# **O3.A2** Guideline notes and functional specifications



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Task leader: Saxion UAS

Author(s): Perry Smit, Saxion UAS, p.j.smit.01@saxion.nl, Netherlands, Ermo Täks, Tallinn University of Technology, ermo.taks@taltech.ee, Estonia, Juana Llorente, Centro Tecnológico del Mármol, Piedra y Materiales, juana.llorente@ctmarmol.es, Spain

**Reviewed by:** Athanassios Mavrikos, National Technical University of Athens, mavrikos@metal.ntua.gr, Greece, Viktoria Voronova, Tallinn University of Technology, viktoria.voronova@taltech.ee, Estonia

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## Contents

Executive	summary	iii
1.	Introduction	1
1.1.	Description of the BlockWASTE project	1
1.2.	Objective of this guideline	1
2.	BlockWASTE Tool	2
2.1.	Introduction to the interactive tool	2
2.2.	Access as Mayor	4
2.3.	Access as Household	7

# List of figures

Figure 1.	Within this section of the website, the user must click on LOG IN to access the tool.
Figure 2.	The "LOG IN" prompt that the user must click on3
Figure 3.	The page where the user selects an available "Game Slot" in order to play the game
Figure 4.	The page where the user selects the role of the "Mayor" or the role of a "Household"
Figure 5.	An example where the user selects the role of the "Mayor"4
Figure 6.	The "Mayor" selects one of the available waste management schemes from the drop-down menu
Figure 7.	Once the waste management scheme has been selected, the "Mayor" clicks on "Proceed"
Figure 8.	After the "Households" have submitted the information, the "Mayor" can assign each "Household" the relevant fees
Figure 9.	The "Mayor" can also see additional information regarding the material flows6
Figure 10	. There is also the option to export the data to a csv file for further processing7
Figure 11	. The player selects the "Household" role7
Figure 12	. The user selects on of the available code names for the "Households"
Figure 13	. The table containing the data of the "Household" that the user must provide8
Figure 14	. Once the data have been entered, the user must click on "Add data"9
Figure 15	After entering the "Household" data, the user must solve a blockchain algorithmic problem in order to be allowed to submit the data to the "Mayor"





# List of abbreviations

Abbreviation	Definition
MSW	Municipal solid waste
MSWM	Municipal solid waste management
MBT	Mechanical Biological Treatment
OER	Open Educational Resource





# **Executive summary**

In the context of the project, an interactive tool ("Interactive BlockWASTE Tool") has been developed, which is free of access and is implemented within the OER, developed in the "IO4: BlockWASTE Open Educational Resource".

The aim of the tool is to offer users several keys to achieve the integration of Blockchain-based MSW and help them understand the whole traceability and visibility of municipal solid waste from the beginning to the end of their management. With the "Interactive BlockWASTE Tool" (https://game.blockwasteproject.eu/), the user will be able to visualize how the encrypting of information of a Blockchain works in a role-playing environment, exploiting - whenever needed - the information collected within the waste database (i.e. "O3/A1. Production of the database for the E-Learning Tool") that has been created.

Although the Application Form initially foreseen one interactive tool (i.e. the "Interactive BlockWASTE Tool"), it was decided to develop two different modules in order to better serve the educational needs of the BlockWASTE project's identified target groups and final users. More specifically, the first module (Blockchain module) aims at visualizing how the encrypting of information of a Blockchain works and is addressed to users who are not familiar with Blockchain technology. This module is described in detail in the O3/A3. Interactive BlockWASTE Tool document. The second module (initially called "MSW Management Tool") focuses only on MSW management using an interactive role-playing game.

The document hereinafter describes the procedure a potential user should follow to successfully play the game (second module). Additional information can also be found in the O3/A3. Interactive BlockWASTE Tool document.



iii



# 1. Introduction

### 1.1. Description of the BlockWASTE project

The project aims to address the interoperability between waste management and blockchain technology and to promote its proper treatment through educational training, so that the data collected is shared within a safe environment, where there is no room for uncertainty and mistrust between all parties involved in waste chains or cycles.

For this purpose, the objectives of the BlockWASTE project are as follows:

- To conduct research on solid waste generated in cities and how it is managed, so that an information base of good practices can be created that helps 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 supports the training of teachers and professionals of organizations and companies of the sector, in the overlap of the fields of Waste Management, Circular Economy 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

Further information is available from the BlockWASTE project website <u>https://blockwasteproject.eu.</u>

### 1.2. Objective of this guideline

This report sets out the guidance notes and functional specifications of the interactive tool. Mainly the look and feel and the interactions with the users. These functional specifications and user guidance serve as an ongoing reference point for the lead developer of the task to write the programming code. This document shows the visual appearance of the user interface and the description of each of the possible user input actions.

A translation of the website of the tool is available, making it accessible in all project languages.





## 2. BlockWASTE Tool

#### 2.1. Introduction to the interactive tool.

The BlockWASTE learning tool can be accessed from the project website: <u>https://blockwasteproject.eu/</u>. Once inside the website, click on the E-LEARNING TOOL tab (<u>https://blockwasteproject.eu/elearning-tool/</u>).



*Figure 1.* Within this section of the website, the user must click on LOG IN to access the tool.







Figure 2. The "LOG IN" button that the user must click on

The interactive tool, BlockWASTE, has been approached as an interactive role-playing game focusing on MSW management. This game allows the interaction of a class group through the use of computers (but also tablets or even smartphones) and shows in real time the progress to the whole class.

The tool has 5 "Game Slots", in order to accommodate a larger number of users. It is necessary to select the "Game Slot" to which the user wants to have access.

Co-funded by the Erasmus+ Programme of the European Union					Interactive BlockWASTE Tool	BlockWaste	)	θ
	Innovative Trainir Project code: 202	ng Based on Block 20-1-EL01-KA203-	chain Technology 079154	Applied to Waste	Management -			
	The "Interactive BlockWASTE 079154) and aims to support Tool through an interactive int MSW to the end of their mana	Tool" has been developed in t e-learning training in MSW ma erface, aims to help users und igement, and the role of Blocko	he framework of the Erasmus+ nagement sector and how Block erstand the basic functions and chain technology in it.	BlockWASTE project (Project ) cchain technology could promo parameters of MSW managen	code: 2020-1-EL01-KA203- te Circular Economy. The nent, from the generation of			
	For detailed instructions on he User's Manual (coming soon)	ow to play the game, the users	(trainers and trainees) are stron	ngly advised to consult the Inte	eractive BlockWASTE Tool			
	Game Slot 1 Occupied time left: 2h:56m:4s	Game Slot 2 Free ENTER	Game Slot 3 Free ENTER	Game Slot 4 Free ENTER	Game Slot 5 Free ENTER			
	Disclaimer: The European C reflect the views only of the a therein.	ommission's support for the pro uthors, and the Commission ca	oduction of this publication does innot be held responsible for an	: not constitute an endorsemer y use which may be made of t	nt of the contents, which he information contained			

*Figure 3.* The page where the user selects an available "Game Slot" in order to play the game





Once the "Game Slot" has been selected, the user's role must be chosen. You can enter either as a "Mayor" (in charge of the MSW management authority) or as a "Household".

Innovative Training Base Project code: 2020-1-EL	d on Blockchain Technology Applied to 01-KA203-079154	o Waste Management -
	Enter as Mayor	
	Enter as Household	
	Choose Household	
	household	
	ENTER	

Figure 4. The page where the user selects the role of the "Mayor" or the role of a "Household"

#### 2.2. Access as Mayor

Click "ENTER".

Innovative Training Based on Blockchain Technology Applied to Waste Management -Project code: 2020-1-EL01-KA203-079154 Enter as Mayor ENTER

Enter as Househod	
Choose Household	
household	
ENTER	

Figure 5. An example where the user selects the role of the "Mayor"

Choose a plan from the drop-down menu. There are four alternative waste management schemes as options for the municipal authorities:

S1. Aerobic MBT – Compost •





- S2. Anaerobic MBT Compost
- S3. Anaerobic MBT Anaerobic
- S4. Biodrying MBT Anaerobic

These alternatives are discussed in "O3/A3. Interactive BlockWASTE Tool".

Chappen your plan	
Chasses your plan	
Choose your plan	
As the mayor, you have to select a plan for	
Choose wisely!	
S1. Aerobic MBT - Compost	
S2. Anaerobic MBT - Compost	
S3. Anaerobic MBT - Anaerobic	
S4. Biodrying MBT - Anaerobic	
4	

*Figure 6.* The "Mayor" selects one of the available waste management schemes from the drop-down menu

Once selected, click on "Proceed".

Choose your plan As the mayor, you have to select a plan for Choose wisely!		
Plan S3. Anaerobic MBT - Anaerobic Proceed	•	

*Figure 7.* Once the waste management scheme has been selected, the "Mayor" clicks on "Proceed"





Once inside, the "Mayor" obtains information on collection costs for each type of waste as well as on the amount of MSW generated, separated and mixed by each household, etc.

Having the costs, the "Mayor" can define the municipal fees that each "Household" has to pay.

BlockWaste	Interactive BlockWASTE To	ool								time left: 2h:9m Hi mayor3! 🕽 🗧
		Balance: €0.57								
		Marth All	* Household All	*				D	Pelete all entries Report	
			Household Mixe	d collected waste (kg) Separat	ed collected waste (kg) Total w	aste collected (Kg). Net (	cost for municipality. Mu	nicipal fees (Euros/month)		
					Jan	uary				
			mayor3_pk11	14.125	42.375	56.5	€4.50	5 € Save		
			mayor3_pk5	19.165	19.165	38.33	€3.02	<sup>7ee</sup> 4 € Save		
			mayor3_pk7	22.5	67.5	90	€7.17	<sup>Fee</sup> € Save		
			mayor3_pk28	66.665	66.665	133.33	€10.52	Fee 15 C Save		
			mayor3_pk1	37.5	112.5	150	€11.95	8 C Save		
			mayor3_pk6	8.333	24.998	33.33	€2.65	5 C Save		
			mayor3_pk10	36.833	107.498	143.33	€11.42	<sup>Fee</sup> 14 € Seve		
			mayor3_pk12	0	100	100	€8.04	7∞ Save		
			Total	 312.87	649.45	962.32	€76.43	Fee €77.00		

Figure 8. After the "Households" have submitted the information, the "Mayor" can assign each "Household" the relevant fees

Also, by activating the option "Show MBT, Biowaste and MRF data", the "Mayor" will receive additional data regarding the material flows (input and output) in the different treatment facilities. Also, the tool provides the opportunity to export the detailed results to a csv file for further processing.

Month All	Household All	Ŧ	Plan S3. Anaer	robic MB	T-A *	0				tF data										
			Collection cost			Treatr	nent cos	Landfil cos		Total cost F			Revenues			Net cost		Net cost / waste (kg)		
			Month	Mixed	Separated	Mixed	Separated	cost	Mixed	Separated	d Total	Mixed	Separated	Total	Mixed	Separated	Total	Mixed	Separate	d Total
			January	€40.3	€258.5	€47.0	€108.7	€17.8	€105.1	€367.2	€472.3	€46.2	€206.5	€252.7	€58.8	€160.7	€219.6	0.088	0.08	0.082
			February	€7.7	€43.3	€9.0	€19.5	€2.9	€19.6	€62.8	€82.4	€7.6	€30.8	€38.4	€12.0	€32.0	€44.1	0.093	0.091	0.091
			March	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	0	0	0
			April	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	0	0	0
			May	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	0	0	0
			June	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	0	0	0
			July	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	0	0	0
			August	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	0	0	0
		s	ieptember	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	0	0	0
			October	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	0	0	0
			November	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	0	0	0
		1	December Total	€0.0 206.8	€0.0 €48.0	€0.0 €301.8	€0.0 €56.0	€0.0 €128.2	€0.0 €20.7	€0.0 €124.7	€0.0 €430.0	€0.0 €554.7	€0.0 €53.8	€0.0 €237.3	€0.0 €291.1	€0.0 €70.9	€0.0 €192.7	0 €263.6	0	0

Figure 9. The "Mayor" can also see additional information regarding the material flows





Menth All			¥	Househol All	đ		÷	,	Plan S3. Ani	aerobi	MBT -	A *	-	Shov	MBT,	Biowa	ste, and	I MRF dat	a																		Dashboard
			MBT - INF	PUT (Mixe	d waste							м	BT - OUT	PUT					BIOWASTE TREATMENT FACILITY - INPUT	BIOWA FACI	STE TRE	ATMENT ITPUT	MJ IN	ATERIALS PUT=OU	RECOVI	ERY FACII parated w	JITY / aste)	Colle	ction cost	Treat	ment cost	Landfill cost		Total cost			Revenuer
Month	Total waste (mixed)	Organi (kg)	: Paper (kg)	Plastic (kg)	Metai (kg)	Glass (kg)	Other (kg)	r Pape (kg)	r Plasti (kg)	c Meti (kg)	l Glass (kg)	Other (kg)	Electricit (kwh)	(kg)	RDI (kg	SRF (kg)	Losser (kg)	(kg)	Organic (kg)	Compost (kg)	Electricit (kwh)	y Losser (kg)	Paper (kg)	Plastic (kg)	Metal (kg)	Glass (kg)	Other (kg)	Mixed	Separated	Mixed	Separated	cost	Mixed	Separated	Total	Mixed	Separated
January	671.0	206.7	135.6	106.5	68.5	66.7	87.0	75.9	62.9	65.0	60.0	43.5	31.1	64.1	69.7	0.0	51.7	178.3	527.0	84.3	126.5	442.7	404.3	323.8	245.0	237.5	278.0	€40.3	€258.5	€47.0	€108.7	€17.8	€105.1	€367.2	€472.3	€46.2	€206.5
February	129.0	45.7	10.7	19.7	7.1	37.8	8.0	6.0	11.6	6.7	34.0	4.0	6.9	14.2	12.5	0.0	11.4	28.6	121.8	19.5	29.2	102.3	25.9	59.2	21.2	111.3	14.3	€7.7	€43.3	€9.0	€19.5	€2.9	€19.6	€62.8	€82.4	€7.6	€30.8
March	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0
April	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0
May	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0
June	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0
July	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0
August	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0
September	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0
October	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0
November	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0	€0.0
Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	82.0	74.5	71.8	94.0	47.5	38.0	78.2	82.1	0.0	63.1	206.8	648.8	103.8	0.0	545.0	0.0	0.0	0.0	0.0	0.0	€48.0	€301.8	€56.0	€128.2	€20.7	€124.7	€430.0	€554.7	€53.8	€237.3 <b>•</b>

*Figure 10.* There is also the option to export the data to a csv file for further processing

#### 2.3. Access as Household

Choose an option from the drop-down menu.

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Figure 11. The player selects the "Household" role

Click "ENTER".



Innovative Training Basec Project code: 2020-1-EL0	on Blockchain Technology Applied to Waste Management - 1-KA203-079154
	Enter as Mayor
	Enter as Household
	Choose Household
	PK1
	РК2
	PK3
	PK4
	PK6
	PK5

Figure 12. The user selects on of the available code names for the "Households"

Interactive BlockWAS	STE Tool						Hi mayor3_p					
Balance: -€28.00												
Only show my entries	Month All	- Household All	•									
Household HH MSW members p	/ generation HH MSW pc/year generation/ month	Time spent on sorting waste (between 0-45 minutes per week)	Value of time (Euros/ month)	Percentage of recyclables separated (different bins)	percentage of mixed MSW (mixed waste, organic and other)	Total cost (Euros/month)	Municipal fees (Euros/month)					
	January											
Me 4	450 150	20	20	75%	25%	28	8					

*Figure 13.* The table containing the data of the "Household" that the user must provide

As far as the households are concerned, the game takes into consideration the following variables:

- HH members
- MSW generation pc/year
- HH MSW generation/month
- Composition of MSW:
  - Organics
  - Paper
  - Plastics
  - Metal
  - Glass
  - Other
- Time spent on sorting waste (between 0-45 minutes per week)
- Value of time (€/hour.month)





- Percentage of waste separated in different bins
- Percentage of mixed MSW (mixed waste, organic and other)
- Municipal fees (€/month)
- Total cost (€/month)

The variables HH members, MSW generation pc/year, Composition of MSW and Time spent on sorting waste are defined by the user. To enter this data, you have to click on "Add data".

BlockWaste	Interactive	e Block\	WASTE Too	bl				
	Balance: -€28.	00 tot my en.	ries All		•	Household All	•	
	Household	HH members	MSW generation pc/year	HH MSW generation/ month	Time (betwee	e spent on sorting waste en 0-45 minutes per week)	Value of time (Euros/ month)	Percentage separated (
			450	450		00	Januar	У
	Total	4	450	150		20 20	€ <b>20.00</b>	

Figure 14. Once the data have been entered, the user must click on "Add data"

In particular, MSW generation pc/year and MSW composition can be retrieved through the MSW database that has been created in O3/O1. The database includes data on MSW generation and management in European countries, socio-economic data, MSW composition, prices of recycled plastics, glass and paper, etc.





BlockWaste	Interactive BlockWASTE T	ool					
		Balance: -€28.00 Add data					
		Household members *	MSW generation *	pc/year			
		Organic: 0% Paper: 0%	Plastic: 0% Met	al: 0% Glass: 0%	Other: 100%		
			•	, •			
		Time spent on sorting waste (	oetween 0-45)* minute	s per week Choo	ose month *		Submit
		Block Area Householder	Total waste	Nonce (1-3)	a b c Lastfivodij	gits from prev. Hash Hash Solved	
		1 Blue Uhw94tkdvuzk	30 Nonce (*	-3) *	66 85 30	10 191 🗙	
		2 Red Jjfaaq0j77n	93 Nonce (*	-3) *	82 74 93	91 340 🗙	
		3 Blue Kkw6s5559cgi	95 Nonce (*	-3) *	66 75 95	40 276 🗙	

*Figure 15.* After entering the "Household" data, the user must solve a blockchain algorithmic problem in order to be allowed to submit the data to the "Mayor"

After submitting the data, the user will receive the municipal fees (as defined by the "Mayor") and will be presented with her/his total cost (i.e. the value of time spent on sorting the waste plus the municipal fees).



