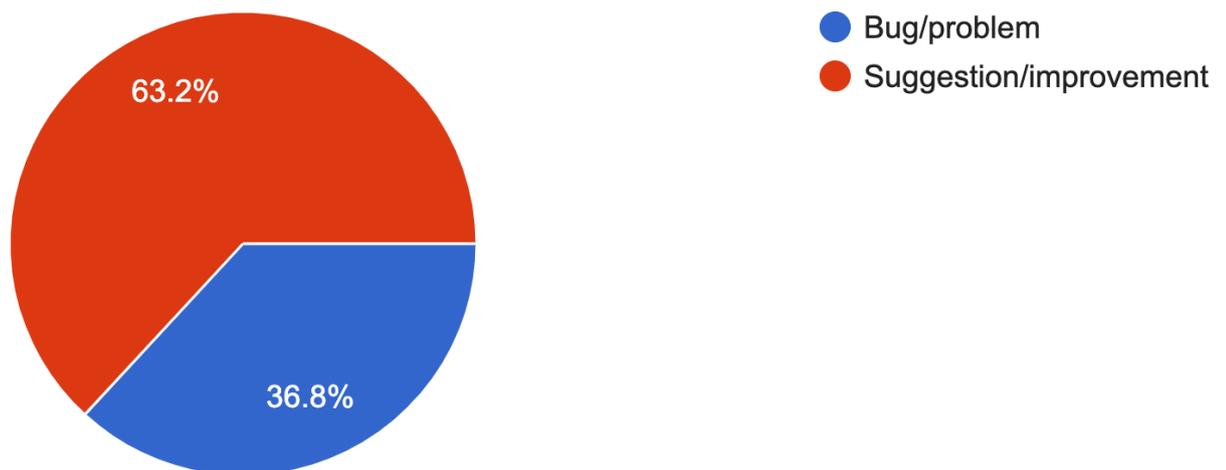


Figure 2.- Type of feedback received

In total feedback was provided 65 times. Out of those reports 22 were bugs (36.8%), and 43 improvements (63.2%).

Not all feedback was accepted. Some items were rejected due to inability to reproduce bugs, complexity or time constraints by the partner responsible for developing the application.

For some feedback no resolution has been provided by the responsible partner, listed under % open. These items should generally be considered “not solved”.

Partner	Application	Number of remarks	Solved	Rejected	Open	% open
GT	Professional comfort label	33	26	7	0	0%
BRAMO	Project portal*	2	2	0	0	0%
BRAMO	Labelling wizard / end-user comfort label	20	8	0	12	60%
BRAMO	Co-design /morphological design	10	0	0	10	100%

* The project portal was not functional at the time of internal testing, hence the low number of reports

Details of all the reported bugs and improvements can be found in Appendix A.

2.2.2 Direct Feedback

For the tools having deployed early version to test by the consortium partners, direct feedback has been provided in the form of reports or e-mails in free format, aiming at developing a discussion or conversation between IT developer and functional requirements or use cases holders.

2.3 External evaluation

The D5.3 protocols offer information about how to develop the evaluation of the platform by indicating the specific steps to be followed, the tools and methods that may be used and the results expected to get homogenous information from the different demonstrators. The methods to be used during the campaigns with end-users were surveys, workshops, competitions, etc.

Nevertheless, COVID-19 crisis modified this approach, and a contingency plan was set in order to contain drawbacks caused by social distance and confinement measures implemented in the different participating countries. Therefore, evaluation and discussion sessions have changed into feedback questionnaires and reporting forms, to retrieve the most information possible in the shortest time frame.

2.3.1 Evaluation form

Based on D5.3 annexes, online questionnaires in Google forms format have been prepared, in order to get tabulated feedback susceptible to transform in reliability, usefulness, applicability, acceptance, user-friendliness, or transferability ratings measuring success on those topics and exposing weaknesses to be transformed into recommendations for further developments.

The evaluation form would require the reporter to fill out the following information:

- Profiling information
 - Age
 - Educational level
 - profession
- Application for which the evaluation is done

- Reliability indicators:
 - Completeness (0-5)
 - Consistency (0-5)
 - Accuracy (0-5)
- Applicability indicators:
 - Relevance (0-5)
 - Functionality (0-5)
 - Usefulness (0-5)
 - User-friendliness (0-5)
- Transferability potential (conceptual, not rated)

The report is anonymous.

The form is to be translated into the different participating countries language at the corresponding partner will, always maintaining the original structure to facilitate the integration and c/or comparison of results.

Together with the different tool’s presentation, description or explanation (and access), the evaluation form link is to be handled to the audience in the form of newsletter, e-mailing campaign or on-line or presential event by the consortium partners within their possibilities and responsibilities as defined in their internal organization or in the project GA.

A total of 4 questionnaires have been answered, with the distribution shown below:

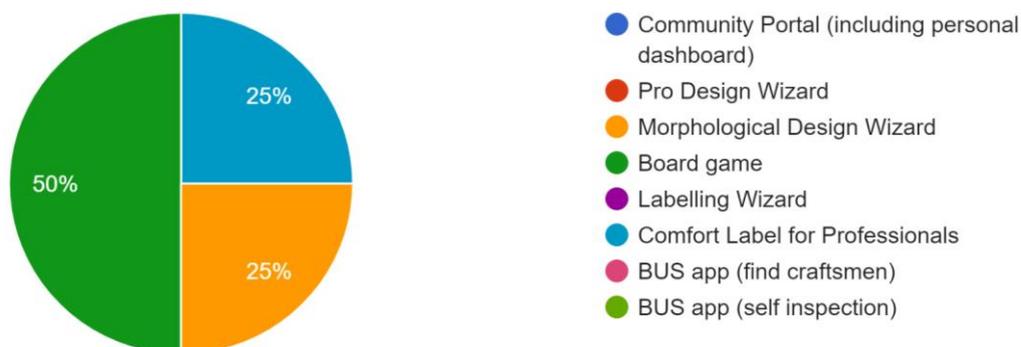


Figure 3.- External evaluation per TAR tool

2.3.2 Indirect Evaluation

Several events and road/home shows disseminated the TripleA-reno outcomes, mainly under the hosting of umbrella organizations or communication, dissemination and/or exploitations responsible partners. Some feedback has been retrieved from the impressions and comments got from the audience which helped building our conclusions and recommendations.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION’S H2020 FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION UNDER GRANT AGREEMENT NO 784972.

The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained therein.

3 Implementation

The previously explained methodology has been implemented in the 6 tools developed and released:

3.1 Gamification engine

3.1.1 Internal testing

Geckotech has developed the gamification engine using CI/CD techniques.

All API methods in the gamification platform has been verified using automatic tests, which are run again after each modification made to the software.

In total 34 tests have been created to test the functionalities exposed by the gamification engine.

Manual testing has been performed through Postman (an application to test REST calls) on an ad-hoc basis, mostly to reproduce errors reported during the internal evaluation phase.

3.1.2 Internal evaluation

Integrating the project portal was the most important part of the internal evaluation.

BRAMO has tested methods during integration of the gamification engine against the project portal. During the integration, several bugs have been found:

1. Player and team delete calls fail
2. Inspection completed generates 7 emails
3. GSON view gamification_engine_shared__player_gson defines package
4. 404 errors return HTML instead of JSON
5. Points should be 0 for new users
6. Swagger docs: create team missing input
7. Omitting Date of Completion When Saving Player Challenge Leads to an Exception
8. Triggering a Challenge For a Player Should Return The Created Object In The Response
9. Updating a Player Challenge Should Use The Id of PlayerChallenge Instead of Challenge

All of these bugs have been fixed, most of them within a week of when they were reported.

During the evaluation, BRAMO requested two additional features for the platform:

1. The ability to start and finish a challenge in a single request. Useful for onboarding challenges, e.g. when registration is completed a challenge needs to be completed immediately.
2. Ability to delete players and teams. Mostly used during the testing phase, to be able to repeat tests using the same player (email address).

Both features have been added to the gamification engine.

3.1.3 External evaluation

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S H2020 FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION UNDER GRANT AGREEMENT NO 784972.

The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained therein.

The external evaluation could not take place, because a public release of the project portal integrating the gamification features was not done in time.

3.2 Project portal

3.2.1 Internal testing

The portal contains the following modules

- the labeling wizard (LW);
- the morphological design wizard (MDW);
- the pro design wizard (PDW)
- the project showcase
- the project portal

Automatic tests have been defined for the parts of the software that do not contain user interactions, while the sections of the software containing modules dedicated to the User Interface have been tested with the help of internal resources.

Specifically, with reference to the pro design wizard, specific tests were performed to verify if the approximations used can be acceptable for the energy calculation, compared to the calculation performed with accurate data.

3.2.2 Internal evaluation

First prototype of welcome page has been tested by CM, GT and IVE, with no other comments than some clarification for the log-in placement.

Welcome page gave access to:

- personal dashboard (mock-up status at the moment of testing)
 - through registration and/or log-in (token to be hidden or simplified was requested)
- the showcase of finished projects (mock-u status), and
- the set of TAR tools (back to the portal button was requested)

Integration of the gamification engine was not in place at the time of testing.

The implementation of the requested modifications or improvements has not been checked by reviewer partners since the new version of the Project Portal was not shared at the time of writing this deliverable.

3.2.3 External evaluation

The external evaluation could not take place, because a public release of the project portal was not done in time.

3.3 Morphological design wizard

3.3.1 Internal testing

BRAMO has developed the Labelling Wizard using a framework (Flutter) that allows the distribution, using the same code, of the application in a Web, Android, IOS environment.

Automatic tests have been defined for the parts of the software that do not contain user interactions, while the sections of the software containing modules dedicated to the UI (User Interface) have been tested with the help of internal resources.

3.3.2 Internal evaluation

First versions of the Morphological Design Wizard were tested by project partners (IVE, COM, ISSO) and feedback was delivered through e-mail conversations and internal reports.

Main bugs or suggestions were referred to:

- Adapting general typology images to TABULA ones (according to country and timeframe)
- Adding explanations or descriptions to some icons and/or labels
- Reusing data from other tools previously used on the same building/project
- Simplify information (less data and indicators) and adding more images (graphic descriptions)
- Coherence of data from different indicators (DB check)
- Understandability of selections (highlighting, changing colors)
- Summary image understandability and compatibility with printed report

The google testing form was used to report a number of suggestions related to:

- Bad links or recovery/storage of data
- Improving user guidance & info
- Better visualization

Integration of the gamification engine was not in place at the time of testing.

The implementation of the requested modifications or improvements has not been checked by reviewer partners since the new version of the Morphological Design Wizard was not shared at the time of writing this deliverable.

3.3.3 External evaluation

The external evaluation could not take place, because a public release of the Morphological Design Wizard was not done in time, but controlled evaluation of pre-release version has taken place, with results shown below, based on 1 response:

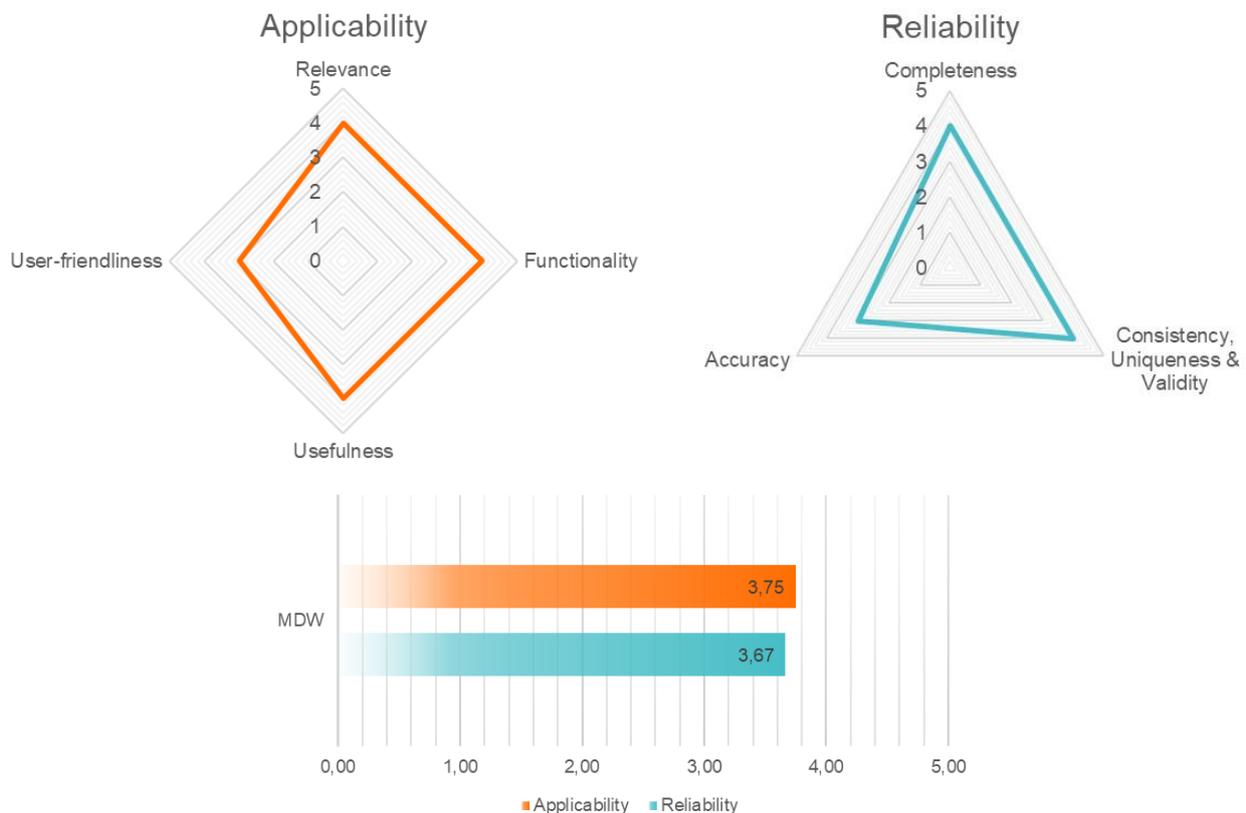


Figure 4.- External evaluation for Morphological Design Wizard on Reliability and Applicability

Major potential for replicability lays on the need to overcome the lack of funding, financing, or subsidies, where this tool could be adopted for designing each energy upgrade building project.

3.4 Labelling wizard

3.4.1 Internal testing

BRAMO has developed the Labelling Wizard using a framework (Flutter) that allows the distribution, using the same code, of the application in a Web, Android, IOS environment. For the development of the more specific part relating to the development of the survey, the LimeSurvey web application, an open source project (GPL v2 license), was used.

Automatic tests have been defined for the parts of the software that do not contain user interactions, while the sections of the software containing modules dedicated to the UI (User Interface) have been tested with the help of internal resources.

In particular, with reference to the labeling wizard, specific tests were carried out based on 20 pre-filled surveys to check if the software updates had introduced errors in the calculation of the score and in the creation of the recommendations.

3.4.2 Internal evaluation

First versions of the Labelling wizard were tested by project partners (IVE, COM, ISSO) and feedback was delivered through the google form, e-mail conversations and internal reports.

Main bugs or suggestions were referred to:

- Format of data to be input by users (text, double, integer, ranks...)
- Coherence of questions content, order and points awarded
- Coherence between questions (and data) asked and results presentation
- Presentation of results in different screen formats (mobile/computer)
- Reusing data from other tools previously used on the same building/project
- Adding explanations or descriptions to some icons and/or labels
- Representativeness of some images and screens
- Recommendations links with pdf downloadable factsheets

The google testing form was used to report a number of suggestions related to:

- Missing word and/or typos
- Broken links
- Visualization of images
- Meaning/need of default values

Integration of the gamification engine was not in place at the time of testing.

The implementation of a part of the requested modifications or improvements has not been checked by reviewer partners since the final version of the Labelling Wizard was not shared at the time of writing this deliverable, but most of them have been attended and main remaining requests refer to:

- integration with other TAR tools and services (reuse of data, gamification)
- coherence of questions content, order and points awarded
- Coherence between questions (and data) asked and results presentation
- Recommendations links with pdf downloadable factsheets

3.4.3 External evaluation

The external evaluation could not take place, because a public release of the Labelling Wizard was not done in time.

3.5 Professional comfort label

3.5.1 Internal testing

Geckotech has also developed the professional comfort label using the same CI/CD techniques used in other software.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S H2020 FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION UNDER GRANT AGREEMENT NO 784972.

The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained therein.

In total 177 automated tests have been created to test the various inputs and outputs of the professional comfort label. All steps of the comfort label are covered by these tests.

3.5.2 Internal evaluation

Comfort Consulting has extensively tested the professional comfort label. See Appendix A for all reported bugs and improvements.

Most feedback was received before December 2020 and was processed before the 7th consortium meeting in July 2021 after which the tool was released for external evaluation.

3.5.3 External evaluation

Professional comfort label has been validated in 4 pilot buildings in the context of sister project U-CERT, in Romania, France, Bulgaria and Spain, with no major problems or inconveniences. Nevertheless, questionnaires or testing sessions were not distributed or implemented.

The external evaluation, based on 1 response, has shown results below:

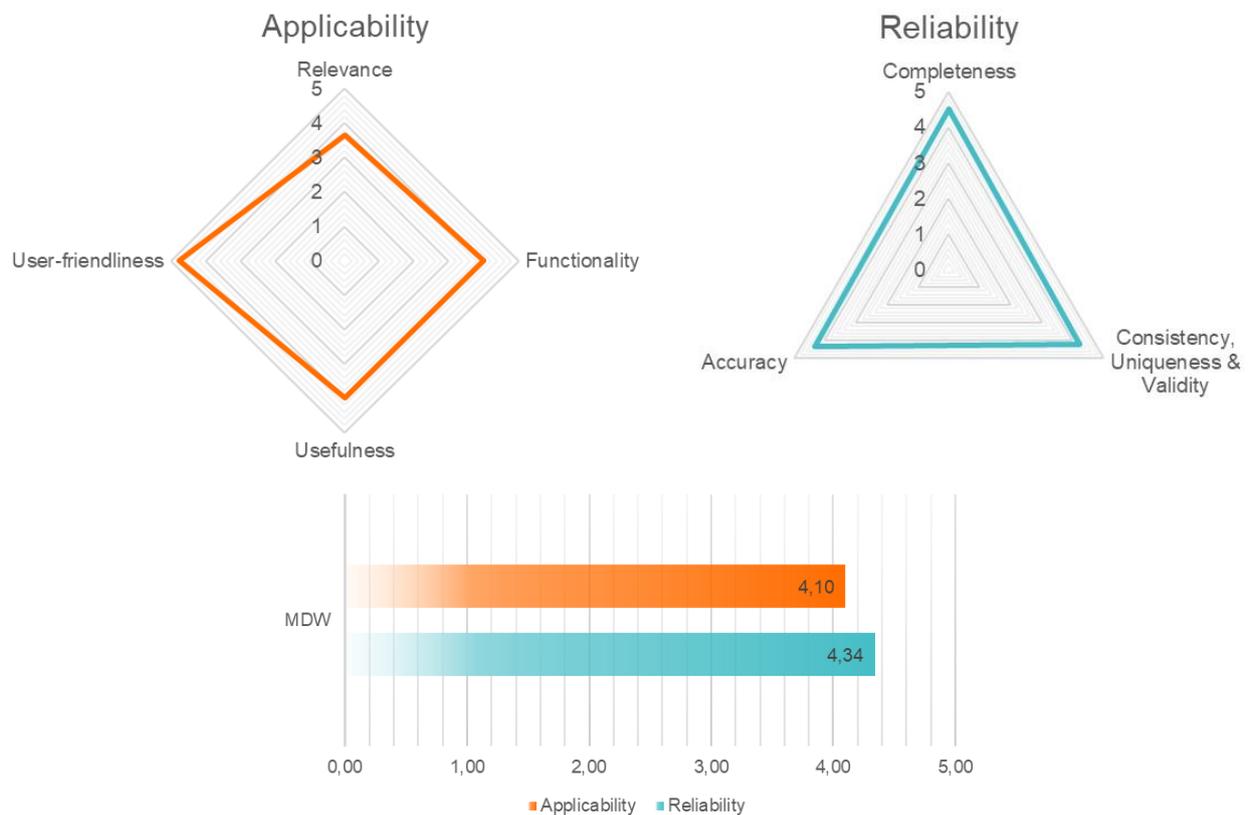


Figure 5.- External evaluation for Professional Comfort Label on Reliability and Applicability

Major potential for replicability lays on the need to overcome the absence of realistic and affordable political action plans for energy upgrade of residential building stock and the lack of funding, financing, or subsidies,

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S H2020 FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION UNDER GRANT AGREEMENT NO 784972.

The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained therein.

where this tool could be adopted for monitoring the performance indicators and benefits of energy renovation in implemented projects.

3.6 BuildUpSkills Advisor app (inspections, find craftsman)

3.6.1 Internal testing

Geckotech has added two new features to the BuildUpSkills Advisor app, in collaboration with ISSO.

- Inspections
- Find your craftsman

For “inspections”, an additional 21 automated tests were added to the test suite. Additionally, these features were manually tested by Jan Cromwijk (ISSO) before they were made more widely available for internal evaluation.

For “find your craftsman” 10 automated tests were added. Another test was performed by Jan Cromwijk (ISSO), and a user acceptance test was done by a non-expert after a one-on-one briefing by Jan.

3.6.2 Internal evaluation

Jan Cromwijk from ISSO has performed the user acceptance test for the inspection functionality. No bugs were found, and the feature was released for external evaluation.

For “find your craftsman” Jan also performed a user acceptance test, and additionally a non-expert was asked to use the application after a one-on-one briefing explaining the goal. This test was performed successfully, and the feature was released for external evaluation.

3.6.3 External evaluation

No results from external evaluation have come in yet.

4 Conclusions

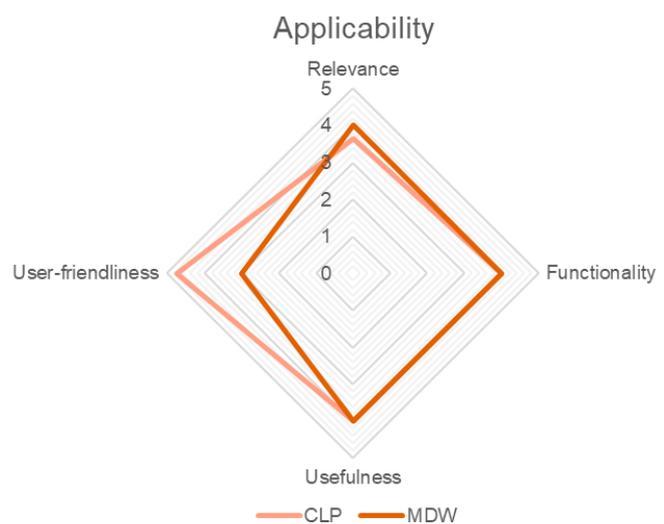
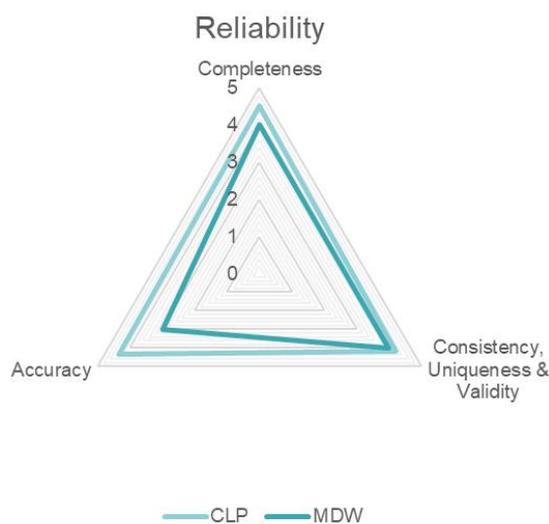
According to the previous section data and the project progress during its 42 months of life we can divide our conclusions in two big categories: those related to successes and failures in contrast to the objectives that this set of tools was to achieve and the planning of its milestones and deadlines; and those related to the value that this project still worth to deliver, and therefore further develop for the exploitation phase.

4.1 Lessons learned

In this section we find the most remarkable successes and failures of the project related to both the objectives that this set of tools was to achieve and to the planning of its milestones and deadlines.

For the objectives achievement:

- Deliver tools for different levels and users...
- Integrate them into a single workspace (including personal workspace)..
- User-centered approach...



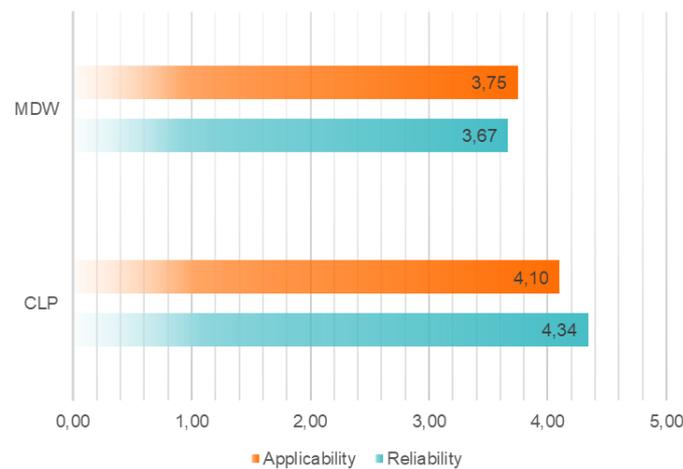


Figure 6.- Summary evaluation of TAR tools

As for the process:

- Ambitious goals in short time → evaluation missing (requirements set by mid-project, implementation by end-project- deployment and testing?)
- IT solutions do not cover whole spectrum of users (board game)

4.2 Future work

In this section we find the next steps worth to take, related to the value that this project still can deliver, linked to the exploitation and business plan delivered in WP6.

- **Refining** tools performance based on evaluation (and if needed, perform more evaluations and testing), specially on the detected KERs (Portal and Labels). The actual status is already being used/ tested in other research projects (U-CERT and reMODULEES), planning to be integrated into other ones. Explore standardization opportunities in connection to the U-CERT project outcomes (EPB Centre)
- Implementing IT requirements and functionalities gamification engine for **integration** of the label into other online environments (i.e., the professional version of the COMFORT label embedded into the Webserver of the U-CERT project, the SENSI monitoring, re-MODULEES project). Implementing IT requirements for online payments. Finalize the development of the Measures Showcase (TAR Objects)
- From these improvements, study how to offer it to public (in English or translated) according to different options. **Translation** to national languages.
- Define **business** model, copyright ownership and licensing scheme. Outline costs for marketing, maintenance, and update.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S H2020 FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION UNDER GRANT AGREEMENT NO 784972.

The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained therein.

Appendix: Feedback TripleA-reno applications

See separately attached:

- D5.4 Appendix A – internal testing feedback.xlsx
- D5.4 Appendix B – internal evaluation feedback.docx
- D5.4 Appendix C – external evaluation feedback.xlsx