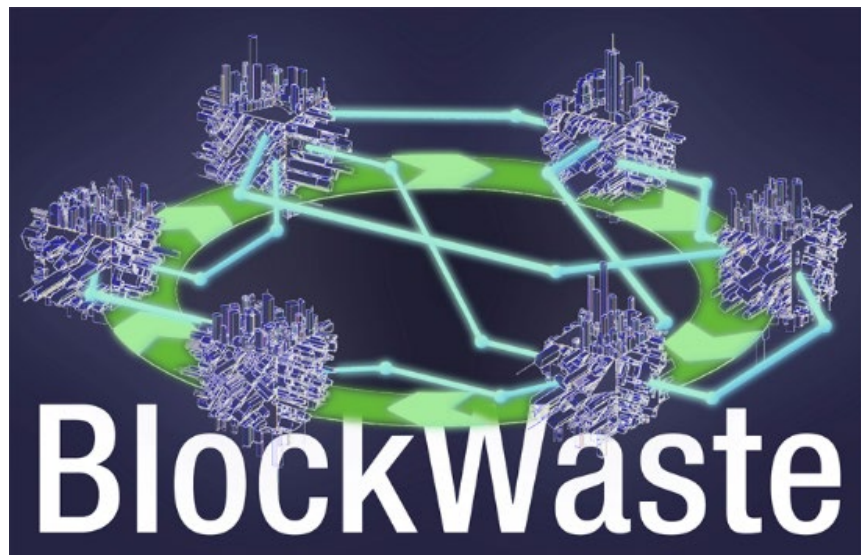


Multiplier events report



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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 the three multiplier events that took place in Bielefeld, Tallin and Athens. For each multiplier event general information is given (information about the date and place of the event, number of the participants and their profile (specifying the target group, countries, organisations), as well as the eventual involvement of the local stakeholders group in the event organisation and any other useful information.

Moreover, the activities , the sessions included and the intellectual outputs of the Blockwaste project that were presented in in each event are described. The form in which each event was organised (online, hybrid, physical presence) is also mentioned.

Finally the evaluation results of each event are presented. The evaluation results include information regarding:

- the degree of fulfilment of the aims of the event were reached;
- the means of communication that were used to spread the information about the event to the bigger number of beneficiaries and stakeholders and if these means revealed themselves sufficient and useful;
- the participants' satisfaction level with the organisation of the event
- the participants' satisfaction level with the intellectual outputs of the project

Detailed agendas and documents used or distributed at the multiplier event are presented. Proof of attendance of each multiplier event in the form of a participants list extracted from the registration form or in the form of a participants list signed by the participants is also available.

2 First International Seminar in Bielefeld (Germany)

2.1 General information about the event

Due to the Corona Pandemic, we have postponed the Multiplier Event again and again in the hope of being able to hold this event face-to-face in Bielefeld. But at some point we made the decision to hold the event online in order to have planning security. The online event with the title “Blockchain-based Waste Management” took place at Dec. 10th 2021 from 13:00 to 16:15.

A total of 85 people registered (**participants of the project partners’ organizations excluded**). Most of the participants were from Germany (36%) and Greece (26%). The participants can be sorted into the categories Business, Academic, Public Organization and Others. Most participants came from the categories Business (44%) and Academic (23%).

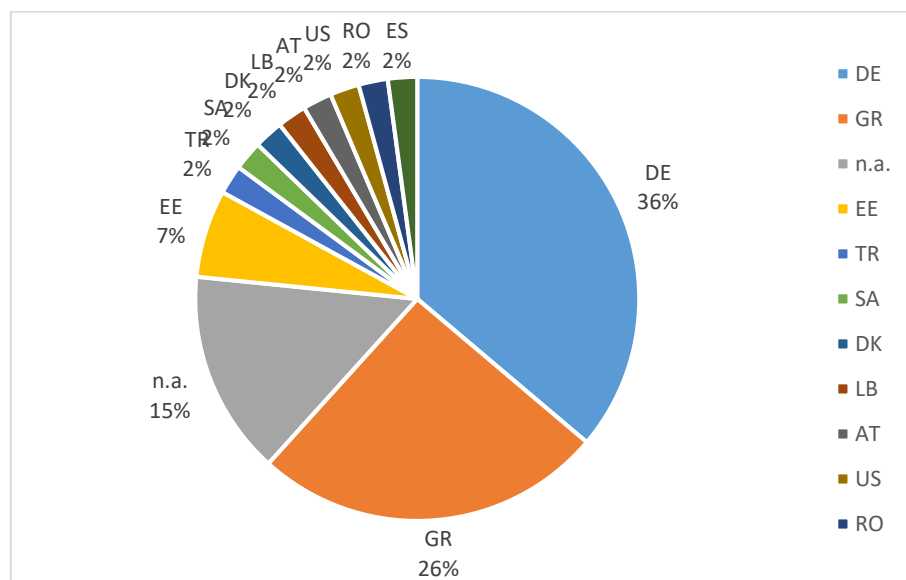


Figure 1: Participants sorted by country

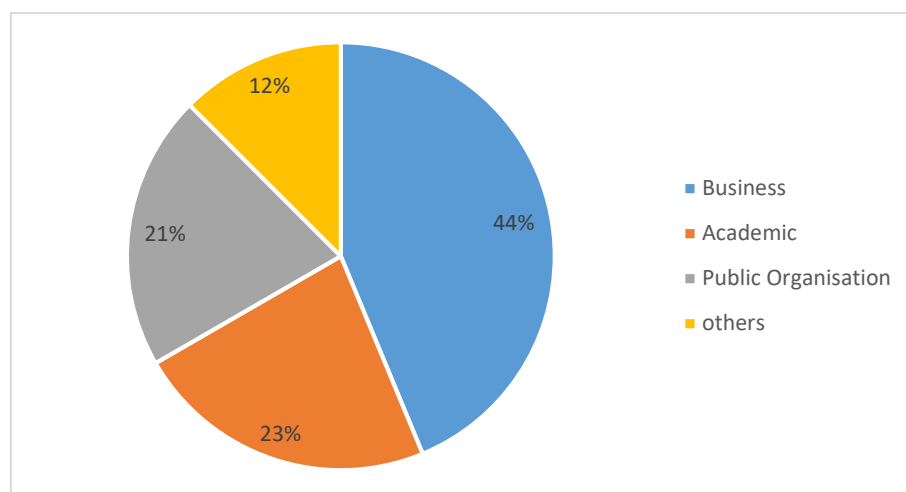


Figure 2: Participants sorted by sector

2.2 Programme and activities

The three-hour online event organized by the FH Bielefeld and partners was divided into two presentation blocks. Within the first block, the use of blockchain technology in waste management was covered and discussed. The second block dealt with education and learning for digital waste management. At the beginning of each of the two blocks, an introduction of the objectives and approach of the BlockWaste project was given. At the end of both blocks, the respective results were briefly presented and discussed.

Within the first block, a short overview of the advantages of blockchain technology in Municipal Waste management was first given. In addition, a simulation model for the use of blockchain technology in municipal waste management processes was presented. Afterwards, participants had the opportunity to exchange ideas in three parallel breakout sessions. The breakout sessions covered 1) the role of blockchain technology as a key technology in shaping a more sustainable world, 2) the development of a tool to co-create the future of waste recycling systems and 3) possible payment models as well as incentive models.

At the beginning of the second block, the role of waste management and Industry 4.0 developments were covered. Afterwards, a choice of two parallel breakout sessions was offered. The breakout sessions covered 1) cooperative learning for a circular economy and 2) data analysis as a core concept of the circular economy.

13:00 Introduction BlockWASTE project (M Menegaki, NTUA Athens) 13:10 Blockchain-based Waste Management (A Uphaus, R Lenz, Bielefeld UAS) 13:20 Modelling a Blockchain for waste management (P Smit, J Veuger, Saxion UAS, E Tääks, TalTech) 13:35 Parallel breakout sessions: a. Blockchain-based Waste Management (J Veuger, C Barkel, Saxion UAS) b. Process Redesign (P Smit, Saxion UAS, E Tääks, TalTech) c. Payment models and incentives (R Lenz, L Holste, Bielefeld UAS) 14:20 Reports from the sessions, poll 14:30 End of Block 1, coffee break	1st block: Blockchain-based Waste Management
14:45 Introduction BlockWASTE project (M Menegaki, NTUA Athens) 14:50 Waste management and Industry 4.0 (A Mavropoulos, former president of the International Solid Waste Association ISWA) 15:10 Parallel breakout sessions: a. Co-operative learning for a Circular Economy (B Kleinheyder, Bielefeld UAS) b. Data Analytics as a core CE skill (P Tsangaratos, NTUA Athens) 16:00 Reports from the sessions, poll 16:15 End of Block 2	2nd block: Education and Learning for Digital Waste Management

Figure 3: Agenda of the ME in Bielefeld

2.3 Evaluation results

Overall, a high number of people could be reached through the event despite the difficult Corona conditions. About 2200 people were contacted twice in a time interval of two weeks via e-mail. The contacted people came from the fields of 1) Public authorities and administrations, 2) Businesses, 3) Associations & NGOs as well as 4) Universities and research institutes. Furthermore, the event was shared on social media (LinkedIn, Xing, Instagram) in relevant groups for Blockchain, Waste Management and Circular Economy. In this manner, it

was possible to reach a heterogeneous group of participants from different countries and fields of expertise. During the event, participants actively participated despite the online environment and gave positive feedback afterwards. All in all, new contacts from different areas could be made and a foundation for the further dissemination of the project results could be laid.

3 Second International Seminar in Tallin (Estonia)

3.1 General information about the event

The second international multiplier event called “Blockchain-based Waste Management seminar” was organized by Estonian partner in Tallinn, Estonia on 10th of June 2022. The event took place in Mektory, which is an innovation and start-up hub of Tallinn University of Technology (TalTech), while at the same time there was the chance of online participation (hybrid event).

The event gathered 51 registrations in total, but in the end 45 people participated, including 28 on-site (**15 of them were not members of project partners organizations**) and 17 online attendees (Figure 4). The 45 participants came from different countries. Most of them were from Estonia, but also from Germany and Greece (Figure 6). The distribution of seminar participants in accordance with their profiles is presented in Figure 6. As can be seen, lecturers and students (“Academic” category) comprised the majority of seminar participants.

Finally, the gender balance was also well maintained among seminar participants (Figure 7).

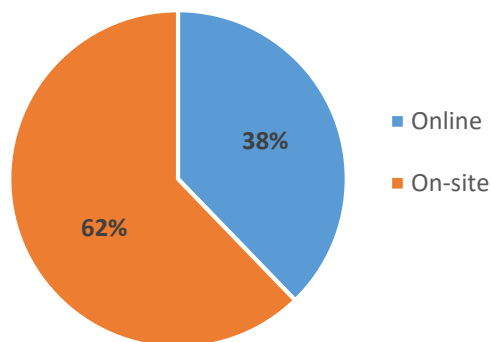


Figure 4: Online and on-site participation of seminar attendees

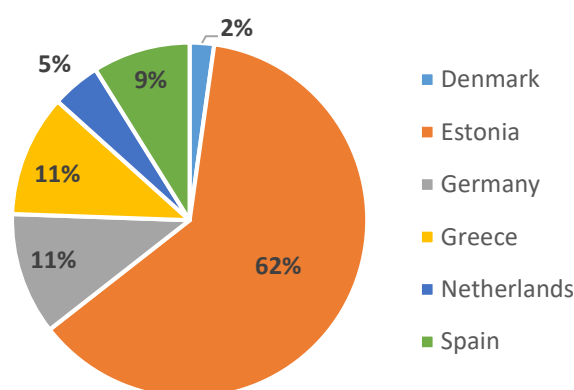


Figure 5: Seminar participants sorted by country

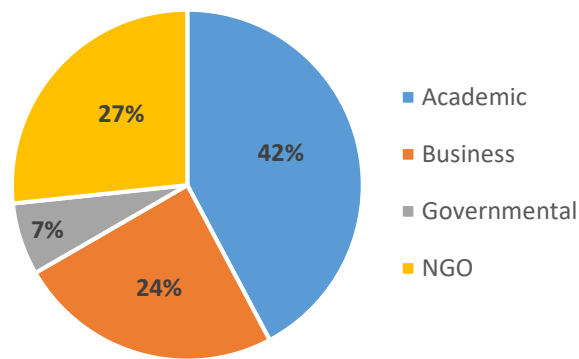


Figure 6: Seminar participants sorted by their profiles

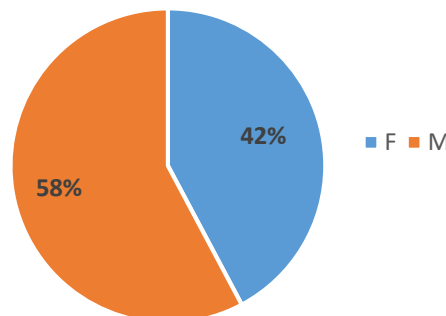


Figure 7: Seminar participants sorted by their gender

3.2 Programme and activities

The agenda of the seminar was centered on demonstrating the results of the IO3 “E-Learning tool based-on Blockchain-MSW focused on Circular Economy”. It was crucial to test the tool and collect valuable feedback from seminar participants to implement any improvements and, if necessary, redirect the results of the project for future tasks. The seminar also covered IO1 “Learning materials for interdisciplinary Blockchain-MSW” and IO2 “European common curricular on MSW applying Blockchain technologies for Circular Economy strategies”.

In order to reach the expected outcomes of the seminar, the three-hour event was divided into two parts: theoretical and practical. The theoretical part consisted of short presentations (approx. 15-20 minutes) on the following topics: Blockchain-MSW management (coverage of IO1 and IO2), IT-systems in MSW management in Estonia (coverage of IO1), European Waste Management and Industry (coverage of IO1 and IO2). The theoretical part included short presentation explaining blockchain principles and demonstration of the tool. Prior the event, the participants were asked to bring their own computers, so they could also test the tool on site. The practical part consisted of presentation of Blockwaste e-learning tool (coverage of IO3) and its demonstration, where participants were able to test the tool. Several questions were raised by the participants referring to Blockchain-MSW presentations as well as e-learning tool and its challenges. project were presented – *see on proposal what is mandatory for this ME*.

3.3 Evaluation results

1. At the end of the seminar 20 feedback surveys were fulfilled by the participants (12 online and 8 on-site). The information below is based on detailed analyse of these evaluation questionnaires.

Since the main aim of the seminar was to test the e-learning tool, the participants were asked to evaluate the BlockWaste and the Waste Management Tools. Overall, the given feedback was very positive. 65% of participants were “strongly agree” that the BlockWaste Tool was useful to better understand how the blockchain works and 60% were “strongly agree” that Waste Management Tool was useful to better understand how the waste management systems and team works. Also, most participants (60%) were “strongly agree” that after the seminar they had a more positive view on the use of the blockchain in the waste management, while 35% marked their level of satisfaction as “agree”. Therefore, it could be concluded that the aims of the event were fulfilled.

2. Prior the event the invitations were sent via emails to different stakeholders’ groups in Estonia and Germany, including academia staff and students, industry, governmental and non-governmental organizations. Preparatory works also included development of seminar landing page and advertising through different social media channels of TalTech. Additionally, invitations to participate were distributed by other project partners within their networks, to increase online engagement of seminar participants. All these ways of communication with potential seminar participants considered to be justified and sufficient.

3. Overall, seminar participants gave positive feedback regarding general organization of the event. Thus, 65% of participants were “strongly agree” that information in the seminar was communicated in an understandable manner, and the remaining 35% were “agree” with this statement. 80% of respondents were “strongly agree” that where was an opportunity to ask questions and they were satisfactorily answered.

4. Overall, the participants’ satisfaction level with the intellectual outputs of the project can be rated as very good. 60% of all respondents were “strongly agree” that information and advice provided was useful and remaining 40% were “agree” with this statement. Also, 55% of respondents were “strongly agree” that after the seminar they became more familiar with the blockchain, while 40% were “agree” with this statement. Finally, 55% of respondents were “strongly agree” that they would like to learn more about blockchain in the waste management in the future, while 40% were “agree” with this statement.

Record of the seminar: <https://echo360.org.uk/media/a04d9ef7-b7bd-4524-aa63-8cd45dcfaebc/public>

4 Final International Seminar in Athens (Greece)

4.1 General information about the event

The BlockWaste multiplier event (ME) took place on Thursday, September 15th, at 15:00, at the Amalia Hotel in Athens (Figures 8, 9, 10).

The goals of the ME were to:

- inform participants on the project's Intellectual Outputs and final products
- share the experience and knowledge acquired throughout the development of the project Intellectual Outputs, especially regarding:
 - the possibilities offered by Blockchain technology in the management of MSW
 - the educational value of integrating elements of the 4th industrial revolution, such as Blockchain technology, into curricula related to waste management
- demonstrate the BlockWaste interactive online tool
- disseminate the project results among wider audience outside the partnership, focusing especially on stakeholders from the universities and the waste management sector
- ask and encourage stakeholders' feedback and evaluation.



Figure 8: Amalia Hotel



Figure 9: View of the room



Figure 10: View of the room

The event was attended by 79 participants (**54 of them were not members of the project partners' organizations**) from different disciplines and institutions (professors and students from universities and other educational institutions, representatives from companies and institutions related to the environment and waste management, freelancers etc.). The profile of the participants is depicted in Figure 11. The event was held mainly in Greek, as the majority of the participants were Greek, except for the presentations of two speakers from abroad (Germany and the Netherlands). The organizers issued certificates of attendance to those you wished.

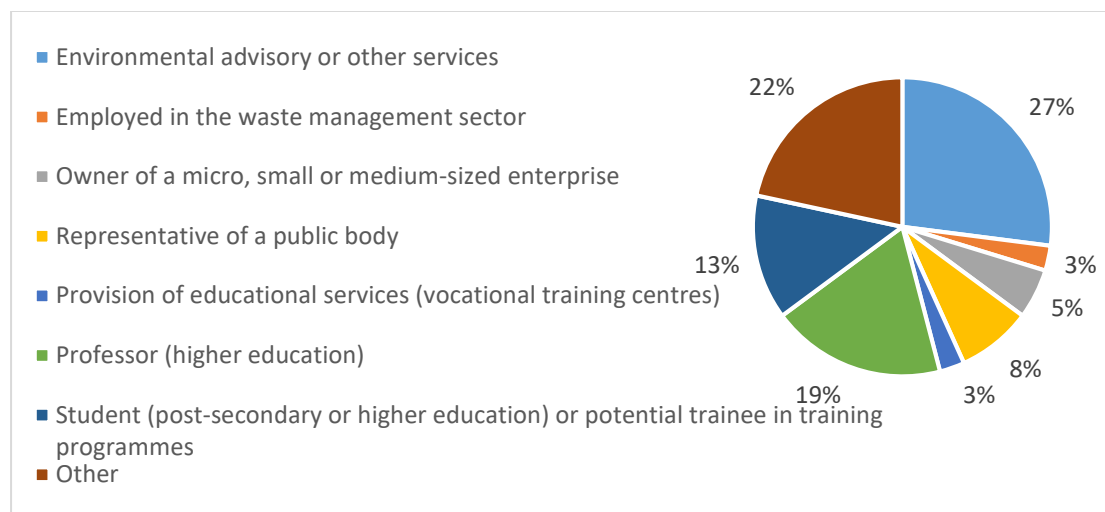


Figure 11: Participants profile

4.2 Programme and activities

The programme of the event was as follows (also shown in Figure 12 in Greek):

15:00 – 15:30 Registration / Coffee

15:30 – 15:45 Welcome

15:45 – 16:05 Circular Economy, Political Economy and Human Labour. Antonis Mavropoulos (EPEM)

16:05 – 16:25 Blockchain-based Waste Management. Christa Barkel (Saxion) and Bernd Kleinheyder (FH Bielefeld)

16:25 – 16:55 Waste Management in Greece & Industry 4.0. Marinella Zourka (D-WASTE)

16:55 – 17:20 Enhancing Education in Waste Management using Blockchain: the BlockWaste Project. Maria Menegaki (NTUA)

17:20 – 17:45 Questions - Discussion

17:45 – 18:00 Closing of the event / Light lunch

After a warm welcoming by Professor Maria Menegaki, Professor Dimitris Kaliampakos, who is the Dean of the School of Mining and Metallurgical Engineering and the Director of the

Laboratory of Mining and Environmental Technology, addressed first the audience and spoke about the opportunities and risks presented by the technologies of the 4th industrial revolution in the field of waste management, with emphasis on the importance of information reliability, which can be enhanced by blockchain technology (Figure 13).



Figure 12: Agenda of the ME (in Greek)



Figure 13: Dimitris Kaliampakos (National Technical University of Athens, Greece)

Next, Mr. Mavropoulos, CEO of EPEM S.A., former president of the International Solid Waste Association and UNEP IETC member, took the podium (Figure 14). Mr. Mavropoulos spoke about the connection of the circular economy with the political economy and human labour, as well as the environmental, social, psychological gap between man and nature that is linked to social metabolism. He concluded that the solution is to think outside the "business as usual" logic, using the right tools.



Figure 14: Antonis Mavropoulos (former president of the ISWA)

Christa Barkel (Figure 15), from the Saxion University of Applied Sciences in the Netherlands, spoke about the fundamentals of blockchain, focusing on the business part. She pointed out that blockchain is a technology used for recording transactions, tracking assets and building trust, that are very important in waste management. Mrs. Barkel referred to the different kind of blockchains and the various applications and she elaborated on off-chain governance and why it is important for blockchain and waste management.

Mr. Bernd Kleinheyer (Figure 16), from the Bielefeld University of Applied Sciences (FH Bielefeld) followed, putting blockchain in the circular economy context. He discussed how digitalisation and blockchain, specifically, might help us in the future, in the challenges that we are facing. He also talked about the role that waste management organisations, universities and research centres will be playing and the skills that will be needed.

The floor was taken by Ms. Marinella Zourka from D-WASTE, who spoke about waste management in Greece and Industry 4.0 (Figure 17). Ms. Zourka spoke about the difficulty of managing a wide range of different types of waste, requiring complex routes and treatment processes. She then referred to the smart MSW management systems that are already in place, optimizing this process, the good practices observed in Europe and the pilot projects that have been implemented in Greece, emphasizing the need to further enhance the use of new technologies.



Figure 15: Christa Barkel (Saxion University of Applied Sciences, Netherlands)



Figure 16: Bernd Kleinheyer (Bielefeld University of Applied Sciences, Germany)



Figure 17: Marinella Zourka (D-WASTE)

The event ended with the presentation by Ms. Maria Menegaki, professor at the School of Mining and Metallurgical Engineering in the NTUA (Figure 18). Ms. Menegaki presented the

results of the Blockwaste project, which aimed to promote interoperability between waste management and blockchain technology, in order to promote the circular economy in the management of MSW. She emphasized that a key role in the transition to the circular economy will be played by the human capital involved in the design and implementation of this process.

In this context, Ms. Menegaki briefly explained the concept of blockchain and the advantages offered by its implementation, promoting transparency in waste management and presented the stages of implementation of the project. She referred to the relevant university curricula in Europe, in which there is an absence of Industry 4.0 elements, such as big data, IoT and blockchain. To fill this learning gap, the aim of the project was to develop an international training programme to train students and professionals from relevant stakeholders in the interface of blockchain and MSW management. Finally, Ms. Menegaki explained the function of the educational interactive tool, developed within the Blockwaste project, which is based on blockchain technology as it can be applied in MSW management.

The presentations were followed by questions from the participants and a constructive dialogue on the content of the presentations and the results of BlockWaste. Attendees had also the opportunity to exchange views and network even more, during the coffee break and light dinner that followed.



Figure 18: Maria Menegaki (National Technical University of Athens, Greece)

4.3 Evaluation results

During the event an evaluation questionnaire was distributed, which was completed by the participants in the room. The results are presented below.

The means to communicate the event to a wide audience were:

- Personal invitations
- Social Media (LinkedIn/ Facebook)
- Project website
- E-mail

Most of the participants were informed about the event through a colleague or personal invitation (Figure 19).

The majority of the participants (67%) stated that the main reason for attending the event was to acquire and exchange new ideas and perspectives on waste management using new technologies, while also a significant percentage (22%) stated that they were interested in forming an opinion on the results of the BlockWaste project (Figure 20).

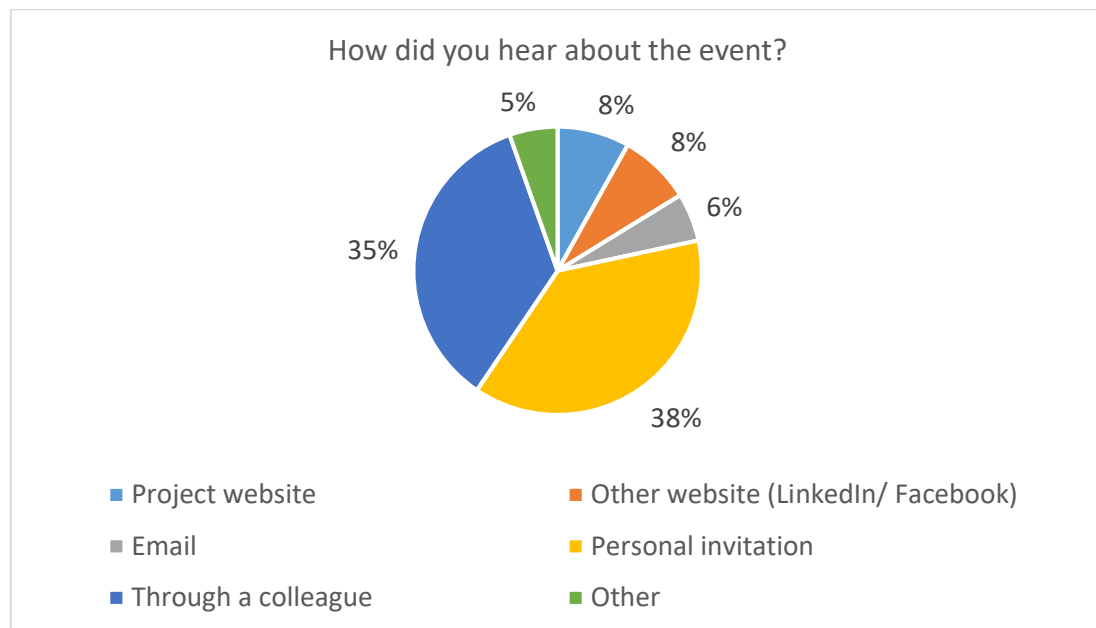


Figure 19: Communication of the event

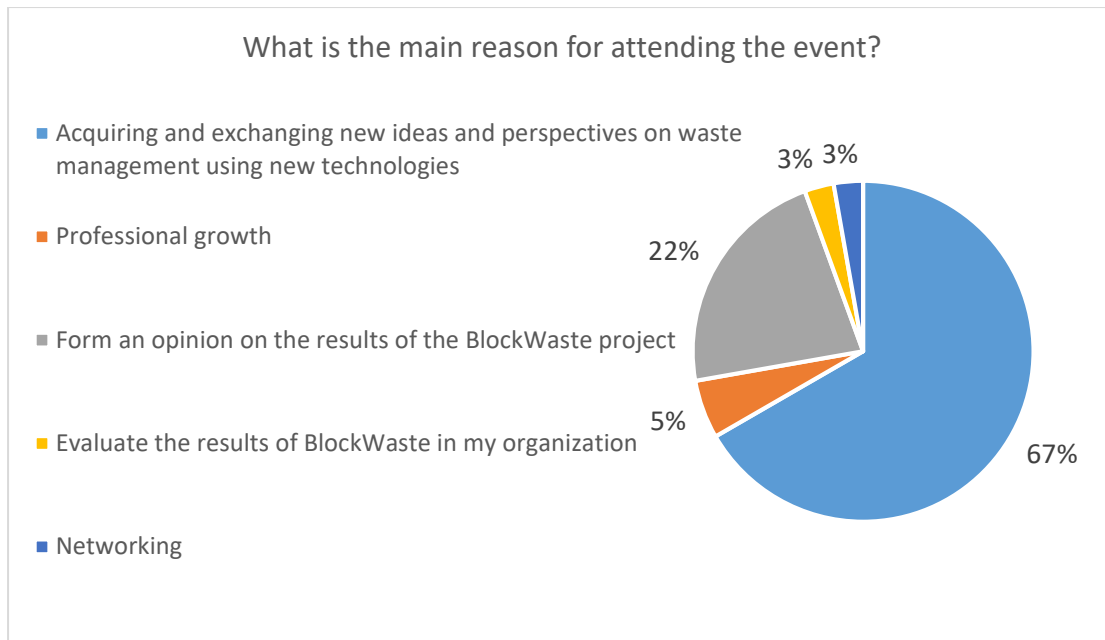


Figure 20: Reasons for attendance

All of the participants found the event as a whole satisfactory. More specifically, 72% rated it as excellent and 28% as very good (Figure 21). All of the participants “strongly agreed” (75%) or “agreed” (25%) that the agenda was suitable for the purposes of the event (Figure 22). 97% participants agreed that the venue was suitable for the event (69% of them strongly agreed, Figure 23), while 86% stated that the information received prior to the event was sufficient (Figure 24).



Figure 21: Evaluation of the event as a whole

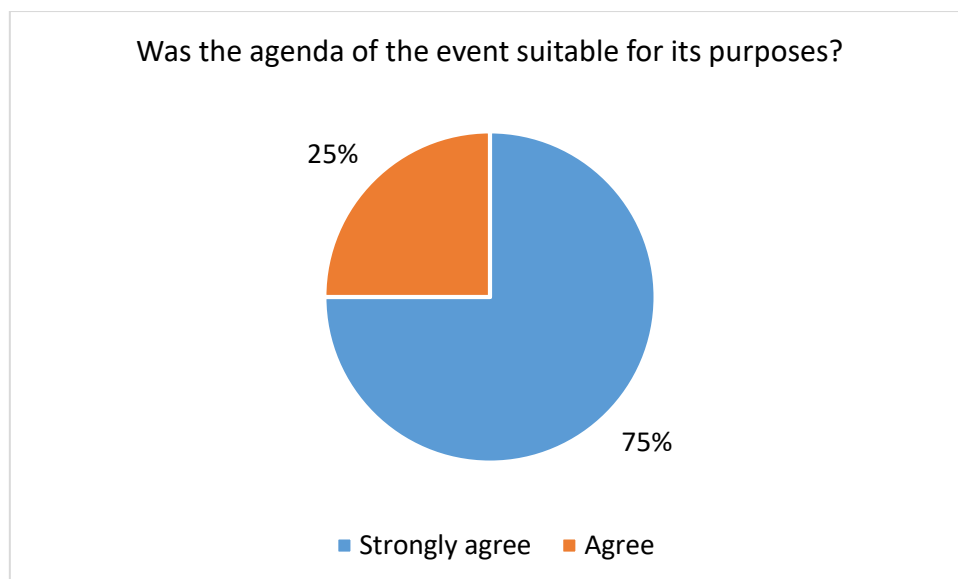


Figure 22: Agenda of the event rating

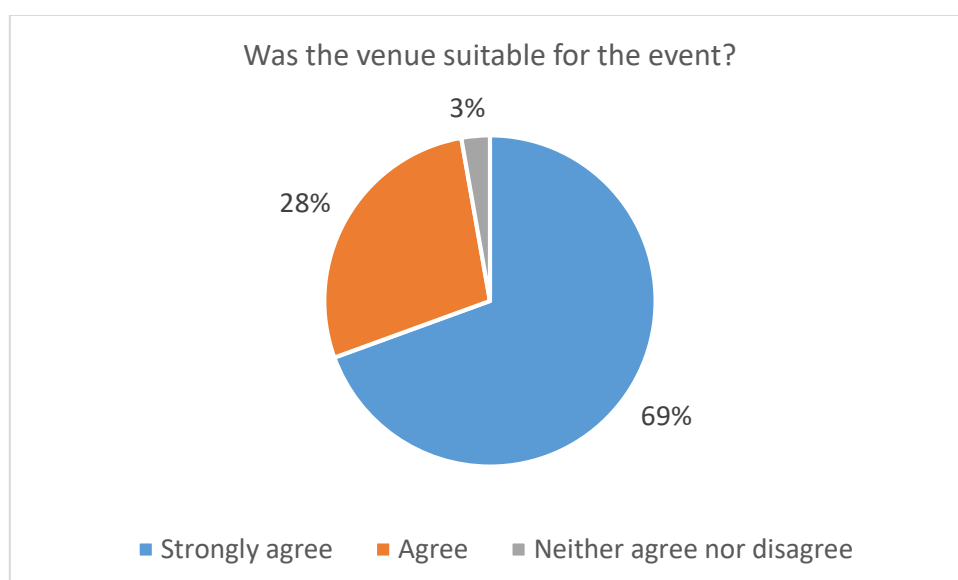


Figure 23: Venue of the event rating

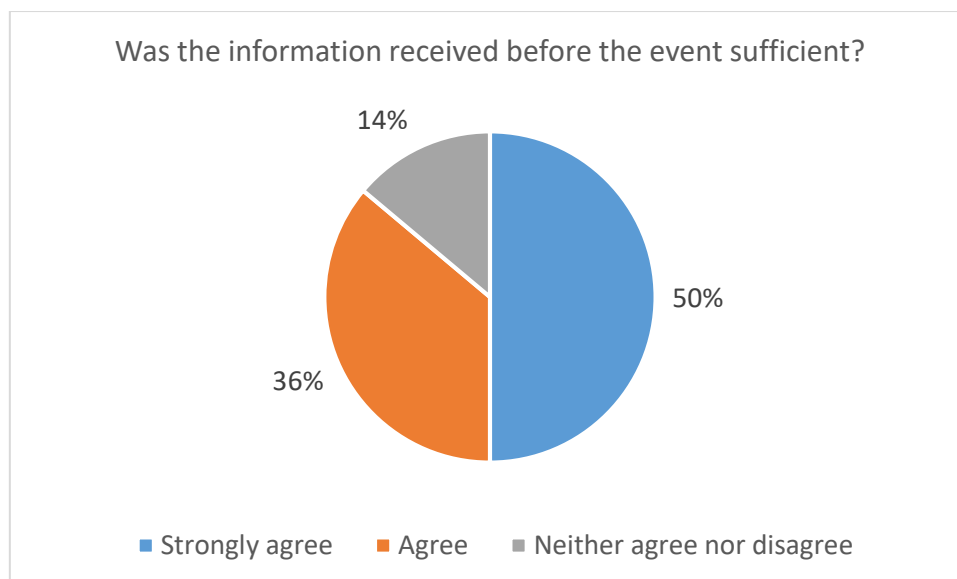


Figure 24: Evaluation of preparatory information prior to the event

As far as the content of the presentations and the speakers are concerned, 75% of the participants found them excellent and 25% found them very good (Figure 25). In fact, the content of the presentations is what most attendees said they liked most about the event. After the presentation there was time for some additional discussion, which was enough to ask questions and get answers for 60% of the attendees and quite enough for 30% for them (Figure 26). However, extra time was the element highlighted by most participants when asked what could have been improved in the event.

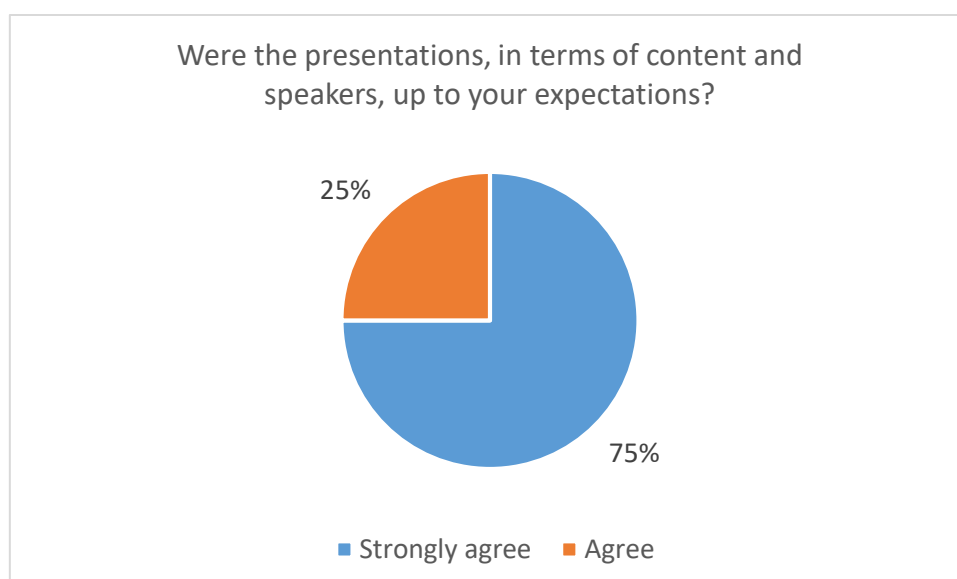


Figure 25: Evaluation of the speakers/ presentations

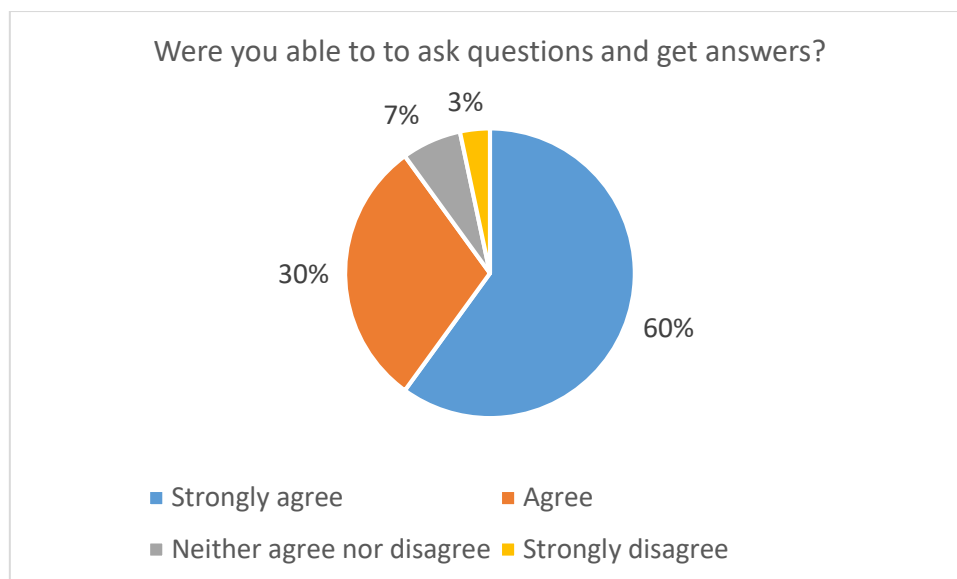
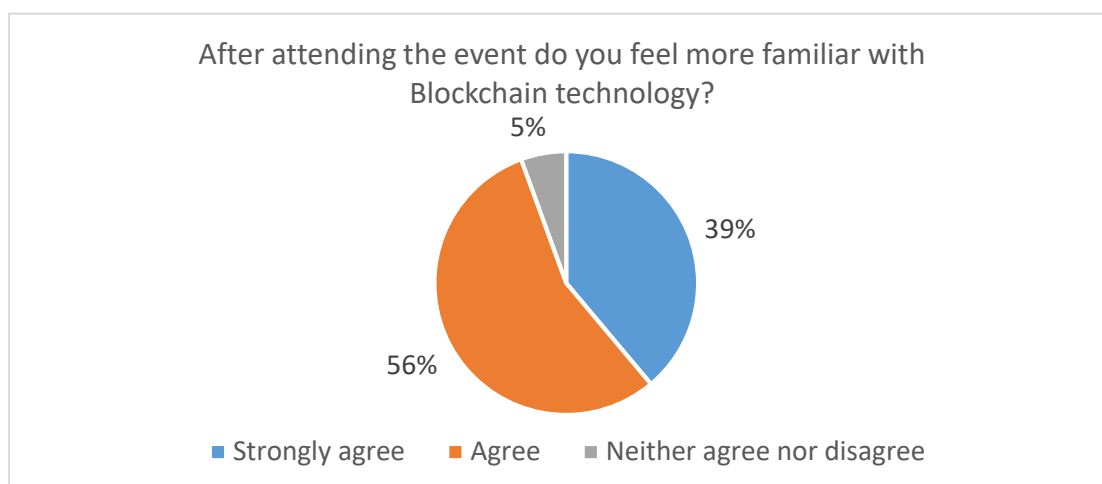
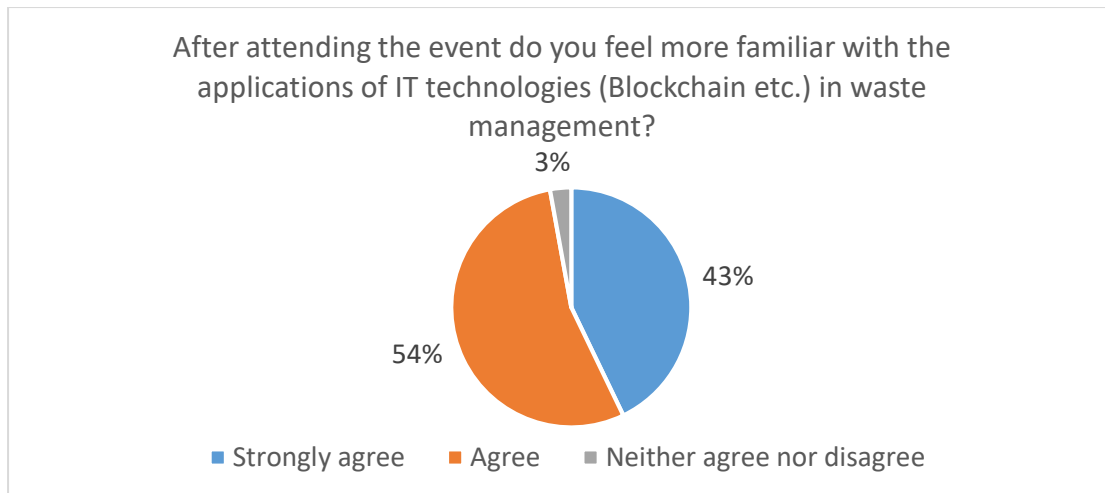


Figure 26: Evaluation of additional discussion and questions session

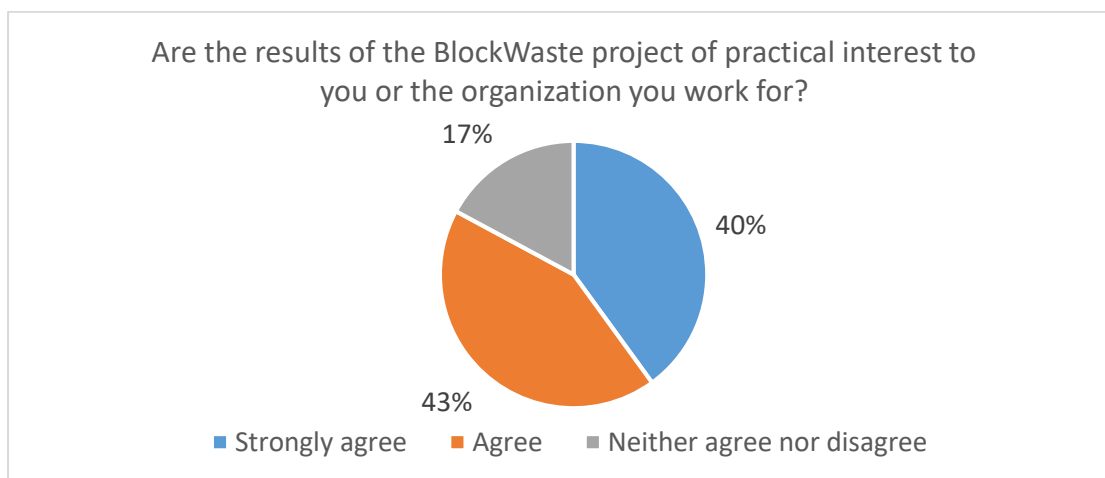
As far as the benefits of attending the event (Figure 27a, b,c), 95% of the participants, in total, stated that they feel more familiar with Blockchain technology (39% strongly agreed, 56% agreed), while 97% feel more familiar with the applications of IT technology in waste management (43% strongly agreed, 54% agreed). Moreover, 83% of the attendees, in total, think that the results of the BlockWaste project are of particular interest to them or the organisation they work for (40% strongly agree, 43% agree).



a



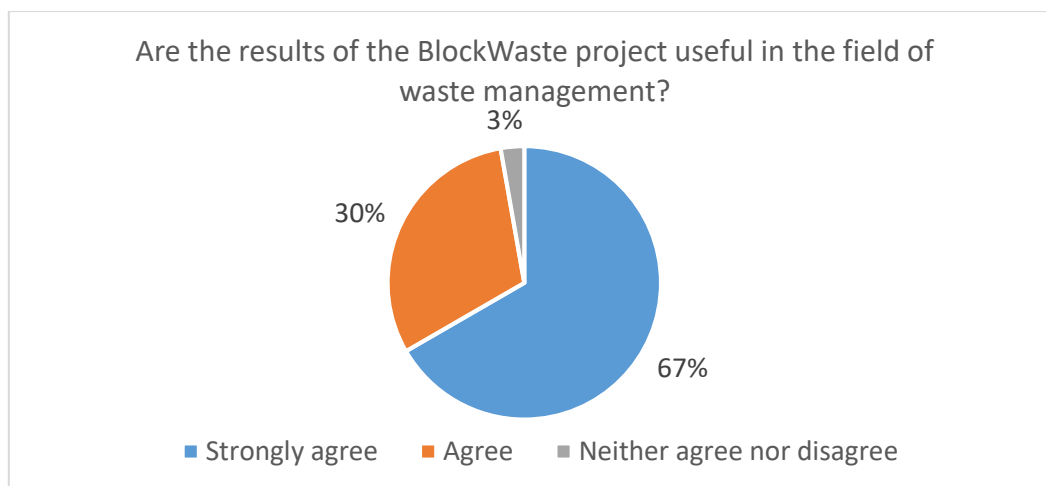
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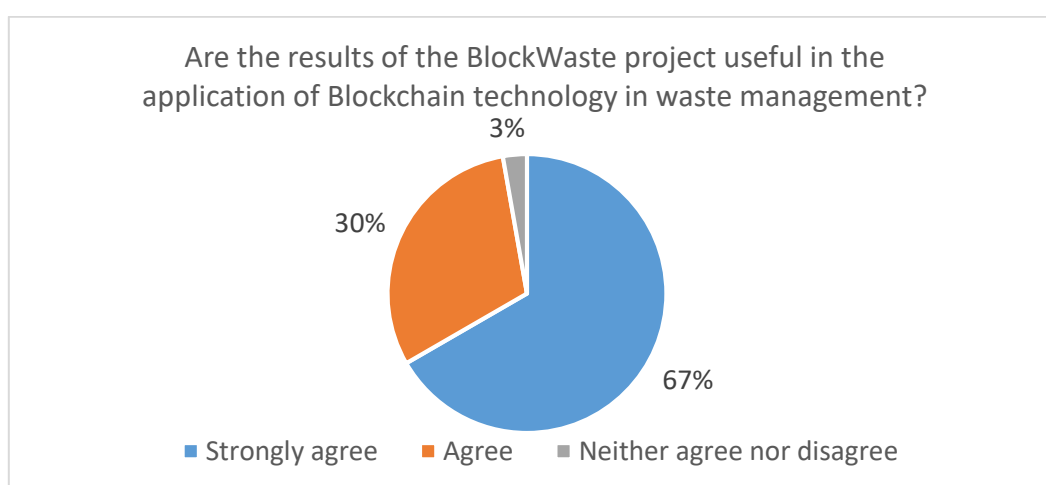
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Figure 27: Evaluation of the benefits of attending the event

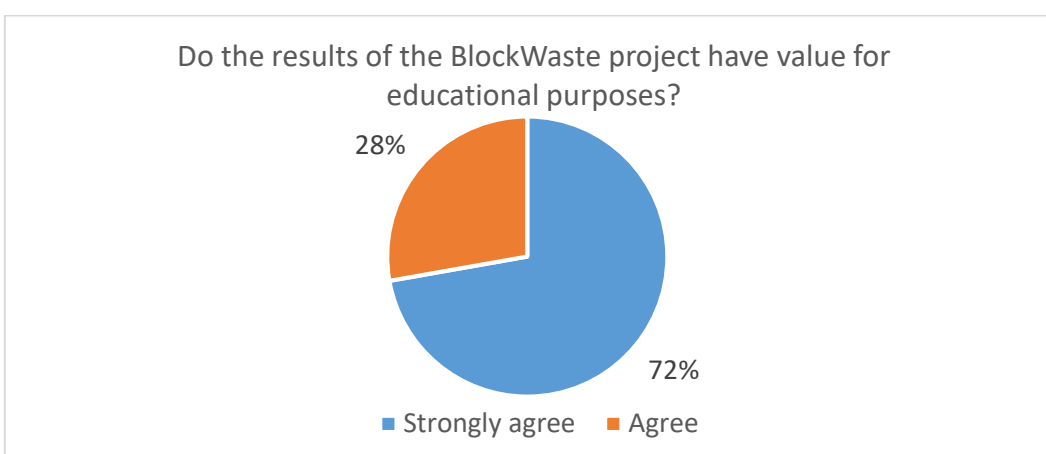
Finally, with regard to the intellectual outputs of the project (Figure 28 a,b,c,,), 97% of the attendees found the results of the BlockWaste project useful in the application of Blockchain technology in waste management and in the field of waste management, in general (67% strongly agreed, 30% agreed) and all of the attendees stated that the results of the BlockWaste project have value for educational purposes (72% strongly agreed, 28% agreed).



a



b



c

Figure 28: Evaluation of the BlockWaste project results

When asked what they liked most about the event, attendees said the content and variety of presentations, the presence of expert speakers from abroad and from different disciplines and institutions, the understanding of blockchain technology, the understanding of the results of the project and the excellent organization. Extra time for discussion/ brainstorming, adherence to the timetable and more publicity, to reach a wider audience, was what they responded that could be done better.

Annex I: Participants list – First International Seminar in Germany

Personal details removed due to privacy concerns

Annex II: Participants list – Second International Seminar in Estonia

Personal details removed due to privacy concerns

Annex III: Participants list – Final International Seminar in Greece

Personal details removed due to privacy concerns