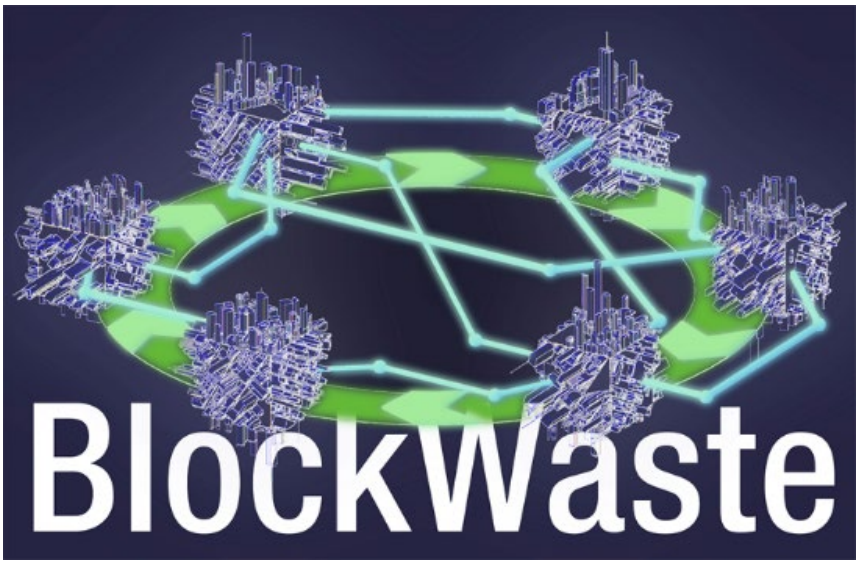
O3/A4. Technical test and implementation of IT improvements Interactive BlockWASTE Tool



ΙΔΡΥΜΑ ΚΡΑΤΙΚΩΝ ΥΠΟΤΡΟΦΙΩΝ IKY

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Author(s): Dimitris Damigos, National Technical University of Athens, damigos@metal.ntua.gr, Greece, Perry Smit, Saxion UAS, p.j.smit.01@saxion.nl, Netherlands, Ermo Täks, Tallinn University of Technology, ermo.taks@taltech.ee, Estonia

Reviewed by: David Caparros Perez, Centro Tecnológico del Mármol, Piedra y Materiales, david.caparros@ctmarmol.es, Spain, Maria Menegaki, National Technical University of Athens, menegaki@metal.ntua.gr, Greece,

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List of abbreviations

Abbreviation	**Definition**
MSW	Municipal solid waste
MSWM	Municipal solid waste management
OER	Open Educational Resource
CE	Circular Economy
SMEs	Small and medium enterprises
IT	Information technology

Executive summary

This document presents the results of the technical tests which were conducted by an external team of eight technical experts to locate possible errors and subsequent corrections. The technical experts evaluated the Interactive BlockWASTE Tool from a technical point of view, that is, they examined the Tool to detect functional problems. The external technical expert group worked during the development of the Interactive BlockWASTE Tool, and they responded to a questionnaire providing recommendations for the improvement of the BlockWASTE Tool.

All in all, the technical experts provided very positive comments about the Interactive BlockWASTE Tool. However, in some questions, non-IT experts disagreed or said that neither agreed nor disagreed. Aiming to address the concern of the technical experts, certain changes were made. First, the Interactive BlockWASTE Tool's webpage includes a direct link with the manual. The manual itself has been revised to make the game easier for non-IT experts. More specifically, particular attention was paid to sections 3.2 and 3.3 of the manual to facilitate the users. Finally, an Excel file with all background calculations of the BlockWASTE Tool is provided as a supplement.

1 Introduction

1.1 Brief project description

The BlockWASTE project aims to address the interoperability between waste management and blockchain technology and promote its proper treatment through educational training, so that the data collected will be shared within a safe environment, where there is no room for uncertainty and mistrust between all parties involved. For this purpose, the objectives of BlockWASTE project are as follows:

- To conduct research on solid waste generated in cities and how it is managed, so that it can be used to create an information base of good practices, in order to reintroduce waste into the value chain, promoting the idea of Intelligent Circular Cities.
- To identify the benefits of the Blockchain Technology within the municipal waste management (MSW) process.
- To create a study plan that allows the training of teachers and professionals of organizations and companies of the sector, in the overlap of the fields of Waste Management, Circular Economy (CE) and Blockchain Technology.
- To develop an interactive tool based on Blockchain Technology, which will make it possible to put into practice the management of data obtained from urban waste, thus visualizing the way in which the data is implemented in the Blockchain and enabling users to evaluate different forms of management

BlockWASTE aims to implement transnationally new educational contents with the goal of training its students in the partner countries and providing them with the necessary basic skills that allow them to act professionally as future workers in the sector, adding digital competences required by companies that are embracing the process of digital transformation. In this sense, the project is addressed to:

- Enterprises and SMEs, IT professionals, urbanisms and waste management professionals.
- Universities (professors, students and researchers).
- Public bodies

The project includes four Intellectual Outputs as follows:

- O1. Learning materials for interdisciplinary Blockchain-MSW
- O2. European common curriculum on MSW applying Blockchain technologies to Circular Economy strategies
- O3. E-Learning tool based-on Blockchain-MSW focused on Circular Economy
- O4. BlockWASTE Open Educational Resource (OER)

1.2 Objectives and methodological approach

This document presents the results of the technical tests which were conducted by an external team of eight technical experts to locate possible errors and subsequent corrections. The technical experts evaluated the Interactive BlockWASTE Tool from a technical point of view, that is, they examined the Tool to detect functional problems. The external technical expert group worked during the development of the Interactive BlockWASTE Tool, and they

responded to a questionnaire (see Annex I) providing recommendations for the improvement of the BlockWASTE Tool.

2 Technical test and implementation of IT improvements

2.1 General information about the experts and the evaluation process

The external pedagogical expert group was formed by 8 experts from Greece (2), Germany (2), the Netherlands (2), Spain (1), and Estonia (1). The technical experts were specialised in the following areas: Blockchain/IT sector (6), Waste Management (1), and other sectors (management) (1). They were recruited after being contacted by the project partners. The details of the experts are provided in Annex II.

Due to delays in the development of the Interactive BlockWASTE Tool, the technical expert's involvement run in parallel with the three pilot courses. Thus, the technical experts were also provided with the draft version of the Interactive BlockWASTE Tool and, therefore, their evaluation and suggestions for improvement couldn't be taken into consideration before the organisation of the pilot schools. Yet, this was not a problem for the final version of the Interactive BlockWASTE Tool, since all the comments and recommendations from the pilot schools and the technical (but also the pedagogical) tests were used to make the necessary improvements.

For the purposes of the technical tests, the experts were provided with the draft version of the Interactive BlockWASTE Tool, and the manual of the Interactive BlockWASTE Tool.

In order to collect their feedback in a consistent way, a questionnaire was created including, in total, about 20 questions regarding the technical evaluation of Interactive BlockWASTE Tool, which were grouped in two categories, i.e. general and technical questions(see also Annex I).

As far as the general questions are concerned, the technical experts were asked to comment on the following statements:

- The BlockWASTE tool is well-structured
- The BlockWASTE tool is easy to use
- The design of the BlockWASTE tool environment is detailed enough to understand the topics
- Overall, the performance of the BlockWASTE tool is satisfactory
- The BlockWASTE tool handbook was helpful and provided all the information it should
- Overall the performance of the BlockWASTE tool is satisfactory
- The BlockWASTE tool handbook was helpful, and provided all the information it should
- It is easy to navigate through the different sections of the BlockWASTE tool
- The BlockWASTE tool interface is easy to understand and motivating
- The BlockWASTE tool runs smoothly
- The BlockWASTE tool met my expectations
- Programming of the BlockWASTE tool is correct

The technical assessment questions of the Interactive BlockWASTE Tool were based on the following statements:

- BlockWASTE Tool has an easy access from the website of the project
- The operating speed of the tool is adequate
- The documentation incorporated in the tool facilitates its use
- The resolution of user queries is easily accessible
- How often does the BlockWASTE Tool "hang" or "crash"?
- Would you recommend BlockWASTE tool from the point of view of its proper technical development?]
- Did you locate functional or other problems? If yes, please provide recommendations for corrections

The evaluation results from the external technical expert group are presented in the following section.

2.2 Evaluation results

All but two external technical experts agreed that the Interactive BlockWASTE Tool is well-structured (Figure 1), and easy to use (Figure 2).

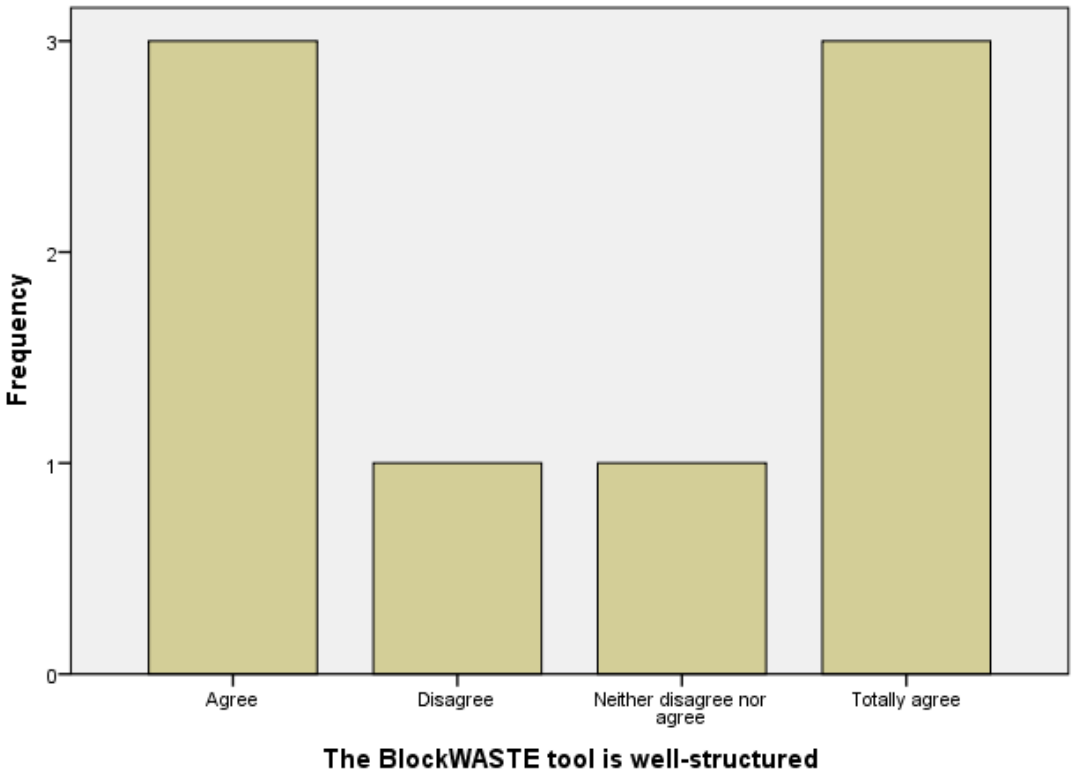

Figure 1: The BlockWASTE tool is well-structured

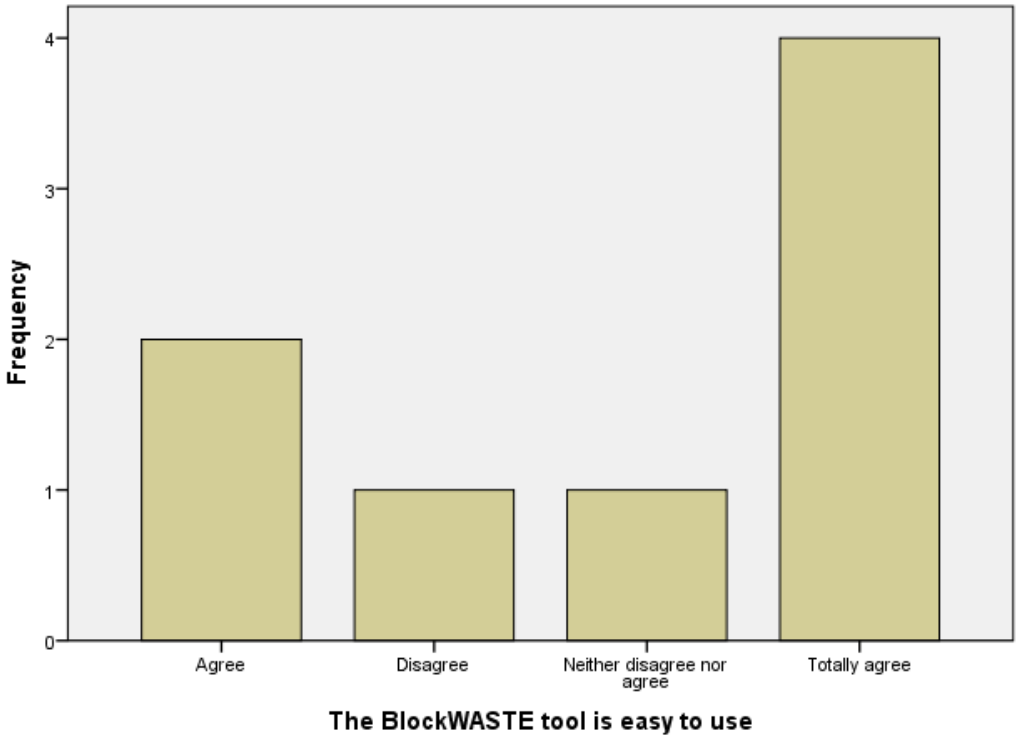

Figure 2: The BlockWASTE tool is easy to use

Five out of the eight experts agreed that the design of the BlockWASTE tool environment is detailed enough to understand the topics, while the rest said the opposite (Figure 3). It should be noted however that two out of the three technical experts who disagreed come from non-IT sectors.

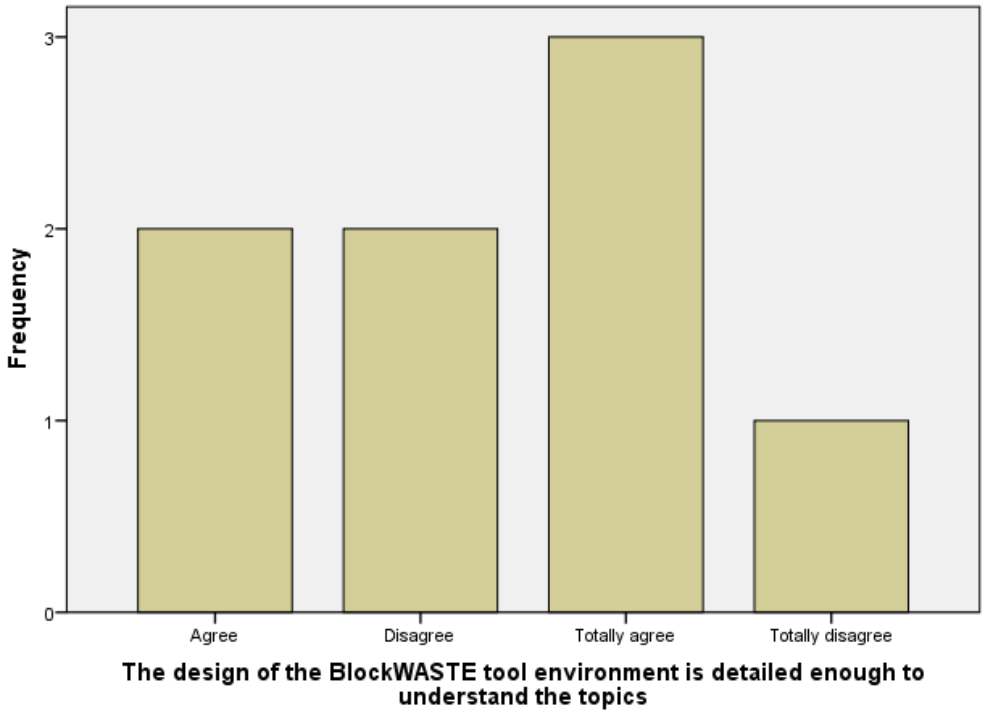

Figure 3: The design of the BlockWASTE tool environment is detailed enough to understand the topics

Regarding the overall performance of the Interactive BlockWASTE Tool, six out of the eight external technical experts agreed that it is satisfactory, one neither agreed nor disagreed, and one (from a non-IT sector) disagreed (Figure 4).

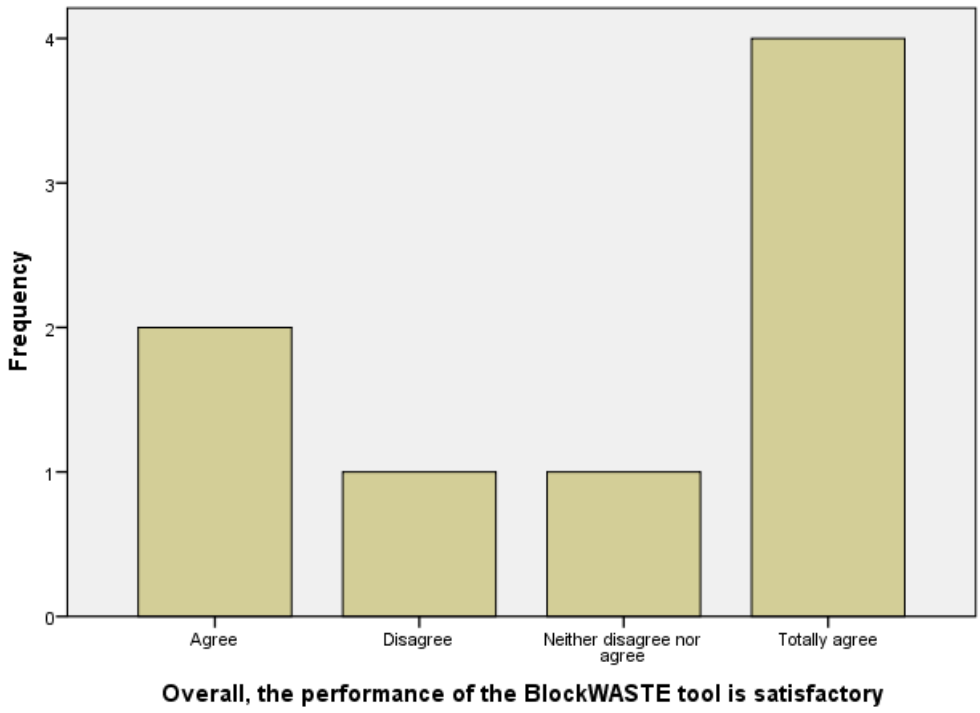

Figure 4: Overall the performance of the BlockWASTE tool is satisfactory

However, none of the technical experts disagreed with the statement that overall the performance of the Interactive BlockWASTE tool is satisfactory (Figure 5).

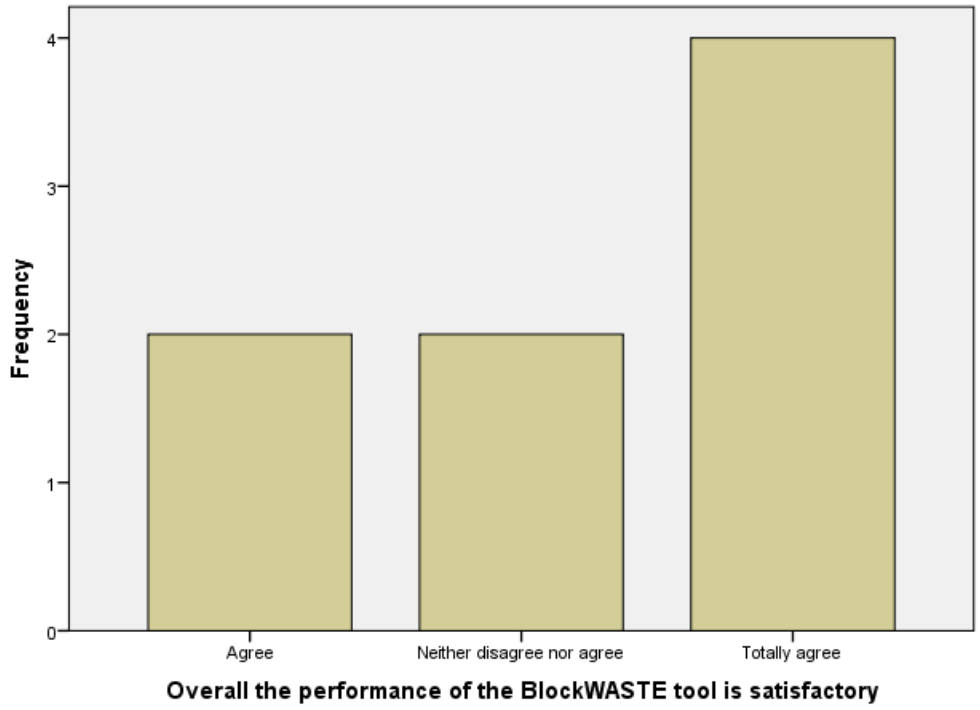

Figure 5: Overall the performance of the BlockWASTE tool is satisfactory

All but one of the experts (again from a non-IT sector) agreed that the Interactive BlockWASTE tool handbook was helpful and provided all the information it should (Figure 6), and that it is easy to navigate through the different sections of the Tool (Figure 7).

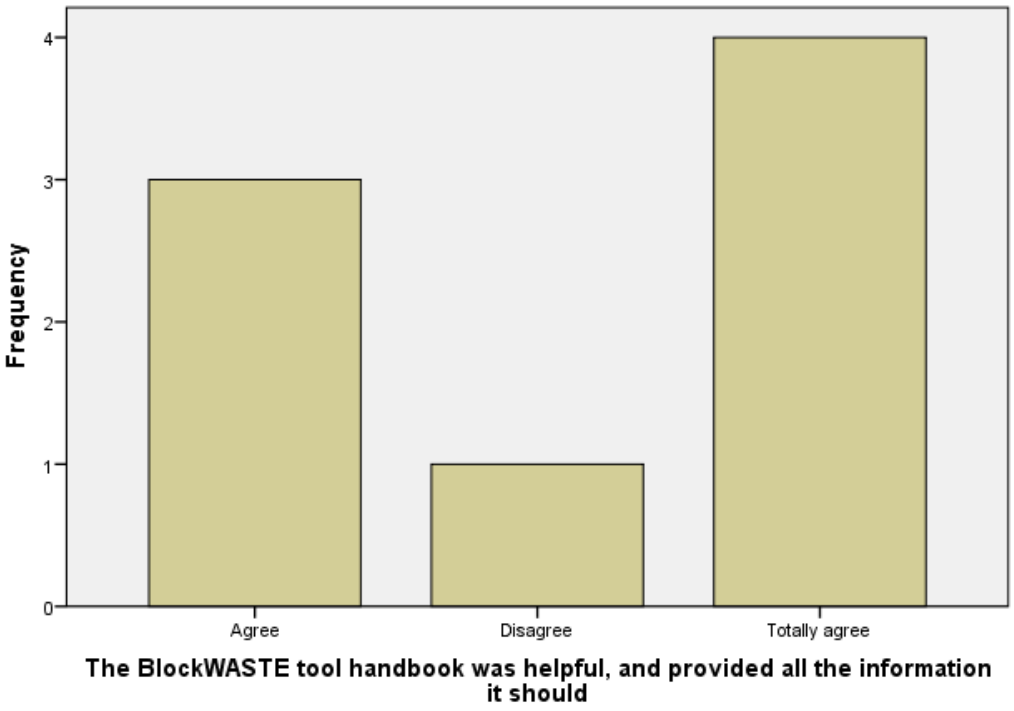

Figure 6: The BlockWASTE tool handbook was helpful, and provided all the information it should

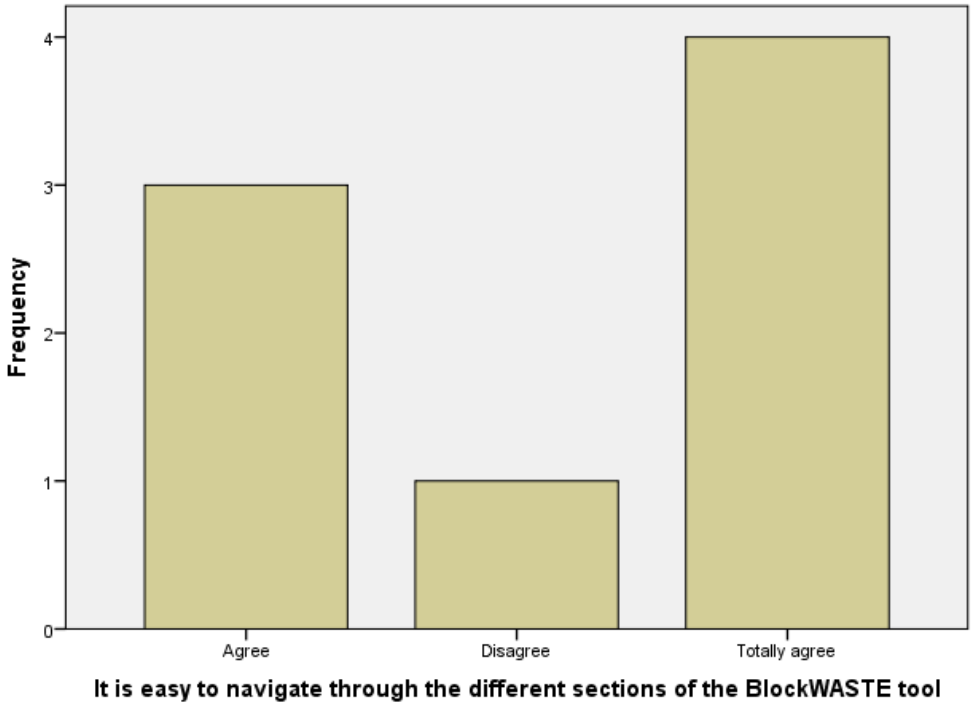

Figure 7: It is easy to navigate through the different sections of the BlockWASTE tool

Moreover, five out of the eight experts said that the Interactive BlockWASTE Tool interface is easy to understand and motivating, one said that neither agrees nor disagrees, and two said that they disagree (Figure 8). Both technical experts who disagreed come from non-IT sectors.

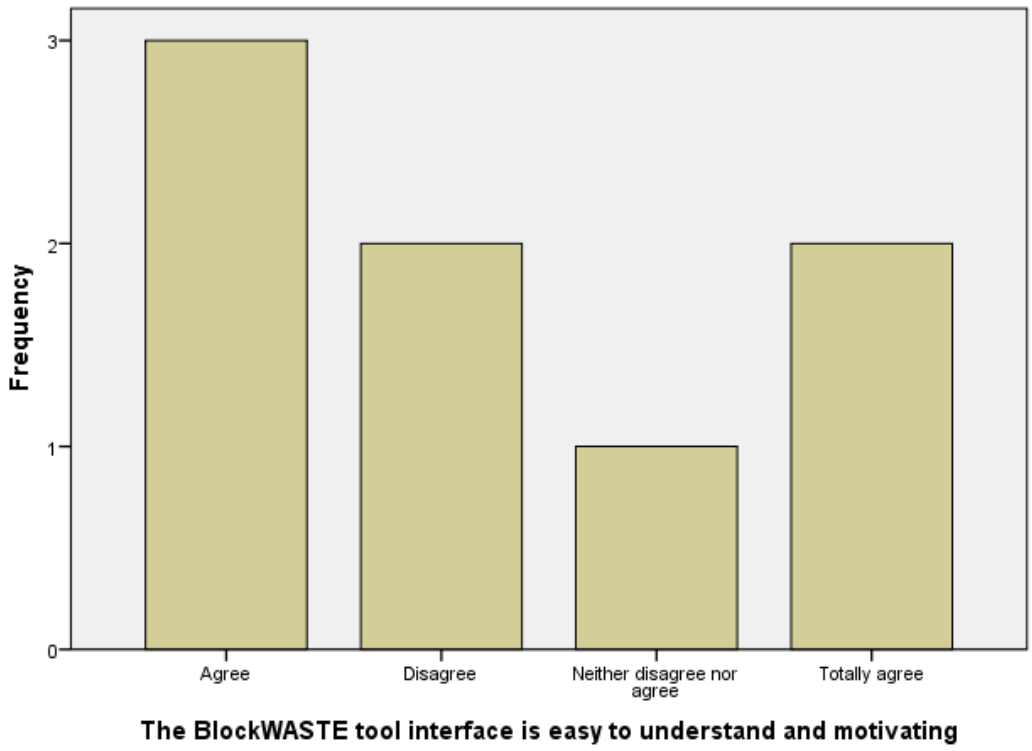

Figure 8: The BlockWASTE tool interface is easy to understand and motivating

Practically all the experts agreed that the Interactive BlockWASTE Tool runs smoothly (Figure 9). One of the non-IT experts stated that neither agrees nor disagrees.

When the experts were asked whether the Interactive BlockWASTE Tool met their expectations, five agreed, one said that neither agrees nor disagrees and two disagreed (Figure 10). Again, the two technical experts who disagreed were from non-IT sectors.

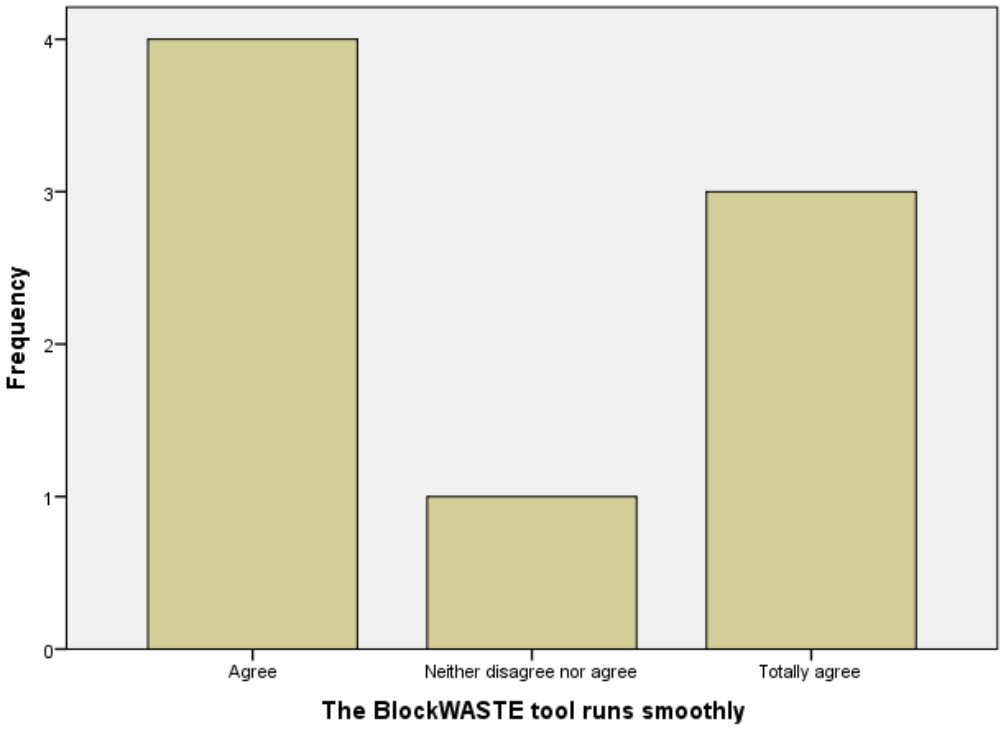

Figure 9: The BlockWASTE tool runs smoothly

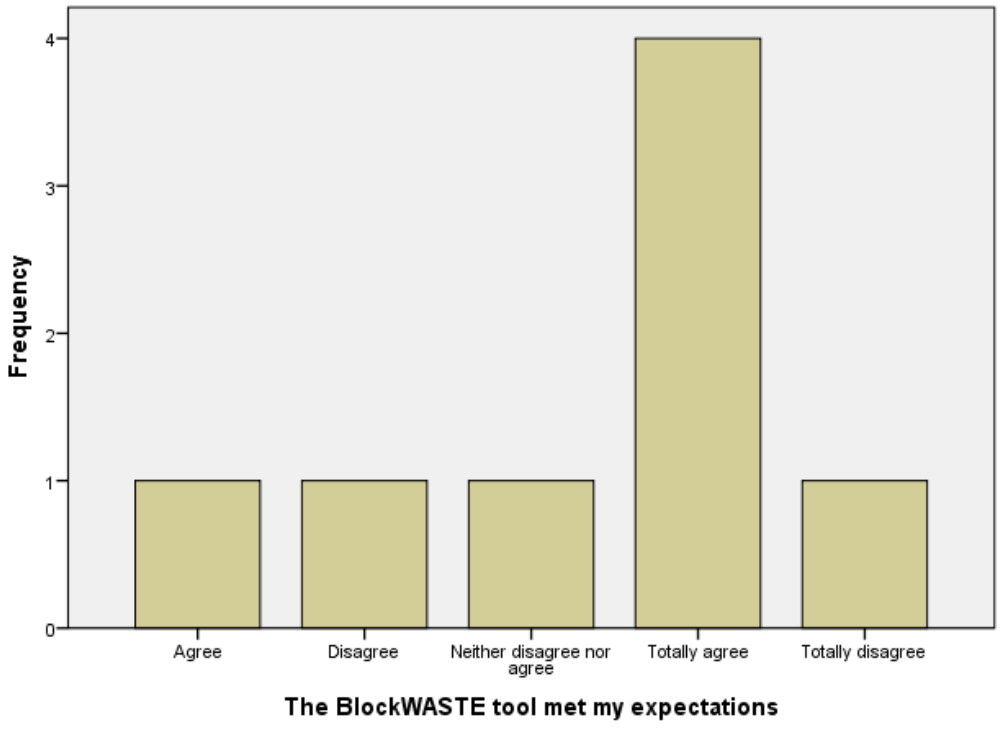

Figure 10: The BlockWASTE tool met my expectations

Practically all the experts agreed that the programming of the Interactve BlockWASTE tool is correct (Figure 11) (one expert who said that neither agrees nor disagrees come from a non-IT sector), and all agreed that the Tool has an easy access from the website of the project (Figure 12).

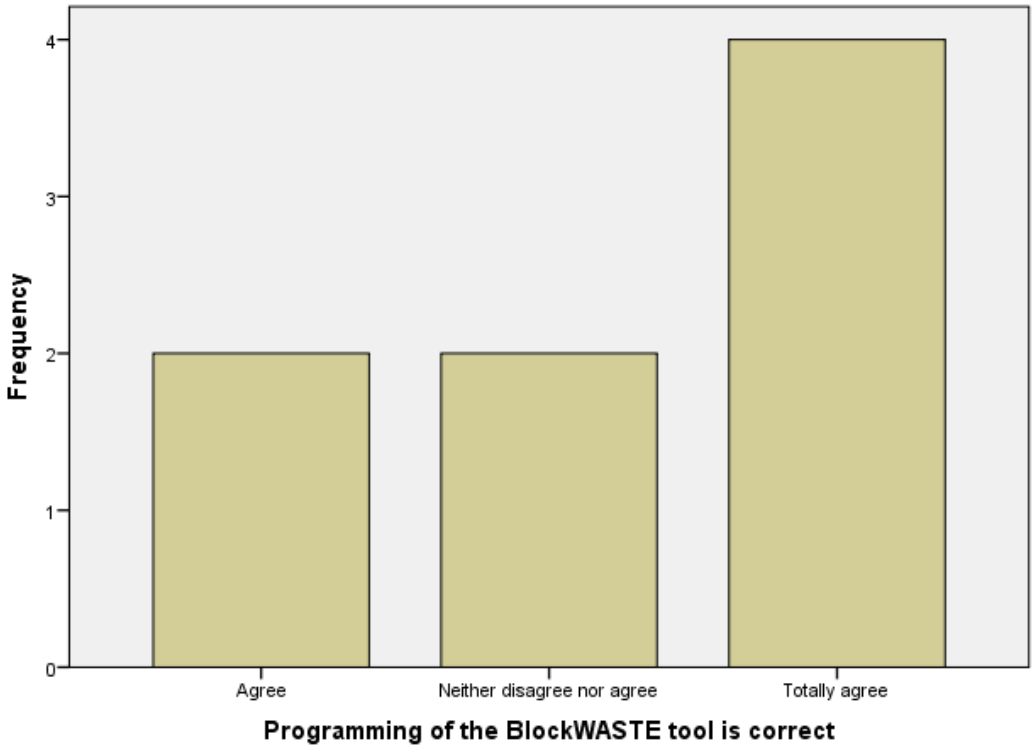

Figure 11: Programming of the BlockWASTE tool is correct

Figure 12: BlockWASTE Tool has an easy access from the website of the project

Further, all the experts agreed that the operating speed of the tool is satisfactory (Figure 13) and that the documentation incorporated in the tool facilitates its use (Figure 14). A non-IT technical expert said that neither agrees nor disagrees with the latter statement.

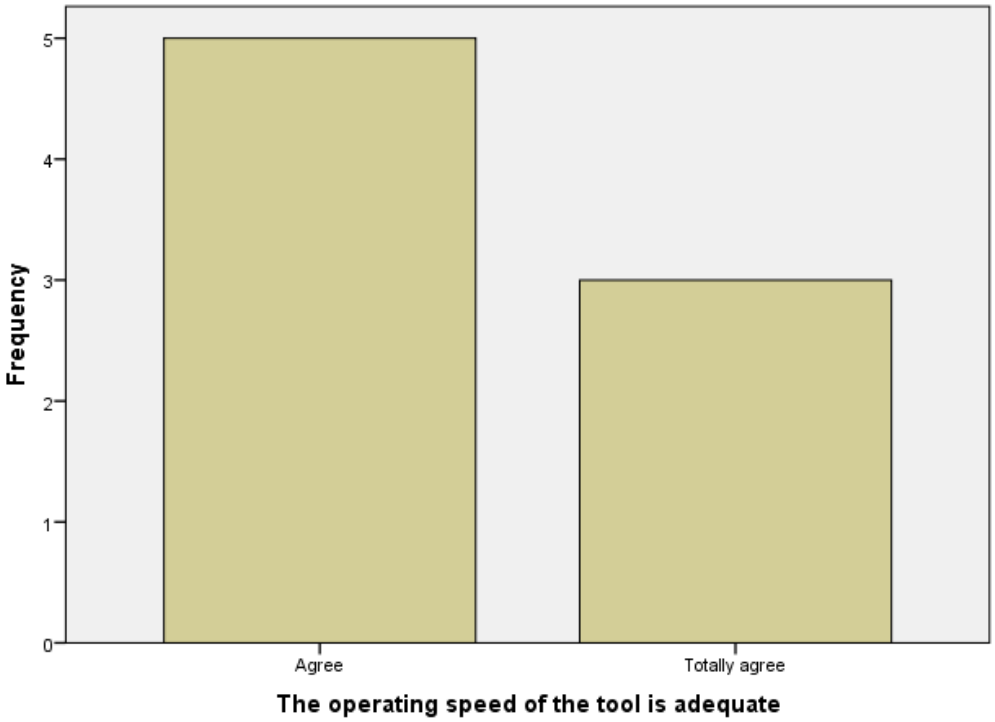

Figure 13: The operating speed of the tool is adequate

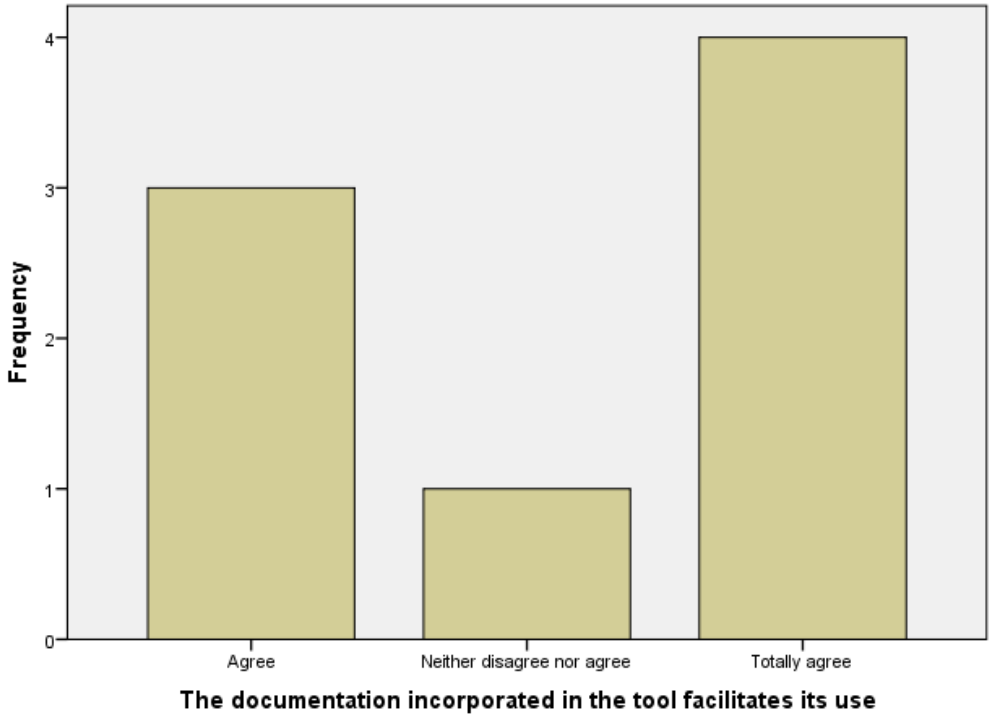

Figure 14: The documentation incorporated in the tool facilitates its use

Similarly, all the experts but one who said that neither agrees nor disagrees (from the IT sector in this case) agreed that the resolution of user queries is easily accessible (Figure 15).

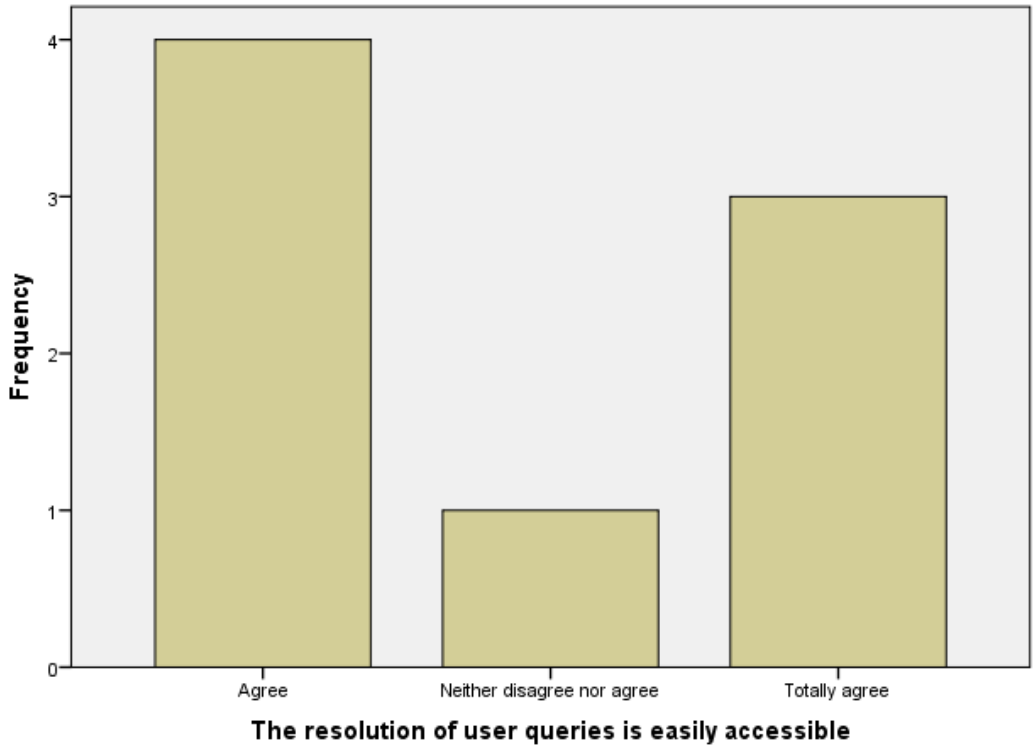

Figure 15: The resolution of user queries is easily accessible

Moreover, half of the experts agreed that the Tool does not crash often, and the rest said that they neither agree or disagree (Figure 16). When asked, they said that they didn't notice any crash, but since the original question was "How often does it 'hang' or 'crash'?", they selected the "neither agree nor disagree" option.

All the experts but two who are not working in the IT area said that they would recommend the Interactive BlockWASTE tool from the point of view of its proper technical development (Figure 17).

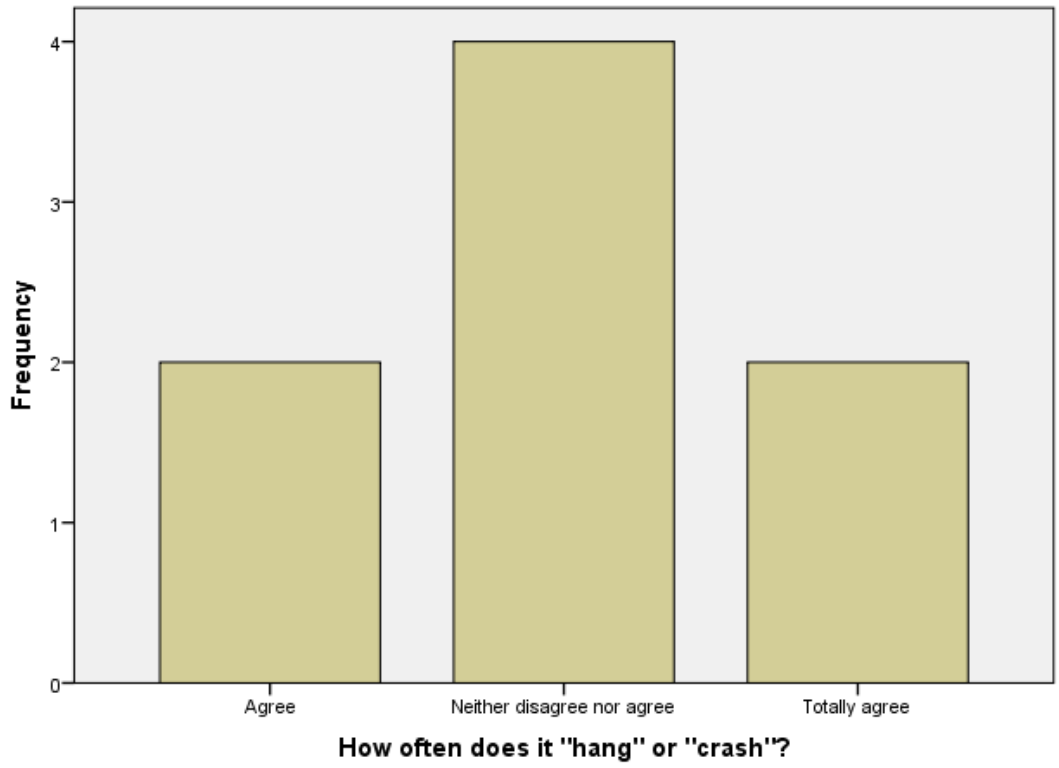

Figure 16: The BlockWASTE Tool does not "hang" or "crash"often

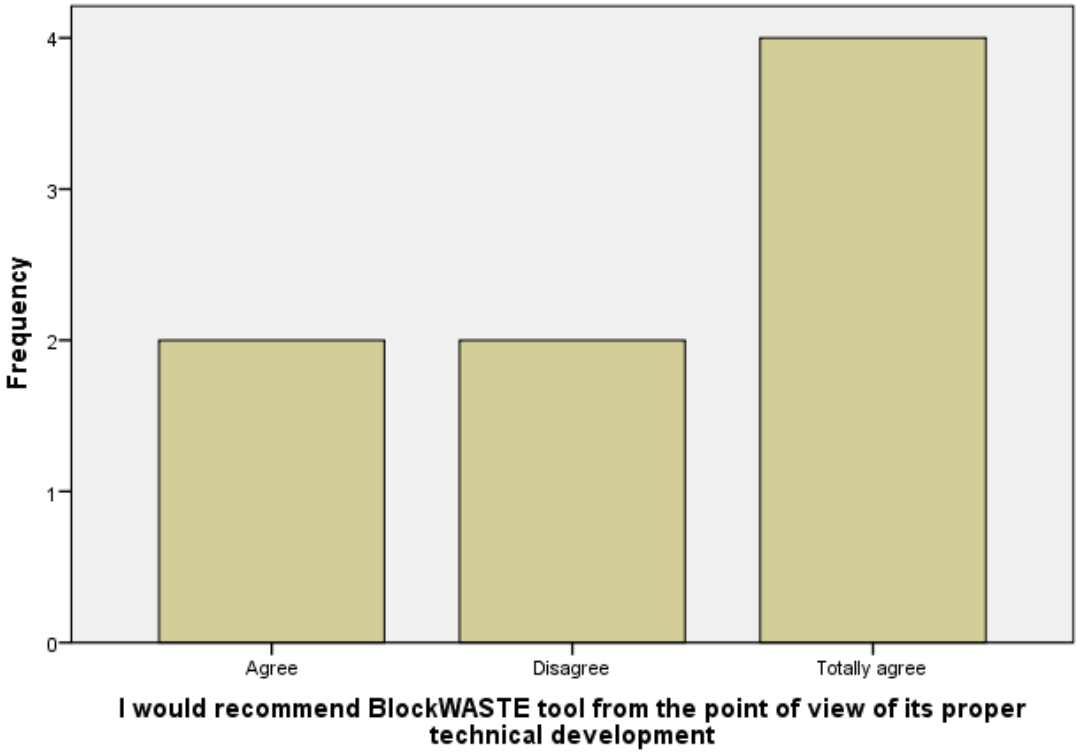

Figure 17: I would recommend BlockWASTE tool from the point of view of its proper technical development

Finally, the experts were asked to state if they noticed any functional or other problems. Three of them answered in the affirmative (Figure 18). All of them noticed that there wasn't a working link to the BlockWASTE Tool manual. Also, one of them who was from the IT sector said that she/he believes that the users have to read the manual before playing the game, otherwise they may have difficulties in understanding the concept. Also, she/he mentioned that "*..it is impossible to evaluate technical implementation without looking at the code*…".

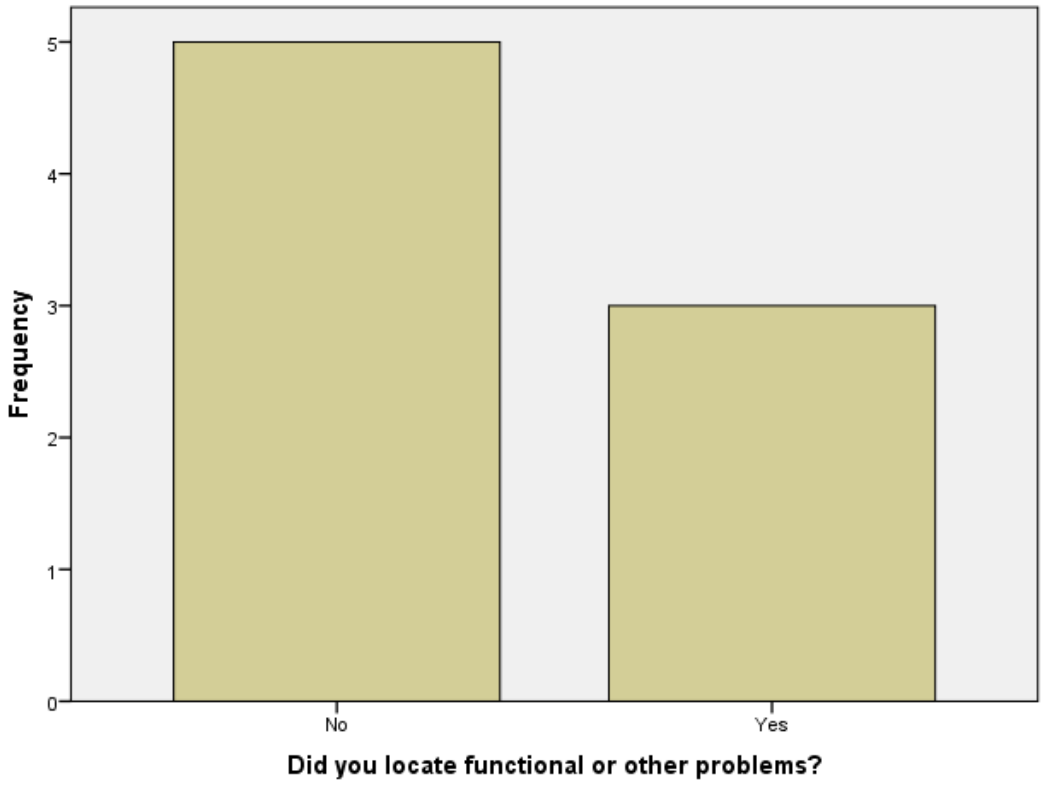

Figure 18: Did you locate functional or other problems

2.3 Recommendations and improvements made

Aiming to address the concern of the technical experts, certain changes were made. First, the Interactive BlockWASTE Tool's webpage includes a direct link with the manual. The manual itself has been revised to make the game easier for non-IT experts. It is reminded that in the vast majority of cases where an expert disagreed or said she/he neither agreed nor disagreed, it was from a non-IT sector. More specifically, particular attention was paid to sections 3.2 and 3.3 of the manual to facilitate the users. Finally, following experts' suggestion, an Excel file with all background calculations of the BlockWASTE Tool is provided as a supplement.

2.4 Conclusions

As a first conclusion, experts from all partner countries involved in the project, which makes the results more robust. In the same direction, responses from specialists in the Blockchain/IT sector as well as from the waste management and other sectors were collected.

Regarding the general evaluation questions of the BlockWASTE Tool, the following conclusions are drawn:

- In general, the respondents (except for two, who do not come from the IT sector) think that the tool is well structured, as well as easy to use.
- Regarding the fact that its design is sufficiently detailed to understand the topics, the respondents have different opinions, 5 of them agree and 3 disagree (only one of them from the IT sector).
- Respondents generally agree with the performance of the Tool (except for two non-IT respondents).
- Respondents generally agree that the handbook was useful, the performance of the tool is satisfactory, that it is easy to navigate through the different sections of the tool and that the BlockWASTE Tool runs smoothly.
- There is a disparity of opinions that the interface is easy to understand and motivating. We also found a disparity of opinions in terms of respondents meeting expectations of the tool.

In the more technical evaluation questions, the results obtained were quite positive. The only non-positive responses in this section are found in the question “Would you recommend BlockWASTE tool from the point of view of its proper technical development?”, by two of the respondents, who are not IT experts however.

Recommendations from the respondents suggested improvements such as: adding information about the blockchain, lack of documentation for the game and the lack of a manual. All these weaknesses, the most prominent being the difficulty in using the game, have been solved by adding the game manual to the project website, which is available in English as well as in all the languages of the project partners. Users also have at their disposal all the project results on the project website: https://blockwasteproject.eu/oer/technical-documents/.

Annex I: Technical experts' questionnaire

Feedback questionnaire of BlockWASTE. Technical test

INNOVATIVE TRAINING BASED ON BLOCKCHAIN TECHNOLOGY APPLIED TO WASTE MANAGEMENT

REFERENCE: 2020-1-EL01-KA203-079154

1. Personal information

1.1. Name: *

Η απάντησή σας

1.2. email: *

Η απάντησή σας

1.3. Country: *

- ◯ Greece
- ◯ Germany
- ◯ Spain
- ◯ Estonia
- ◯ Netherlands
- ◯ Other

1.4. Sector: *

- ◯ Blockchain/IT sector
- ◯ Waste management
- ◯ Other

2. Interactive BlockWASTE Tool evaluation. General questions: *

	Totally disagree	Disagree	Neither disagree nor agree	Agree	Totally agree
The BlockWASTE tool is well-structured	◯	◯	◯	◯	◯
The BlockWASTE tool is easy to use	◯	◯	◯	◯	◯
The design of the BlockWASTE tool environment is detailed enough to understand the topics	◯	◯	◯	◯	◯
Overall, the performance of the BlockWASTE tool is satisfactory	◯	◯	◯	◯	◯

The BlockWASTE tool handbook was helpful and provided all the information it should	○	○	○	○	○
Overall the performance of the BlockWASTE tool is satisfactory	○	○	○	○	○
The BlockWASTE tool handbook was helpful, and provided all the information it should	○	○	○	○	○
It is easy to navigate through the different sections of the BlockWASTE tool	○	○	○	○	○
The BlockWASTE tool interface is easy to understand and motivating	○	○	○	○	○
The BlockWASTE tool runs smoothly	○	○	○	○	○
The BlockWASTE tool met my expectations	○	○	○	○	○
Programming of the BlockWASTE tool is correct	○	○	○	○	○

3. Interactive BlockWASTE Tool evaluation. Technical questions: *

	Totally disagree	Disagree	Neither disagree nor agree	Agree	Totally agree
BlockWASTE Tool evaluation has an easy access from the website of the project	○	○	○	○	○
The operating speed of the tool is adequate	○	○	○	○	○
The documentation incorporated in the tool facilitates its use	○	○	○	○	○
The resolution of user queries is easily accessible	○	○	○	○	○
How often does it "hang" or "crash"?	○	○	○	○	○
Would you recommend BlockWASTE tool from the point of view of its proper technical development?	○	○	○	○	○

4. Further comments and suggestions of improvement of the BlockWASTE Tool

Did you locate functional or other problems? *

- ◯ No
- ◯ Yes

If yes, please provide recommendations for corrections

Η απάντησή σας

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- ◯ Yes
- ◯ No

Annex II: Technical experts' details

Personal details removed due to privacy concerns