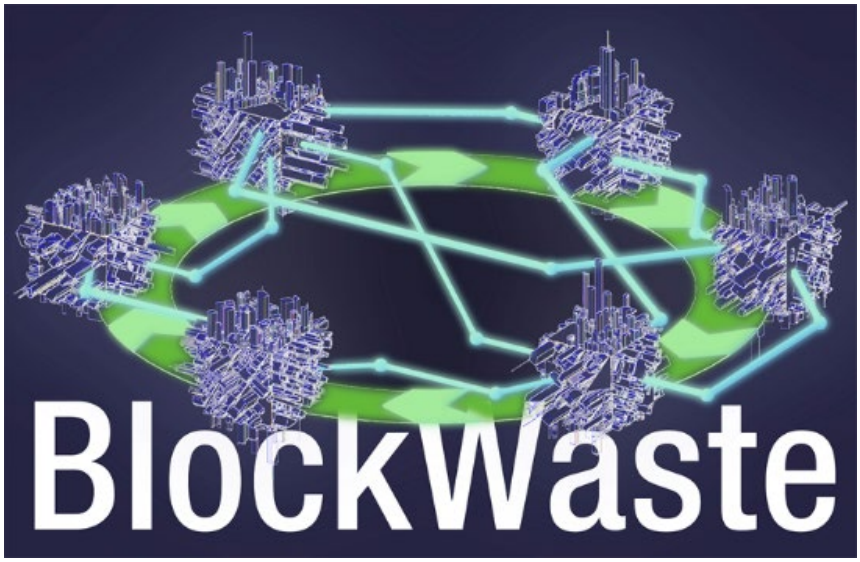
O3/A5. Pedagogical test and implementation of IT improvements Interactive BlockWASTE Tool



Disclaimer

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ΙΔΡΥΜΑ ΚΡΑΤΙΚΩΝ ΥΠΟΤΡΟΦΙΩΝ IKY

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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 pedagogical tests which were conducted by an external team of seven experts to quantify the pedagogical scope of the material included in the Interactive BlockWASTE Tool. The external pedagogical expert group worked during the development of the Interactive BlockWASTE Tool, and evaluated from an educational point of view, all the materials developed to be used as training means. The group of experts responded to a questionnaire and provided recommendations appropriate for the implementation of the BlockWASTE Tool.

All in all, the experts provided very positive comments about the Interactive BlockWASTE Tool and the related training materials. All the experts agreed that the Tool as a whole, is satisfactory and useful, motivates the user to utilise it, and fulfils its purpose and targets. In combination with the teaching material, it creates a stimulating learning environment and, therefore, they would recommend it to others. Some experts expressed some minor and major concerns that were addressed in the final version of the Tool and its manual.

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 pedagogical tests, which were conducted by an external team of seven experts in order to quantify the pedagogical scope of the material included in the Interactive BlockWASTE Tool. The external pedagogical expert group worked during the development of the Interactive BlockWASTE Tool, and evaluated from an educational point of view, all the materials developed to be used as training means. The group

of experts responded to a questionnaire (Annex I) and provided recommendations appropriate for the implementation of the BlockWASTE Tool.

2 Pedagogical 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 7 experts from Greece (4), the Netherlands (2) and Estonia (1). The pedagogical experts were drawn from stakeholder groups (i.e., academia and professionals from the IT and the waste management sector) and specialised in the following areas: Blockchain/IT sector (1), Waste Management (1), and other sectors – mainly the environmental sector (5). 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 pedagogical expert's involvement run in parallel with the three pilot courses. On the one hand, this means that they 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. On the other hand, however, this was not a problem for the final version of the Interactive BlockWASTE Tool, since all the comments and recommendations from the pilot schools, the technical and the pedagogical tests were used to make the necessary improvements.

For the purposes of the tests, the experts were provided with the draft version of the Interactive BlockWASTE Tool, the manual of the Interactive BlockWASTE Tool, as well as the accompanying training materials (e.g., the database for the E-Learning Tool, the handbooks, etc.).

In order to collect their feedback in a consistent way, a questionnaire was created including, in total, about 30 questions regarding the evaluation of Interactive BlockWASTE Tool, the evaluation of the BlockWASTE Course Curriculum/Learning materials, and an overall assessment together with suggested recommendations (see also Annex I).

As far as the evaluation of Interactive BlockWASTE Tool is concerned, the experts were asked to comment on the following statements:

- The BlockWASTE tool is well-structured, and its design facilitates online and in-the-classroom learning
- The BlockWASTE tool is easy to use
- The BlockWASTE tool is useful from an educational viewpoint
- The quality of the content and the innovative character of the BlockWASTE tool are satisfactory
- The BlockWASTE tool has clear learning outcomes
- Overall the performance of the BlockWASTE tool is satisfactory
- The BlockWASTE tool handbook was helpful, and provided all the information it should
- The BlockWASTE tool is an appropriate element of BlockWASTE's syllabus

The evaluation of the BlockWASTE Course Curriculum/Learning materials evaluation was based on the following statements:

- The Curriculum and related teaching material as, a whole, is satisfactory and facilitates the online and in-the-classroom learning
- The Curriculum can be implemented in the European HEI organisations
- The teaching material contains adequate information to improve the knowledge on blockchain and waste management
- The teaching material is interesting so as to motivate the user to utilize it
- The teaching material fulfils its purpose and targets, i.e., it is suitable for universities training programmes and companies in waste management sector
- The teaching material is easy to navigate and ease of use in learning contexts and self-training
- The obtained value from the utilization of the teaching material of BlockWASTE can be characterized as high
- The provided information is clear, concise, well-written and informative to the user
- The language and the content of the tool are non-discriminatory
- The information provided in the tool is valuable and help in understanding innovation and sustainability criteria in the new system based on CE criteria
- The teaching material met my expectations
- The way the teaching material is presented, creates a stimulating learning environment
- I would recommend the teaching material to others

Finally, the overall assessment and the suggested recommendations were collected through the following statements:

- The BlockWASTE Tool, as a whole, is satisfactory
- The BlockWASTE Tool is useful and motivates the user to utilise it
- The BlockWASTE Tool fulfils its purpose and targets
- The obtained value from the utilization of the BlockWASTE Tool can be characterised as high
- I would recommend the BlockWASTE Tool for use to others
- The BlockWASTE Tool met my expectations
- Specific comments and suggested recommendations (open-ended question)

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

2.2 Evaluation results

All the external pedagogical experts agreed that the Interactive BlockWASTE Tool is well-structured and its design facilitates online and in-the-classroom learning (Figure 1), easy to use (Figure 2), and useful from an educational viewpoint (Figure 3). It is mentioned that one of the experts responded that she/he neither agrees nor disagrees that the Interactive BlockWASTE Tool is well-structured and its design facilitates online and in-the-classroom learning and easy to use.

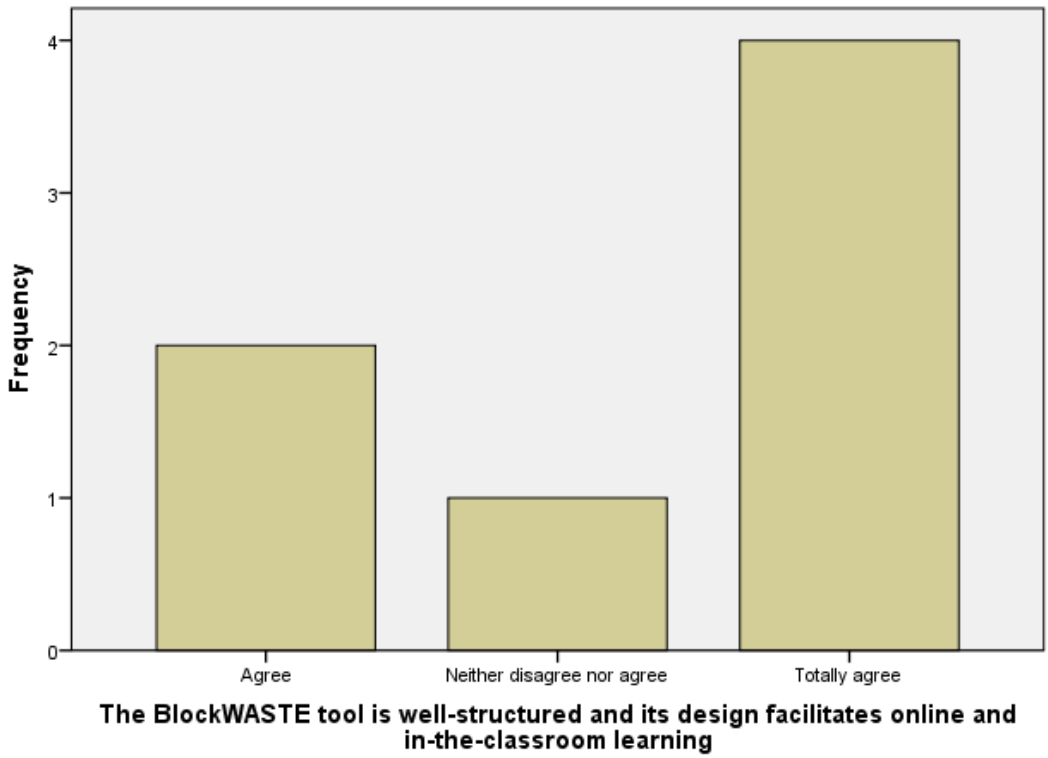

Figure 1: The BlockWASTE tool is well-structured and its design facilitates online and in-the-classroom learning

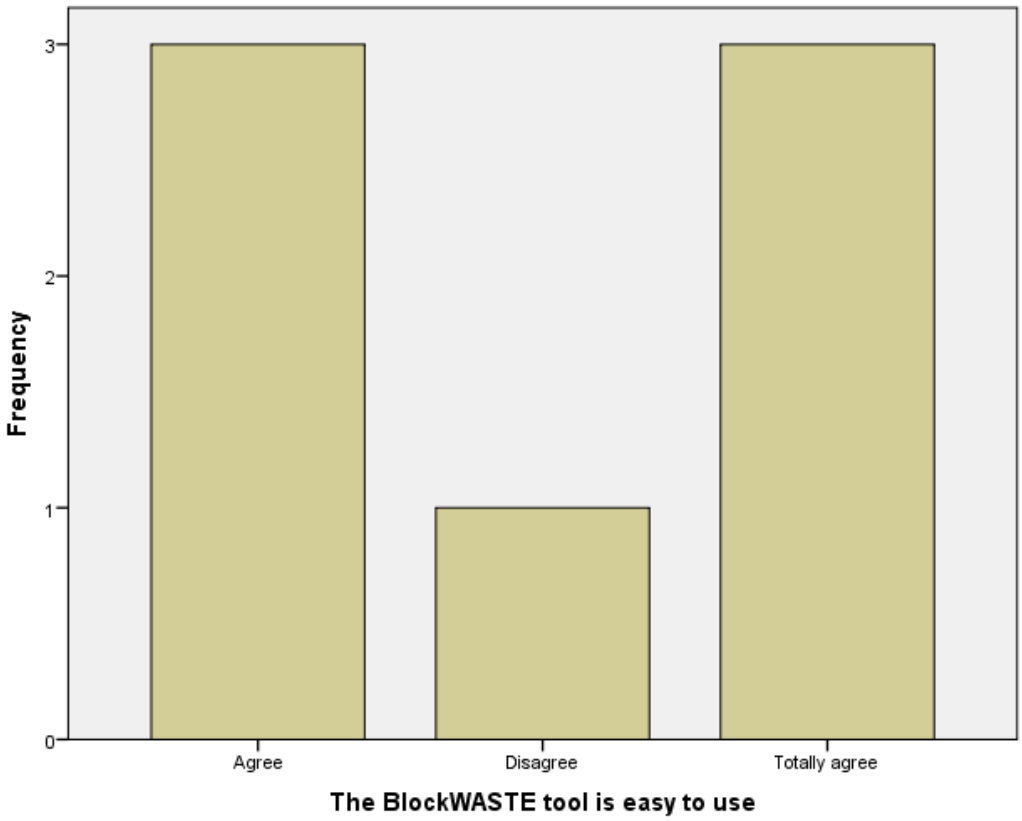

Figure 2: The BlockWASTE tool is easy to use

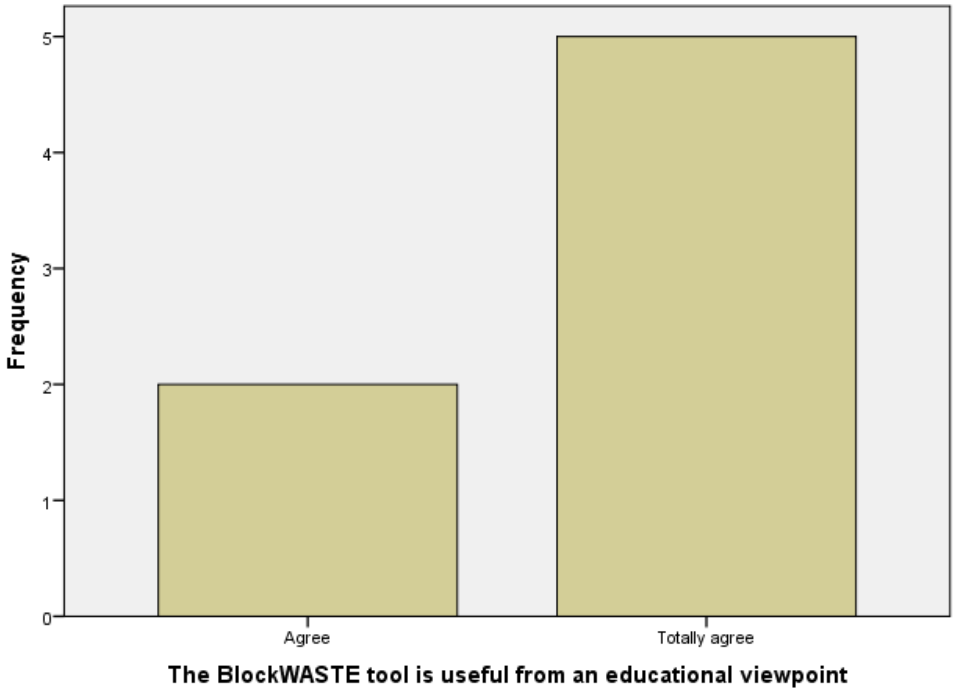

Figure 3: The BlockWASTE tool is useful from an educational viewpoint

Further, all the external pedagogical experts agreed that the quality of the content and the innovative character of the BlockWASTE tool are satisfactory (Figure 4).

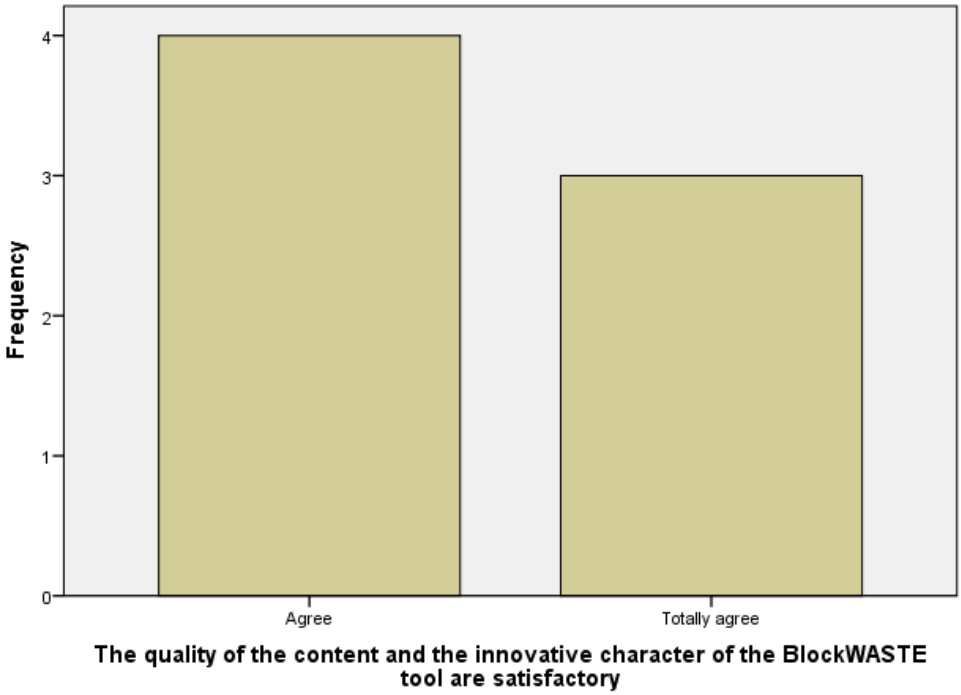

Figure 4: The quality of the content and the innovative character of the BlockWASTE tool are satisfactory

All the experts but one also agreed that the Interactive BlockWASTE tool has clear learning outcomes (Figure 5). However, all the experts said that the overall the performance of the Interactive BlockWASTE tool is satisfactory (Figure 6).

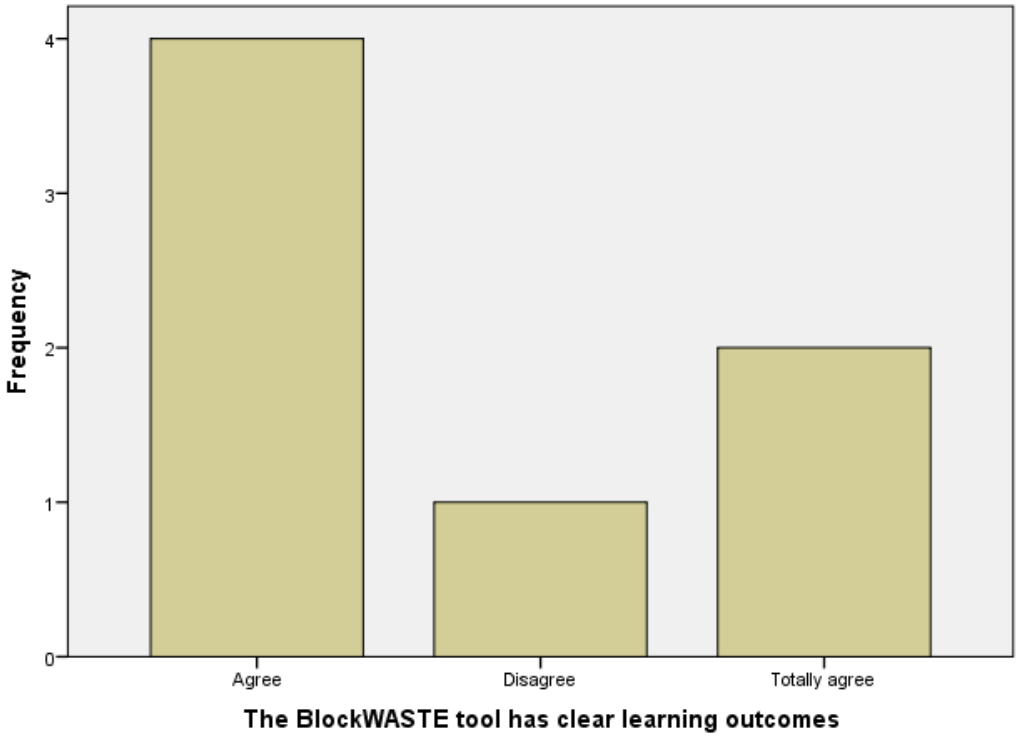

Figure 5: The BlockWASTE tool has clear learning outcomes

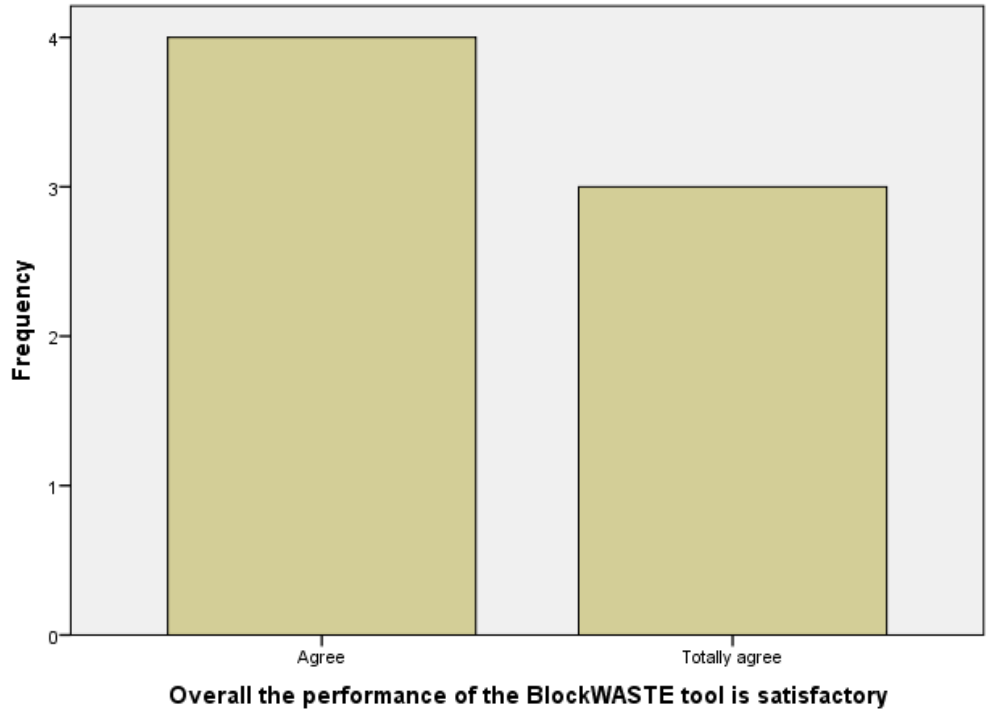

Figure 6: Overall the performance of the BlockWASTE tool is satisfactory

Also, all the experts had positive comments about the handbook of the Interactive BlockWASTE Tool (Figure 7). Finally, all the experts but one said that the Interactive BlockWASTE tool is an appropriate element of BlockWASTE's syllabus (Figure 8).

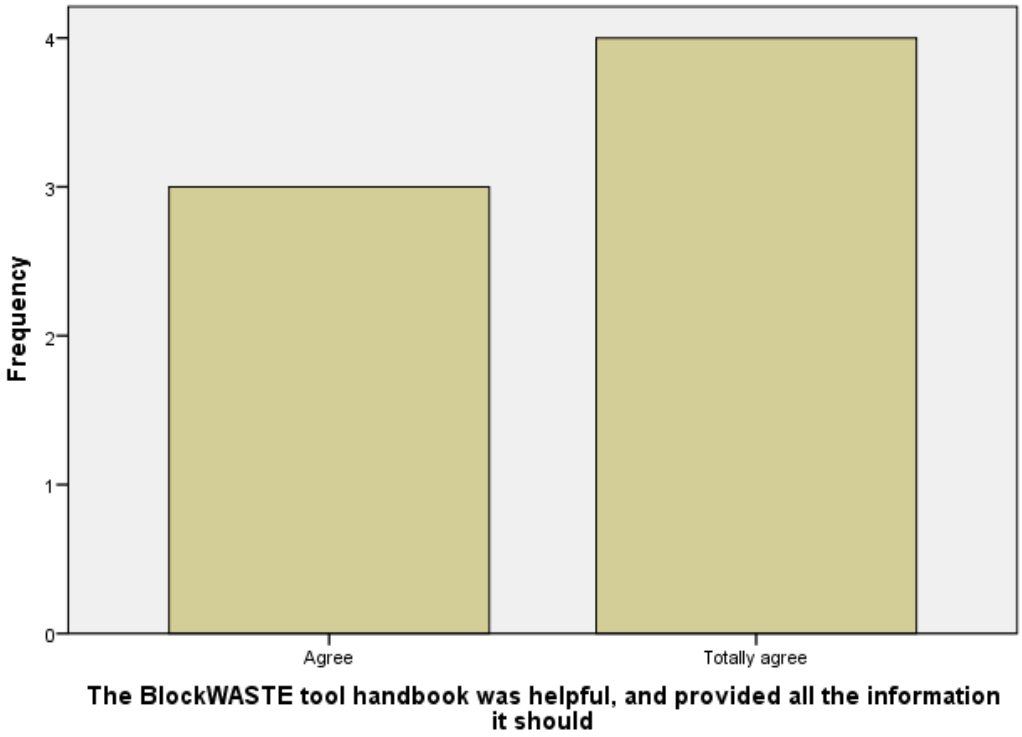

Figure 7: The BlockWASTE tool handbook was helpful and provided all the information it should

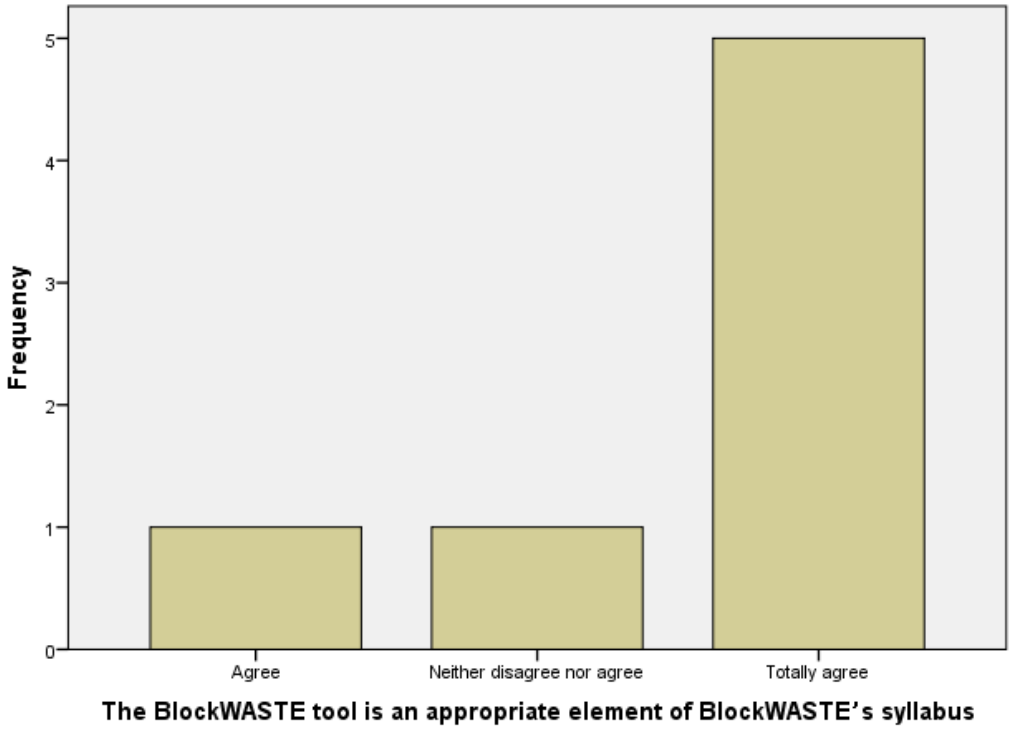

Figure 8: The BlockWASTE tool is an appropriate element of BlockWASTE's syllabus

As far as the BlockWASTE Curriculum and related teaching material are concerned, the experts said that they are satisfactory and facilitate the online and in-the-classroom learning (Figure 9), and can be implemented in the European HEI organisations (Figure 10). However, an expert neither agrees nor disagrees with the latter statement.

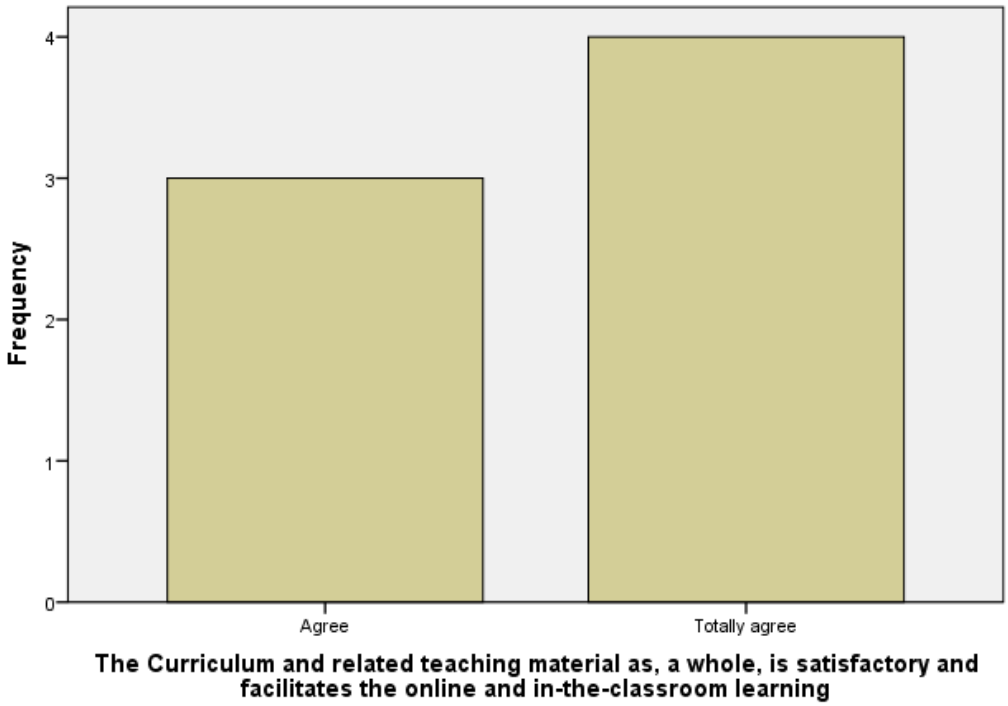

Figure 9: The Curriculum and related teaching material as, a whole, is satisfactory and facilitates the online and in-the-classroom learning

Moreover, all the pedagogical experts agreed that the teaching material contains adequate information to improve the knowledge on blockchain and waste management (Figure 11), is interesting and motivates the user to utilise it (Figure 12), and fulfils its purpose and targets, i.e., it is suitable for universities training programmes and companies in waste management sector (Figure 13).

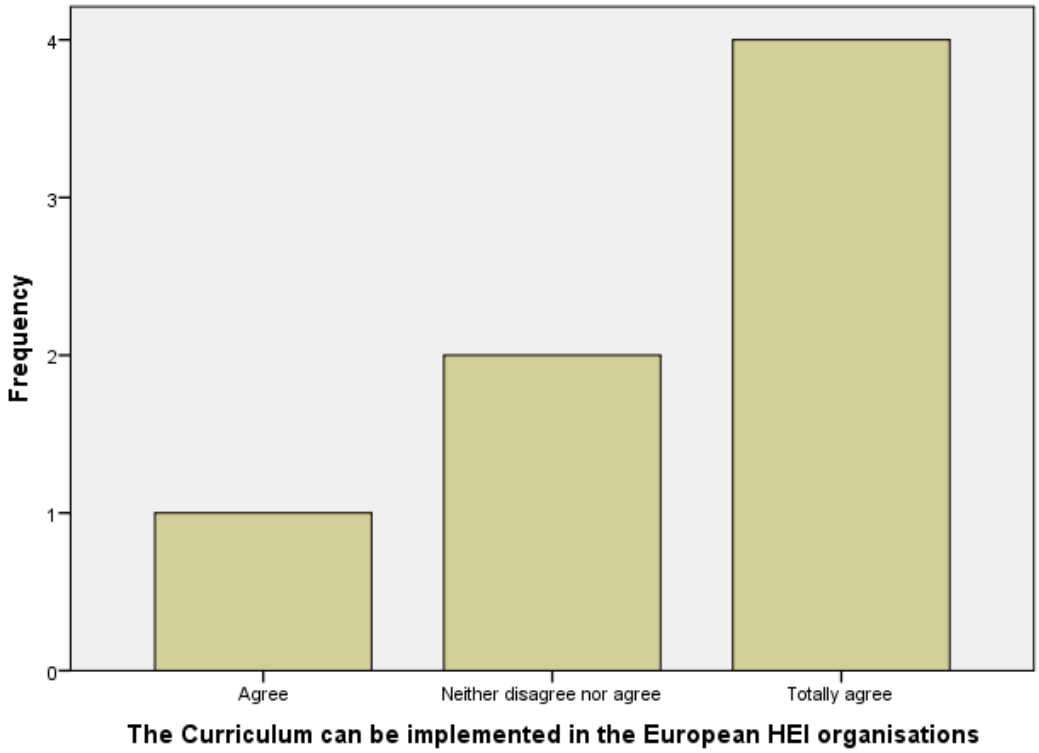

Figure 10: The Curriculum can be implemented in the European HEI organisations

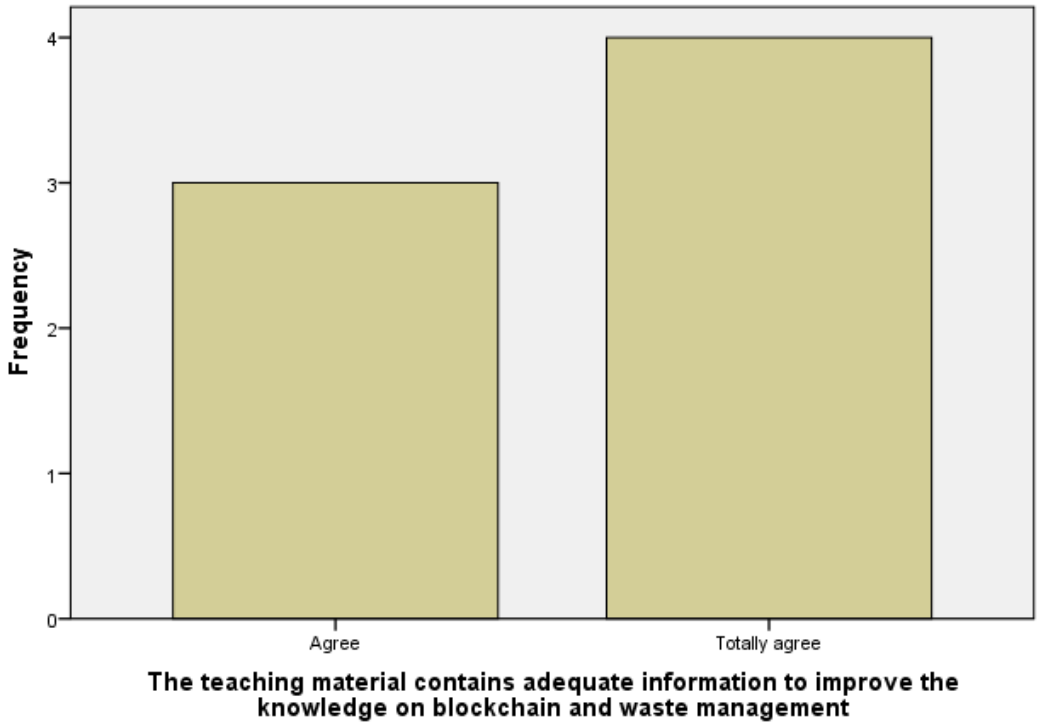

Figure 11: The teaching material contains adequate information to improve the knowledge on blockchain and waste management

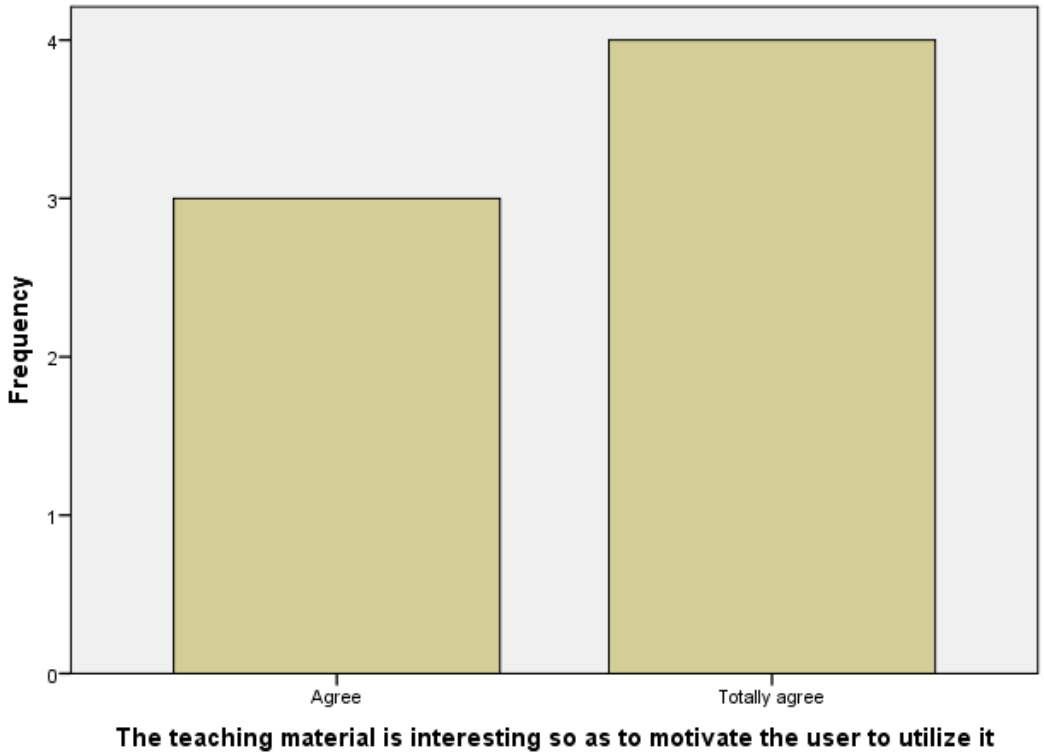

Figure 12: The teaching material is interesting so as to motivate the user to utilize it

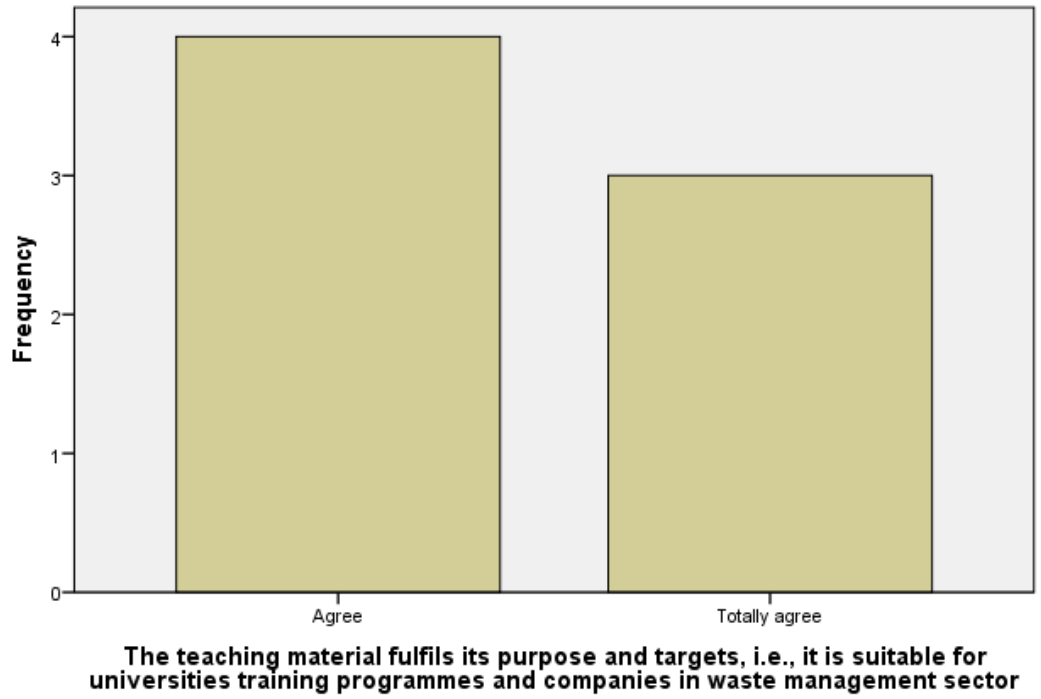

Figure 13: The teaching material fulfils its purpose and targets, i.e., it is suitable for universities training programmes and companies in waste management sector

Almost all the experts said that the teaching material is easy to navigate and ease of use in learning contexts and self-training (Figure 14) and that the obtained value from the utilisation of the teaching material of BlockWASTE is high (Figure 15).

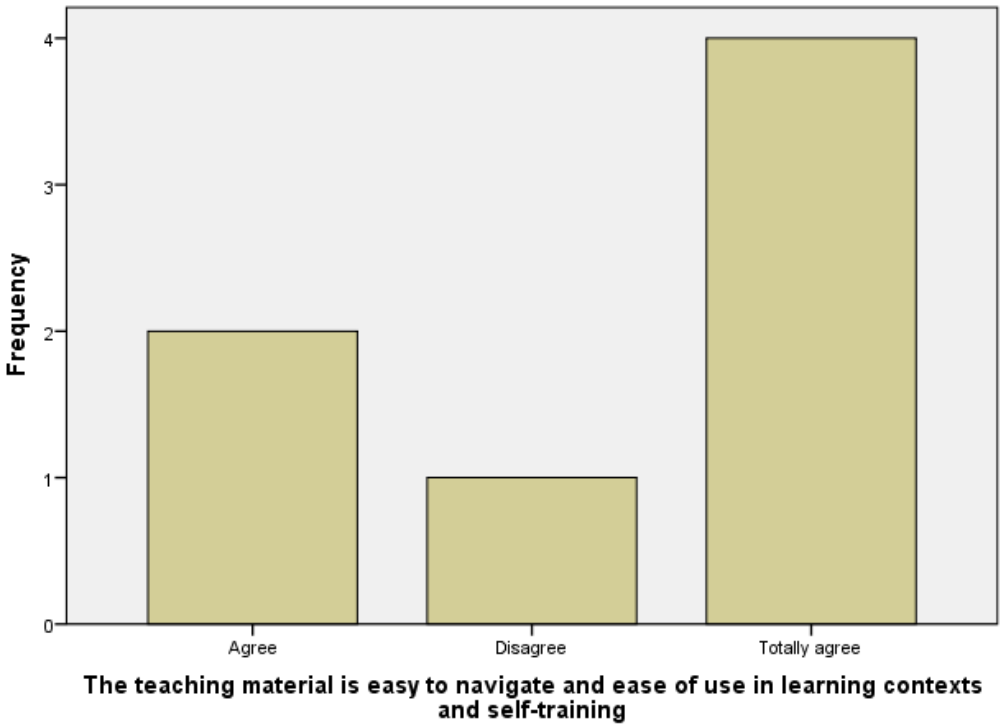

Figure 14: The teaching material is easy to navigate and ease of use in learning contexts and self-training

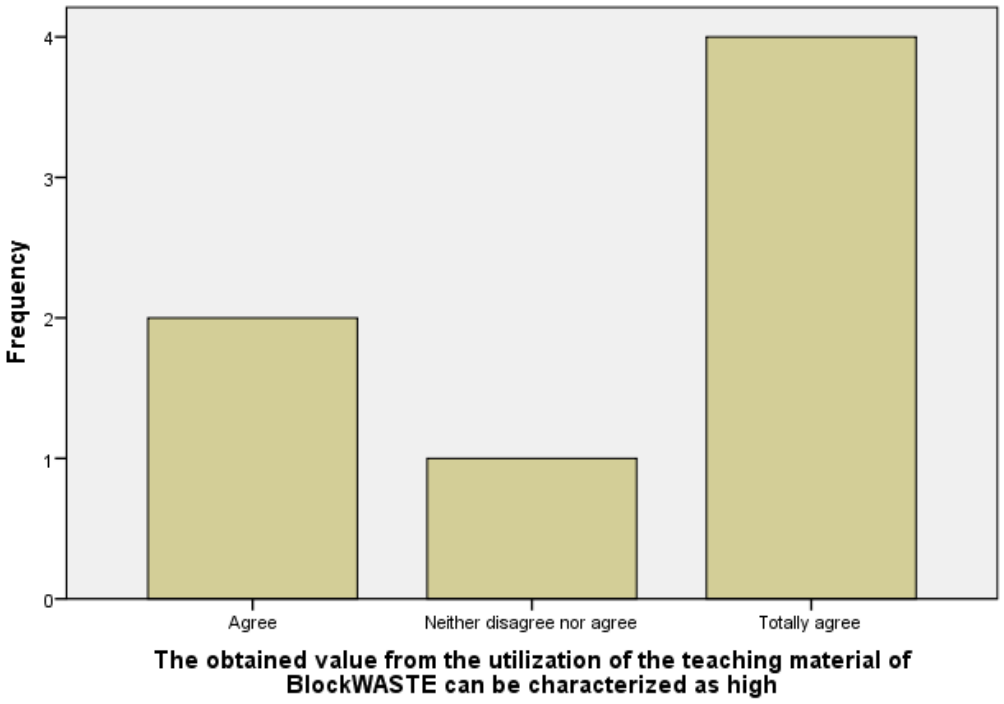

Figure 15: The obtained value from the utilization of the teaching material of BlockWASTE can be characterized as high

Regarding the information and the language of the training material, all the experts believe that the information is clear, concise, well-written and informative to the user and that the language and the content of the tool are non-discriminatory (Figure 16 and Figure 17).

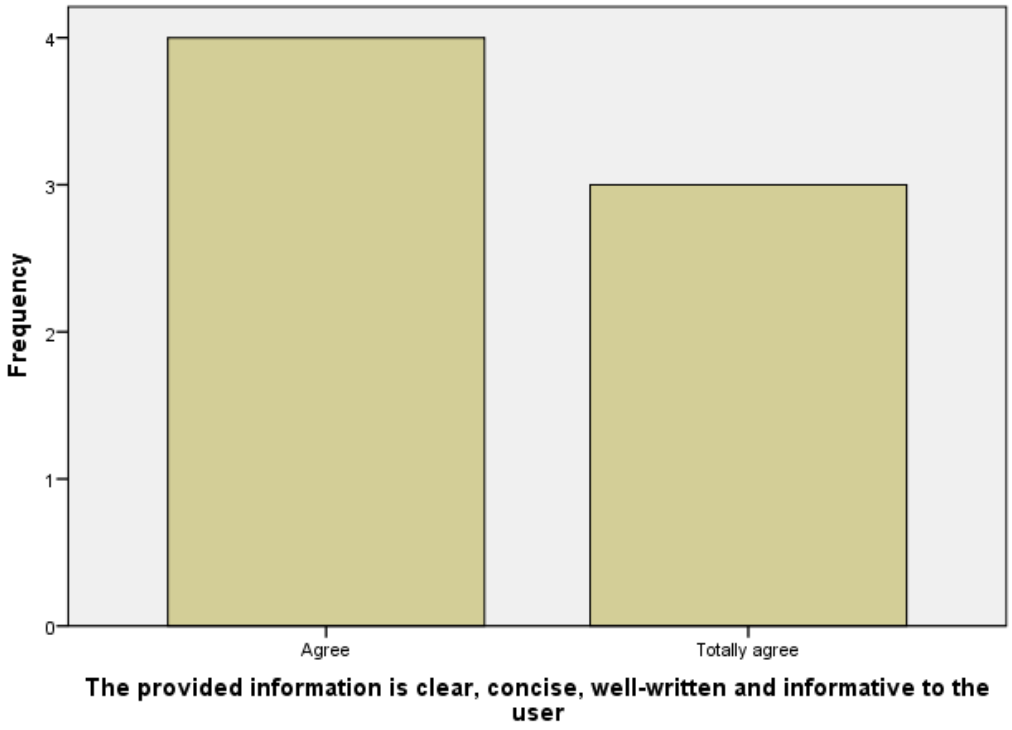

Figure 16: The provided information is clear, concise, well-written and informative to the user

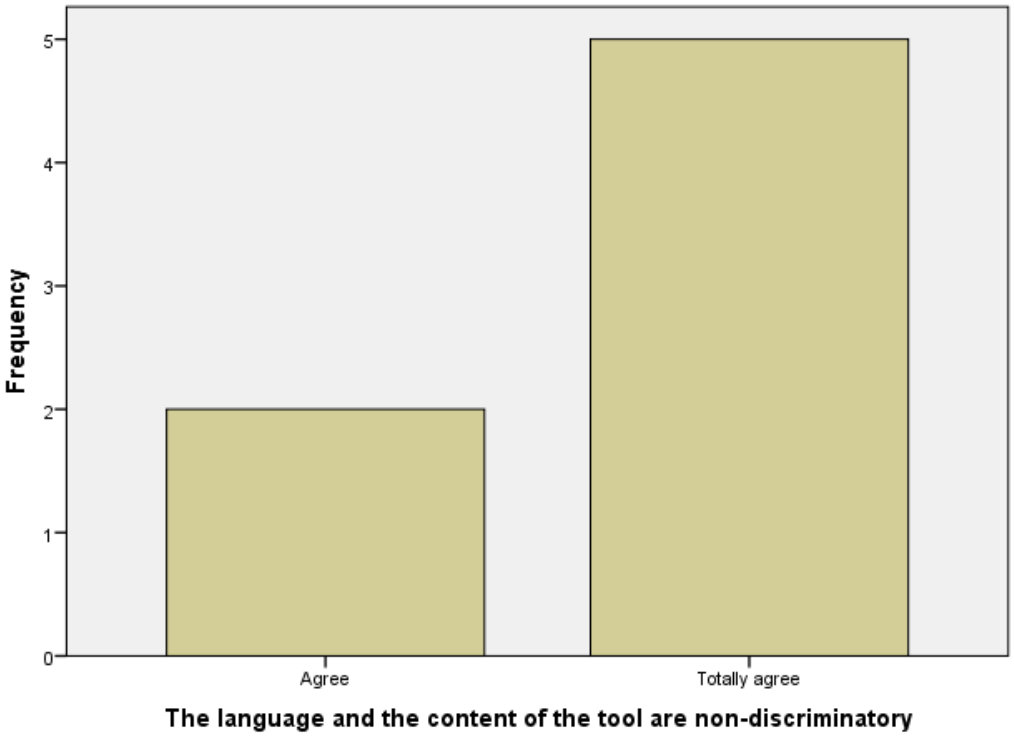

Figure 17: The language and the content of the tool are non-discriminatory

Moreover, all the experts but one who neither agrees nor disagrees, believe that the information provided in the tool is valuable and help in understanding innovation and sustainability criteria in the new system based on CE criteria (Figure 18).

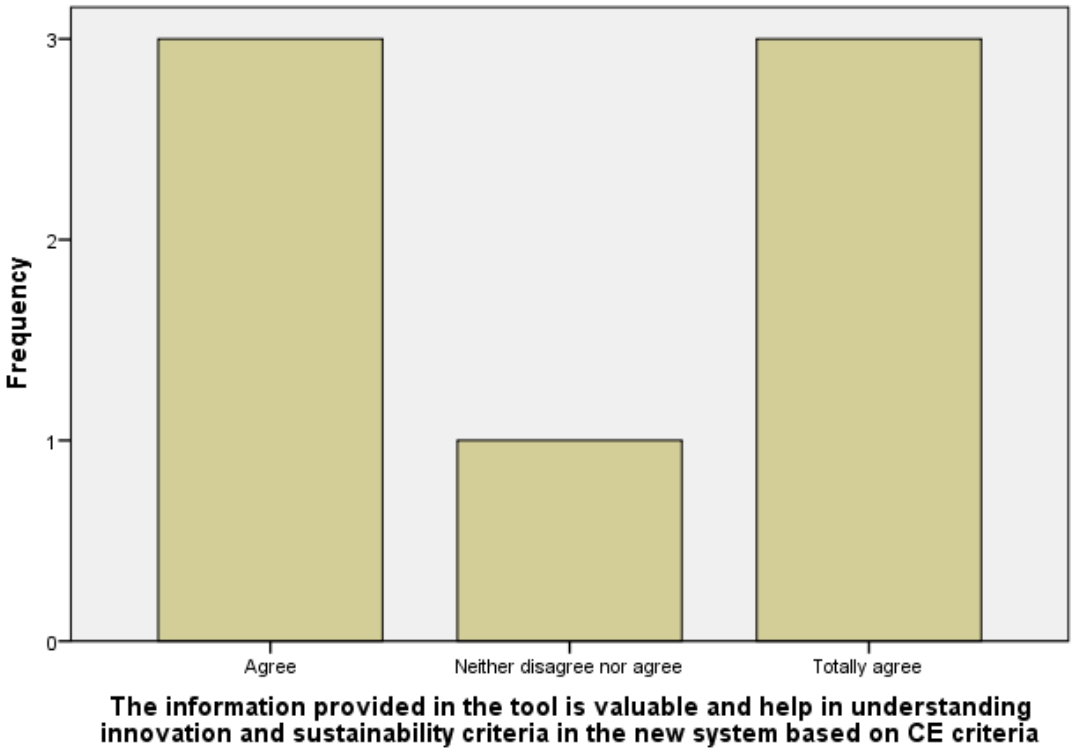

Figure 18:. The information provided in the tool is valuable and help in understanding innovation and sustainability criteria in the new system based on CE criteria

Overall, the teaching material received very positive comments since all the experts agreed that the teaching material meets their expectations and creates a stimulating learning environment (Figure 19 and Figure 20) and, therefore, they would recommend it to others (Figure 21).

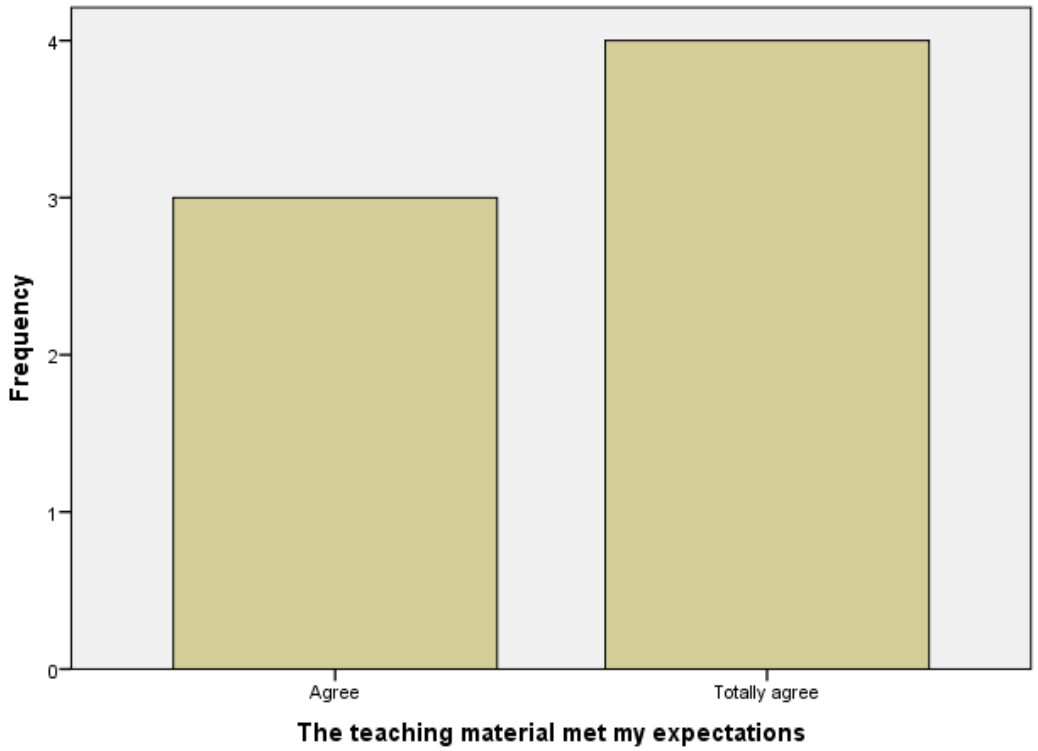

Figure 19: The teaching material met my expectations

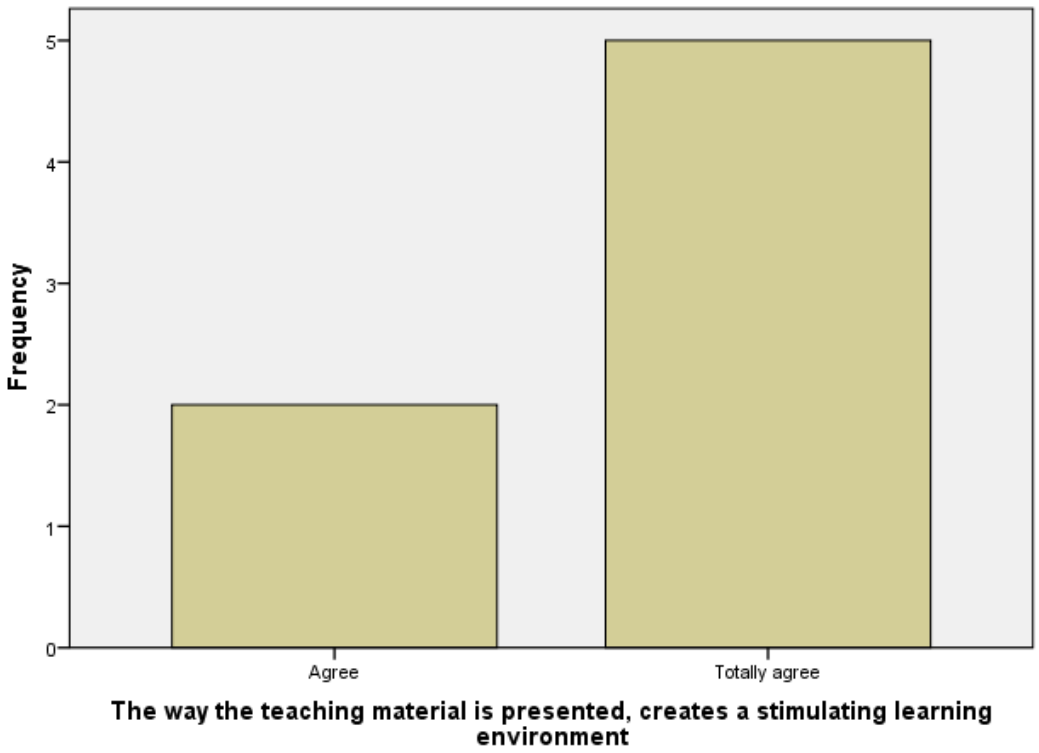

Figure 20: The way the teaching material is presented, creates a stimulating learning environment

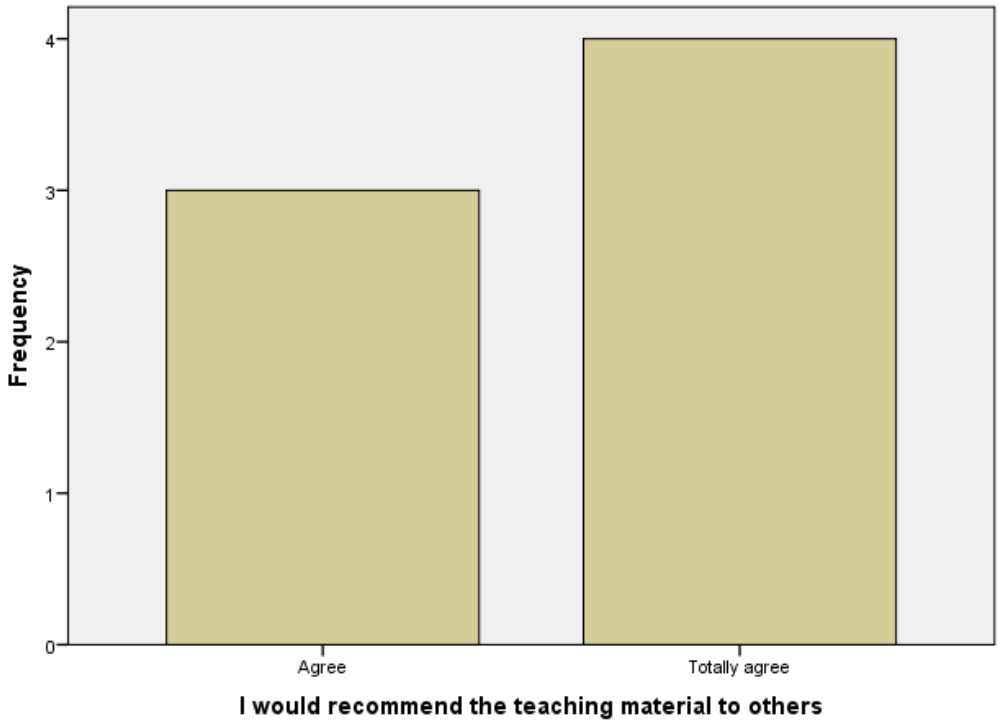

Figure 21:. I would recommend the teaching material to others

All in all, the experts provided very positive comments about the Interactive BlockWASTE Tool. More specifically, all the experts agreed that the Interactive BlockWASTE Tool as a whole, is satisfactory (Figure 22), is useful and motivates the user to utilise it (Figure 23), and fulfils its purpose and targets (Figure 24).

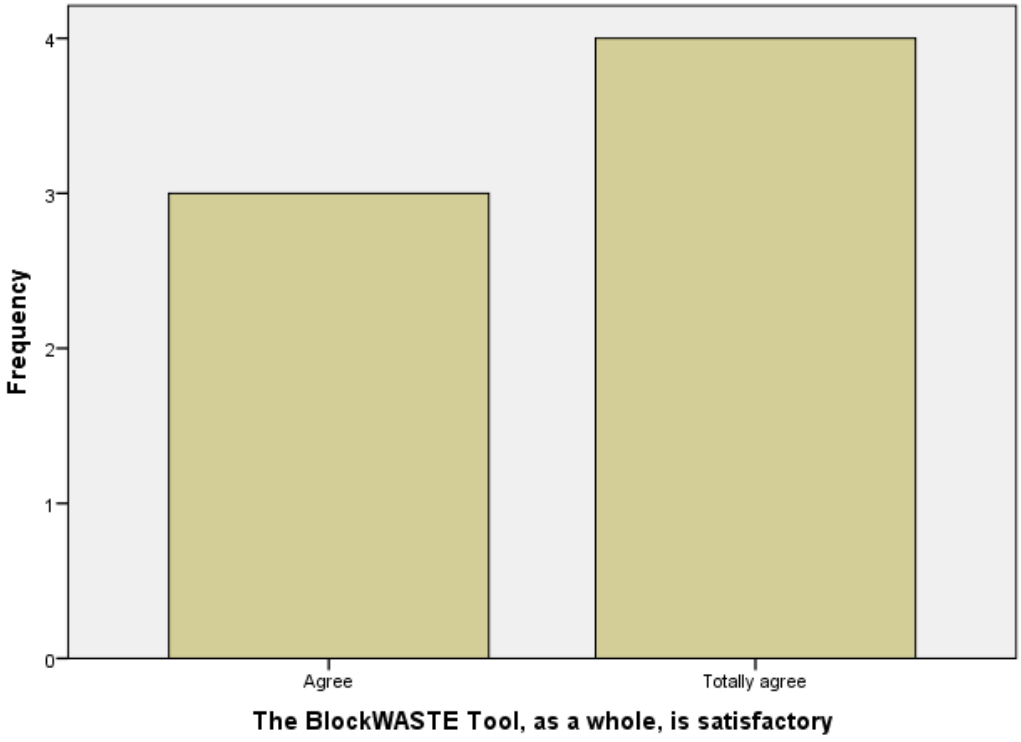

Figure 22:. The BlockWASTE Tool, as a whole, is satisfactory

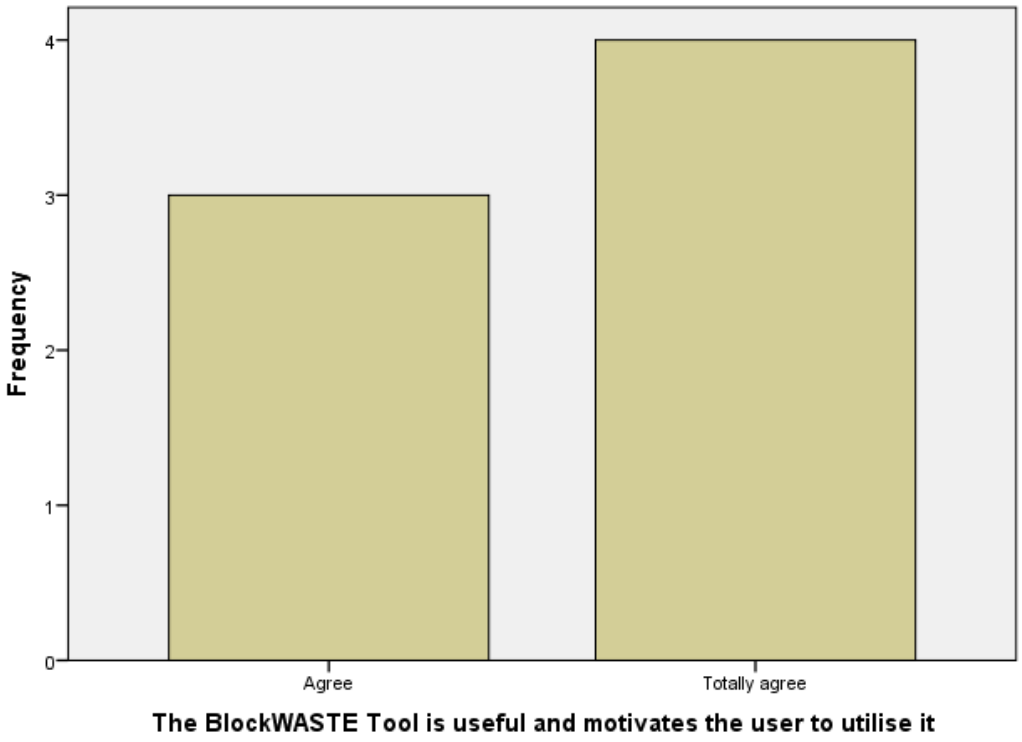

Figure 23: The BlockWASTE Tool is useful and motivates the user to utilise it

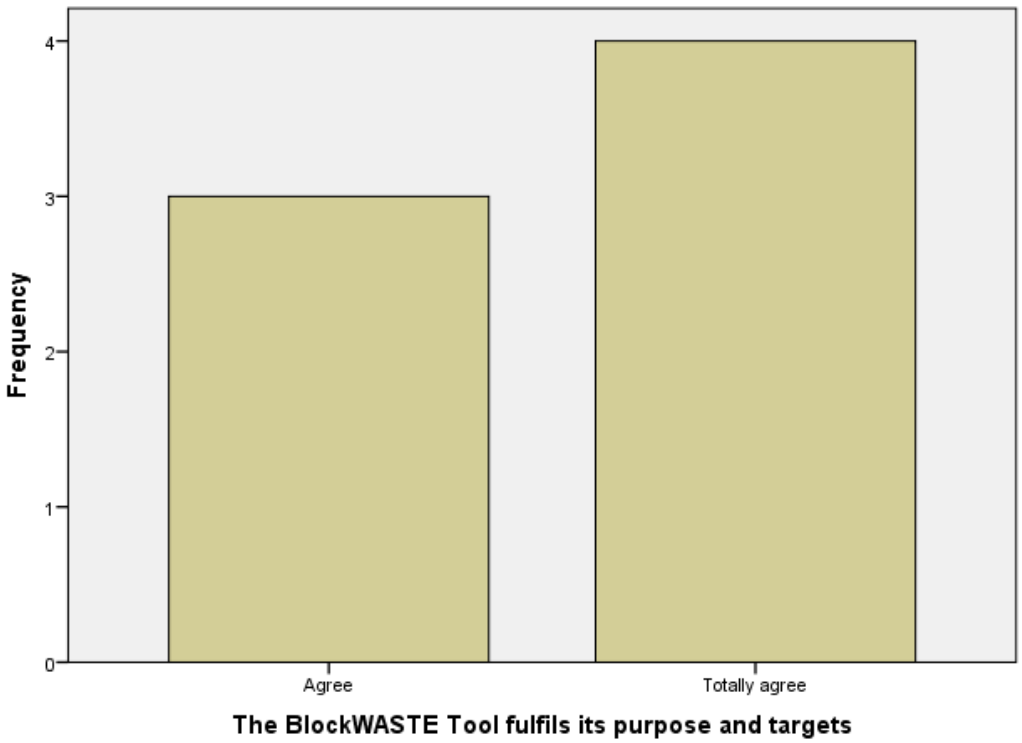

Figure 24: The BlockWASTE Tool fulfils its purpose and targets

Also, almost all the experts agreed that the obtained value from the utilisation of the BlockWASTE Tool can be characterised as high (Figure 25).

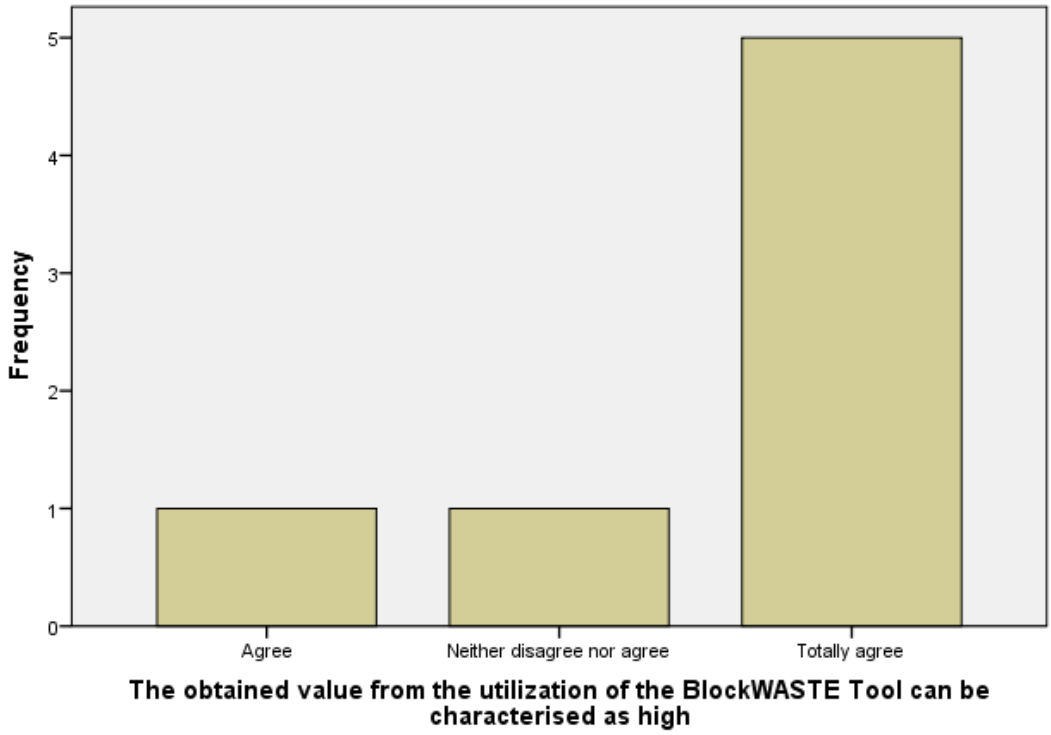

Figure 25: The obtained value from the utilisation of the BlockWASTE Tool can be characterised as high

Finally, all the experts said that they would recommend the BlockWASTE Tool for use to others (Figure 26) and that it met their expectations (Figure 27).

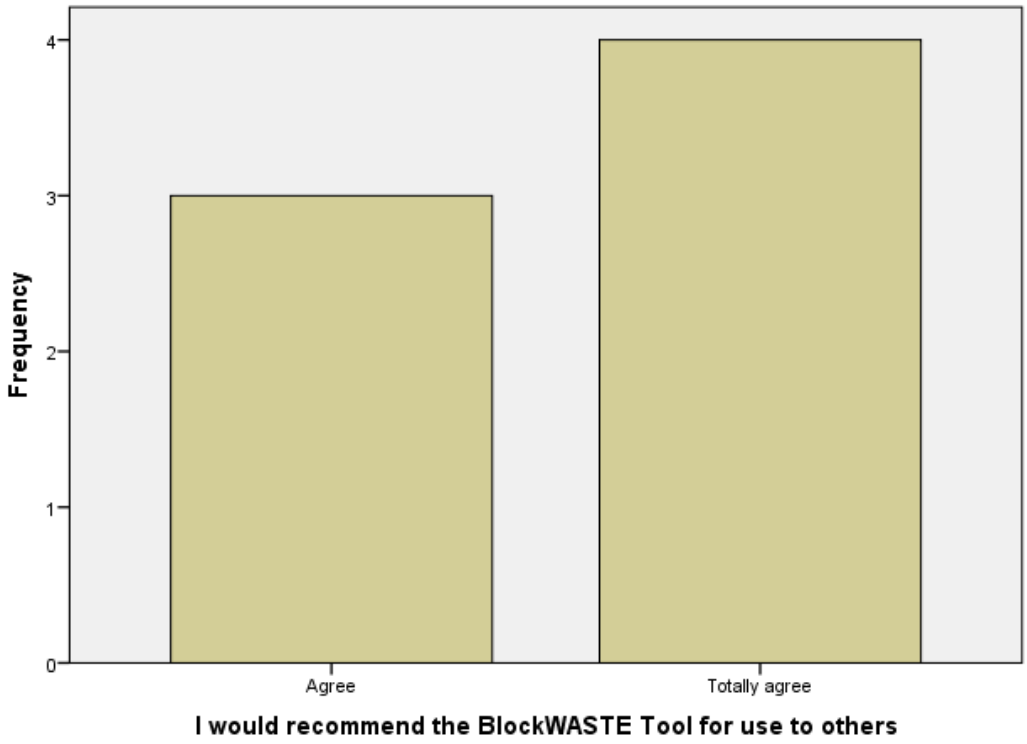

Figure 26: I would recommend the BlockWASTE Tool for use to others

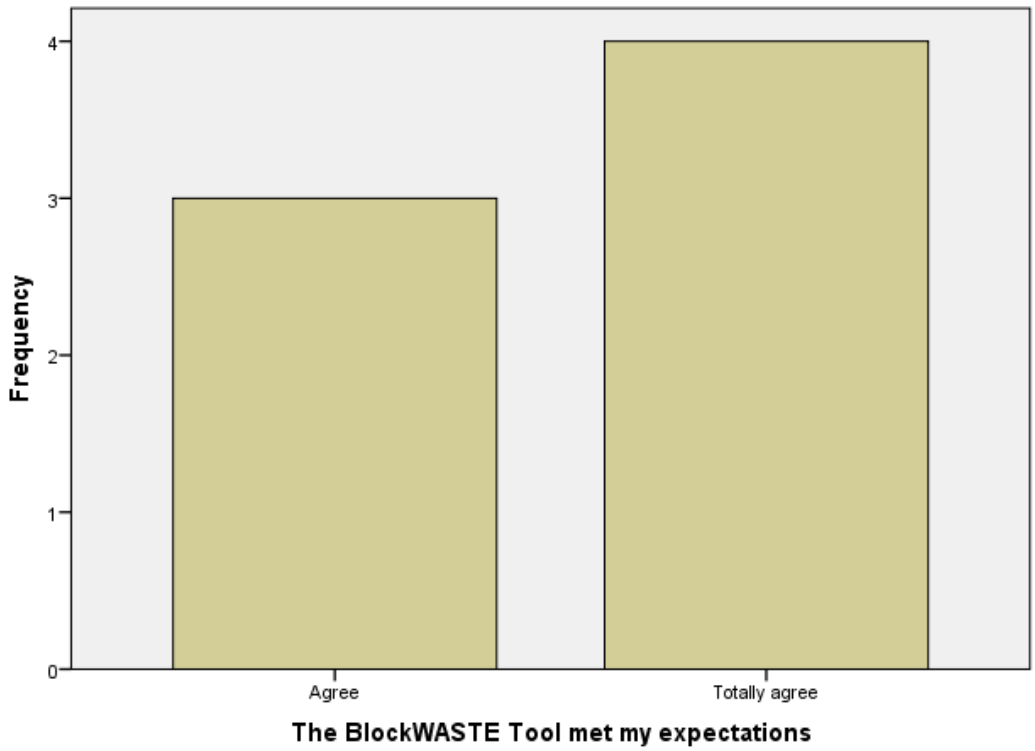

Figure 27: The BlockWASTE Tool met my expectations

2.3 Recommendations and improvements made

At the last stage, the experts were asked to provide specific recommendations that would help the BlockWASTE team to improve the Interactive BlockWASTE Tool. Some experts provided only positive comments, e.g., they mentioned that the Interactive BlockWASTE Tool "*… is a good interactive tool which can give the user the ability to actually identify the benefits of the Blockchain Technology within the municipal waste management process*...", or that "*…the cooperation between different actors of the blockchain is very important and difficult part... The course is very interesting, and its format is easy to follow from the point of view of new knowledge and new approach in MSW management. Handbooks are clear and useful, many thanks to the authors for their contribution (lectures, video, tool, games, examples etc.) to Circular Economy novel approach application…*".

Two other experts expressed minor comments (i.e., one mentioned that the link of the manual was inactive and the second pointed out that there were some minor spelling mistakes). These minor issues were fixed in the final version.

Finally, one external expert expressed some concerns, as follows:

"*…There are clear learning outcomes/goals formulated in the manual for the Interactive Blockchain Simulator, but these are missing for the Blockwaste Tool. Also, the names of the different game slots are not clear since they don't give any insight in what the learner can expect of each specific game slot. The manual does provide a lot of information, but sometimes I felt lost. I expected a hands-on instruction, which was provided, but I first had to go through*

a lot of additional background information. That information was definitely useful and relevant but could be presented in a different structure or by making it clearer for a learner what to expect in which order and that they need to read through all the information before they can actually start working with the tool…".

In order to address the first concern of the expert, the final version of the Interactive BlockWASTE tool integrated a Blockchain problem that must be solved by the user to activate the submission process. The rest of the comments referred practically to the manual of the Interactive BlockWASTE Tool. The manual was supplemented by missing information (i.e., the information about the game slots), and was restructured to make it easier for the user to follow (i.e., sections 3.2 and 3.3 were enriched with more information and pictures), and it was decided to provide, as a supplement, an Excel file with all background calculations of the Tool. Moreover, the Tool's webpage includes a direct link with the new manual.

2.4 Conclusions

Generally, the feedback obtained from the pedagogical experts were very positive. Going deeper into the results obtained, the responses regarding the "Evaluation of Interactive BlockWASTE Tool" questions didn't include the "Disagree" or "Totally disagree" options, which means that the tool is well structured, easy to use, useful from an educational point of view, its content is of innovative character and quality, the performance of the tool is satisfactory, and the handbook is useful and supportive.

Similarly, the feedback obtained in the "BlockWASTE Course Curriculum/Learning materials evaluation" questions was also quite positive. There was only one response that didn't agree with the rest. This answer was to the question "The teaching material is easy to navigate and ease of use in learning contexts and self-training". Hence, one out of the seven participants in this pedagogical evaluation of the BlockWASTE tool found it complicated to use it. As for the rest of the questions with positive answers, it can be concluded that the educational material developed is satisfactory and of high quality and facilitates face-to-face learning, as well as online learning, thus allowing its implementation in European HEIs.

The overall conclusions also show positive results. The experts rated the BlockWASTE tool as satisfactory and found it to be useful and motivating for the user to use it. All in all, the experts rated the tool very highly, recommending it and stating that it meets their expectations.

Annex I: Pedagogical experts' questionnaire

Feedback questionnaire of BlockWASTE. Pedagogical 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. Evaluation of Interactive BlockWASTE Tool *

	Totally disagree	Disagree	Neither disagree nor agree	Agree	Totally agree
The BlockWASTE tool is well-structured and its design facilitates online and in-the-classroom learning	◯	◯	◯	◯	◯
The BlockWASTE tool is easy to use	◯	◯	◯	◯	◯
The BlockWASTE tool is useful from an educational viewpoint	◯	◯	◯	◯	◯

The quality of the content and the innovative character of the BlockWASTE tool are satisfactory	○	○	○	○	○
The BlockWASTE tool has clear learning outcomes	○	○	○	○	○
Overall the performance of the BlockWASTE tool is satisfactory	○	○	○	○	○
The BlockWASTE tool handbook was helpful, and provided all the information it should	○	○	○	○	○
The BlockWASTE tool is an appropriate element of BlockWASTE's syllabus	○	○	○	○	○

3. BlockWASTE Course Curriculum/Learning materials evaluation *

	Totally disagree	Disagree	Neither disagree nor agree	Agree	Totally agree
The Curriculum and related teaching material as, a whole, is satisfactory and facilitates the online and in-the-classroom learning	○	○	○	○	○
The Curriculum can be implemented in the European HEI organisations	○	○	○	○	○
The teaching material contains adequate information to improve the knowledge on blockchain and waste management	○	○	○	○	○
The teaching material is interesting so as to motivate the user to utilize it	○	○	○	○	○

The teaching material fulfils its purpose and targets, i.e., it is suitable for universities training programmes and companies in waste management sector	○	○	○	○	○
The teaching material is easy to navigate and ease of use in learning contexts and self-training	○	○	○	○	○
The obtained value from the utilization of the teaching material of BlockWASTE can be characterized as high	○	○	○	○	○
The provided information is clear, concise, well-written and informative to the user	○	○	○	○	○
The language and the content of the tool are non-discriminatory	○	○	○	○	○

The information provided in the tool is valuable and help in understanding innovation and sustainability criteria in the new system based on CE criteria	○	○	○	○	○
The teaching material met my expectations	○	○	○	○	○
The way the teaching material is presented, creates a stimulating learning environment	○	○	○	○	○
I would recommend the teaching material to others	○	○	○	○	○

4. Conclusions - Overall assessment and suggested recommendations *

	Totally disagree	Disagree	Neither disagree nor agree	Agree	Totally agree
The BlockWASTE Tool, as a whole, is satisfactory	○	○	○	○	○
The BlockWASTE Tool is useful and motivates the user to utilise it	○	○	○	○	○

The BlockWASTE Tool fulfils its purpose and targets	○	○	○	○	○
The obtained value from the utilization of the BlockWASTE Tool can be characterised as high	○	○	○	○	○
I would recommend the BlockWASTE Tool for use to others	○	○	○	○	○
The BlockWASTE Tool met my expectations	○	○	○	○	○

Specific comments and suggested recommendations

Η απάντησή σας

In compliance with the provisions of the LOPD (Organic Law on the Protection of Personal Data), BlockWASTE consortium informs you that your personal data reflected in our commercial documentation will be incorporated into an automated file with the purpose of being used for the development of the commercial activity itself and to inform you of those products, services and events offered by the entity and that could be of interest to you. You can select "no" in the previous question or, subsequently, exercise your rights of access, rectification, cancellation and opposition by sending a request to the following e-mail address: info@ctmarmol.es *

- ○ Yes
- ○ No

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Annex II: Pedagogical experts' details

Personal details removed due to privacy concerns