Development of an Innovative Insulation Fire Resistant Façade from the Construction and Demolition Waste

DEFEAT

INTEGRATED/0918/0052

DELIVERABLE D1.4

18 MONTHS PROGRESS REPORT

The Project DEFEAT (INTEGRATED/0918/0052) has been co-funded by the European Regional Development Fund (ERDF) and the Cyprus Government, through the RESTART 2016-20 framework program of the Cyprus Research & Innovation Foundation

PROGRESS REPORT

RESTART 2016-2020 Programme for Research, Technological Development and Innovation

RESEARCH AND INNOVATION FOUNDATION

Ευρωπαϊκή Ένωση
Ευρωπαϊκό Ταμείο Περιφερειακής Ανάπτυξης

Κυπριακή Δημοκρατία

Διαρθρωτικά Ταμεία
της Ευρωπαϊκής Ένωσης στην Κύπρο

A.1. GENERAL PROJECT INFORMATION	
Project Protocol Number:	INTEGRATED/0918/0052
ESIF Number:	
Project Title:	Development of an innovative insulation fire resistant façade from the Construction and Demolition Waste
Project Title in Greek:	Ανάπτυξη ενός καινοτόμου θερμομονωτικού και πυράντοχου υλικού από Απόβλητα Εκσκαφών, Κατασκευών και Κατεδαφίσεων για εφαρμογή σε προσόψεις κτιρίων
Host Organisation:	Frederick Research Center (FRC)

A.2. DESCRIPTION OF THE WORK CARRIED OUT BY ALL BENEFICIARIES DURING THIS REPORTING PERIOD. *(Maximum Recommended 3 pages)*

Please provide an overview of the progress towards the project objectives, justifying the differences between work described under Annex I of the Contract and work actually performed, if any.

The "Development of an innovative insulation fire resistant façade from the Construction and Demolition Waste" (DEFEAT) project envisions to develop in a pilot scale, and through detailed experimental study, an innovative separation method of CDW, as well as a composite material generated also from the CDW, which will gain low thermal conductivity, satisfactory mechanical properties and at the same time will be fire resistant. The produced material will be able to be applied as a façade, either on existing or new construction projects.

The DEFEAT work plan consists of ten (10) distinct work packages, implementing activities like separation of CDW, material characterization, prototype design and process engineering, production and application, management, exploitation and dissemination, techno-economic analysis and last but not least, development of guidelines for a strategic action plan for recycled CDW reuse. The successful completion of all the WPs will result in the achievement of all the project objectives.

The implementation of the DEFEAT project was inevitably affected by the Covid-19 pandemic. Despite the fact the research team made all the possible efforts for the smooth implementation of the project according to the original schedule, the following issues arose:

- Several disruptions on the progress of the experimental work, either due to the enforced lockdowns by the Cyprus Government for a considerable period of time, or due to limited access to the laboratories due to internal measures taken by each project's partner authorities, or due to positive Covid-19 cases amongst the members of the research team.
- Considerable delay on the manufacturing and delivery of the equipment for the robotic separation of the Construction and Demolition Wastes (CDW) from the successful tenderer. This had as a result the delay of the overall progress of WP 3. The Coordinator asked for a modification of the WP3 end month, along with the submission deadline of the corresponding deliverables. The request was approved from the RIF.
- Limited or delayed supply of specialised consumables from local or international suppliers. This had also negative effect on the progress of WPs 3, 4 and 5.
- Increased prices of consumables and other project related expenses due to transportation issues and/or limited availability.
- Cancellation of international conferences in which the research team was planning to present parts of the DEFEAT project's obtained results.
- Cancellation of scheduled visits in the premises of the Foreign Research Organisation, i.e. the Katholieke Universiteit Leuven for the needs of the project.
- The majority of the consortium's meetings were conducted online, instead of with physical presence of the participants.

Despite of the above-mentioned barriers, the overall project's progress for the first reporting period is considered as satisfactory. Detailed report regarding the implementation of each WP is provided in section "A.3. EXPLANATION OF THE WORK CARRIED OUT PER WORK PACKAGE (WP)". Briefly, the progress of each separate WP towards the accomplishment of the project objectives is presented below:

- WP1: The overall project management required excessive amount of time (considerably more than initially planned), due to the Covid-19 pandemic consequences and the unavoidable generated difficulties. The research team was closely monitoring the WP1 progress and worked methodologically towards the preparation of the corresponding deliverables. All the deliverables related to WP1 were prepared on time and revised by the assigned internal peer-reviewers, according to the described quality assurance plan.
- WP2: The WP2 devoted in "Dissemination Activities, Exploitation & Innovation Management" was also affected by the Covid-19 pandemic consequences. The pandemic's negative effects on WP2 are thoroughly described in section A.3. below. The deliverables related to WP2 were prepared on time and revised by the assigned internal peer-reviewers. Further to the official deliverables, a considerable number of other activities were implemented in the frame of WP2, aiming at the widest possible dissemination and exploitation of the project's results.
- WP3: WP3 was the one mostly affected by the ongoing Covid-19 pandemic for the reasons that are analysed explicitly in section A.3. below. It is estimated that the overall delay in the progress of WP3 (specifically of Task 3.2) due to these problems exceed the 12 months. The project's steering committee requested an extension regarding the submission deadlines of all the deliverables (i.e. D3.2-D3.8) related to the usage of the robotic separation system and that were affected by the extensive delay. The request was approved by the funding agency. Deliverable 3.1 was successfully submitted with small delay due to the applied lockdown in Cyprus at that time. Also, despite the fact that an extension for the submission of Deliverable 3.3 was approved, the research team managed to complete Task 3.3 and therefore the corresponding deliverable D3.3 ahead of time.
- WP4: The WP was completed with small delay, resulting in two extensive technical reports, that correspond to the WP4 deliverables (i.e. D4.1: Full characterization of the separated waste concrete and ceramic and D4.2: Data sheet of these two waste streams). A budget revision of the originally allocated budget of PA1 was requested and approved by the funding agency. Details regarding this budget modification are provided in section B.1. below.
- WP5: The experimental work towards the development of the DEFEAT composite is progressing very well. Despite the fact that WP5 will be officially completed in month 24 of the project (i.e. end of June 2022), the properties of the developed material (by the time of submission of this interim report) are very good, thus nearly meeting the targeted values. The research team is confident that by the completion time of WP5 all the scientific and technical objectives will be successfully implemented. Deliverables D5.1 (Report on the fire and insulation design) and D5.2 (Publication in open access journal) were prepared on time, meeting the project's requirements. Deliverable D5.4 (Presentation in conference) was scheduled and prepared on time. However, as it is explained in section A.3. below, the conference was postponed due to Covid-19 pandemic, from November 24-26, 2021 to July 13-15 2022. It is the aim of the consortium to participate in the particular conference and present part of the project's results.
- WP6: The progress of this WP is strongly related to the progress of WP5. By the time of submission of this report, WP6 was progressing in a very satisfactory manner. Although the official deadlines for the submission of deliverables related to WP6 are scheduled at a later stage, the consortium has already drafted deliverables D6.1 and D6.4.
- WP7: This WP has not started by the time of submission of this interim report. The corresponding deliverables are scheduled to be prepared and submitted at a subsequent stage of the project.
- WP8: This WP has not started by the time of submission of this interim report. The corresponding

deliverables are scheduled to be prepared and submitted at a subsequent stage of the project.

- WP9: This WP has not started by the time of submission of this interim report. The corresponding deliverables are scheduled to be prepared and submitted at a subsequent stage of the project.
- WP10: The particular WP seeks to identify and report possible mechanisms that can assist in the successful implementation of a recycled CDW reuse scheme in Cyprus. WP10 is progressing according to the original timeframe of the project. Deliverables D10.1: A Stakeholders' workshop and D10.2: Survey Questionnaires were prepared on time and revised by the assigned internal peer-reviewer, according to the described quality assurance plan. In addition, Deliverable D10.3: Statistical Analysis of Results and Findings of Questionnaires (originally planned to be submitted on project's month 19) was prepared ahead of time and it is therefore submitted along with this report.

Despite all the efforts of the DEFEAT consortium, the project's progress is unavoidably affected by the ongoing Covid-19 pandemic. The research team is putting considerable effort to prevent any further delays and complete the assigned tasks on time. Nevertheless, this was proved to be practically impossible on several occasions, as it is explained in this report. The project's coordinator will inform the funding agency for the overall project's progress and the possibility for an extension need.

A.3. EXPLANATION OF THE WORK CARRIED OUT PER WORK PACKAGE (WP).

(Maximum Recommended 3 pages per WP)

Work Package Number:	1	Start Month:	1	End Month:	36
Work Package Title	Project Management				
Work Package Leader	FRC				
Partner Role	HO	PA1	PA2	PA3	PA4
Person Months	5	3	3	1	2
Partner Role	PA5	PA6	PA7	PA8	
Person Months	1	0.5	2	0.5	

Work Package Objectives as described in Annex I of the Contract.

Briefly describe the objectives of the WP and the work carried out during the reporting period towards the achievement of each listed objective.

WP1 is related to the overall project management and the monitoring, coordination and processing of all management issues. This work package supports all the other WPs of the project, and its objectives are: 1) to establish a project/consortium agreement amongst the partners and to prepare meetings, 2) to act as an interface to the Research and Innovation Foundation (RIF) management team, 3) to follow-up on the project's progress, 4) to execute the dissemination strategy and to track closely the deliverables and milestones; all while, finally, being wary of the risks and mitigating them when necessary. In addition, to ensure: (i) achievement of all project objectives on time, quality and costs; (ii) achievement of the specific scientific and technical objectives for each of the WPs and (iii) adequate management of innovation and IPR.

Work Description and Key Results

Describe the activities undertaken relating to project management (e.g. preparation of Progress Reports, coordination meetings, decision making procedures etc.) and networking (i.e. exchange of visits between partners including timeframe and purpose of each visit). Where possible, provide quantitative information on activities and results.

Where appropriate, give details of the work carried out per task by each beneficiary involved, indicating the lead partner.

WP1 is leaded by the Host Organization, i.e. Frederick Research Center (FRC), with the support and the active involvement of all the consortium partners. The Project Coordinator, Dr. Demetris Nicolaides, has the overall responsibility for the smooth implementation of all the legal and contractual issues, the financial and administrative management, the management of IPs, along with the management of the project's technical and scientific issues. Towards this important and crucial objective, Dr Nicolaides is supported by the DEFEAT project's committees, the HO's administrative mechanisms, the WP and the Tasks' leaders and all the other consortium partners.

Within the frame of WP1 the research team was aiming to implement the requirements and obligations arising under each one of the three following Tasks:

- Task 1.1: General Project Management
- Task 1.2: IP Management

- Task 1.3: Technical Project Management

An overall review of the activities implemented in the frame of WP1 during the first half of the project will be summarised below.

During the kick-off meeting of the project the Coordinator presented the framework of DEFEAT Project Management, aiming at the best possible implementation of all the technical and scientific tasks, the compliance with the provisions of the Grant Agreement and any other applicable provisions of RIF, the handling of legal issues, the maintenance of the Consortium Agreement and finally the proper financial and administrative management. For the successful implementation of the aforementioned important objectives the following specific actions proposed and decisions made:

- Formation of a Steering Committee composed by the Project Coordinator (i.e. Dr Demetris Nicolaides, FRC), the Technical Manager (i.e. Dr Konstantinos Sakkas, RECS) and the Quality Manager (i.e. Professor Michael Petrou, UCY).
- Assignment of Work Packages and Tasks Leaders, based on each organisation's and individual researcher's background and expertise.
- Adoption of a Quality Assurance Plan of the project's deliverables. Specifically, for each one of the deliverables, a member of the consortium has been assigned as a "Responsible Researcher". Responsible researchers will be in charge of coordinating the group of researchers involved in the particular deliverable, in order to ensure its implementation on time, within the allocated budget, meeting all the technical requirements. Furthermore, in order to ensure the highest possible quality of all the deliverables of the DEFEAT project, a peer review system has been applied. Responsible researchers will have to submit the completed deliverables to the corresponding Peer Reviewer(s) before the official deliverable completion deadline, so to allow sufficient time for the reviewing procedure to be completed by the end of the official deadline. A detailed table summarising Project Deliverables, Responsible Researchers, Peer Reviewers and the Deliverables Completion Month was presented and distributed to the consortium members. The procedure will be under the close monitoring and supervision of the assigned Quality Manager of DEFEAT.
- Templates for the production of deliverables, presentations and reports, the project's logo and the essential text related to acknowledgement of the funding agency were presented to the participants.
- A tentative plan related to the meetings of the consortium (either as a whole or in smaller groups) was presented and discussed. Specifically, the Coordinator referred to meetings of the General Assembly, the Steering Committee, the WP Leaders, the Task Leaders, etc.
- Last, detailed presentations related to the financial management of the project and the applied RIF regulations were made to the participants by the director of the FRC (i.e. the Host Organisation) Research Office, Mr. Alexis Onoufriou.

The aforementioned points were also discussed in detail during the 1st, 2nd and 3rd Steering Committee meetings, in General Assembly meetings and in ad-hoc meetings with several project partners.

In addition to the scheduled formal consortium meetings (e.g. kick-off and Steering Committee meetings), a big number of informal meetings were organised by the Project Coordinator. Specifically, the Coordinator had weekly (separated) meetings with the Technical Manager and the Quality Manager

of the project, to discuss issues related to purchases of equipment, research progress and management of delays, evaluation of results, resolving of problems, Covid-19 complications, quality of results and deliverables, etc. Regular meetings were also conducted between the Project Coordinator and the several WP and Task Leaders. The majority of these meetings were conducted between the Coordinator and the leaders of WPs 1, 2, 3, 4, 5, 6 and 10 that were running during the first half of the project period. Meetings were also conducted with the leaders of WP 7, 8 and 9 for planning purposes.

The Project Coordinator was preparing and sending out an invitation and the agenda, he was preparing the minutes and he was sending them for accordance to the participants of the formal meetings. The aforementioned practices were not applied in the case of informal meetings.

An important number of other activities related to the management of the DEFEAT project were also conducted during the project's first 18 months. A sample of such activities is provided below:

- Establish an agreement and sign the pertinent contract with the Foreign Research Organisation (FRO) of the project, i.e. the Katholieke Universiteit Leuven.
- Prepare tender documents for the purchase of equipment (i.e. 3D-printer, RCPT, robotic system for the separation of CDW), evaluate the tenders received and proceed with the necessary administration issues for the purchase of the equipment.
- Hire new researchers for the needs of the project.
- Conduct formal and informal communication with RIF officer related to project's issues.
- Request for modification of WP3 end month, along with the submission deadline of the corresponding deliverables (submitted on 29-01-2021).
- Request for revision of project's budget through the IRIS platform (submitted on 27-04-2021).

Special mention is essential to be made on the unavoidable negative effects of Covid-19 pandemic on the DEFEAT project's implementation. Despite the fact the research team made all the possible efforts for the smooth implementation of the project according to the original schedule, the following issues arose:

- Several disruptions on the progress of the experimental work, either due to the enforced lockdowns by the Cyprus Government for a considerable period of time, or due to limited access to the laboratories due to internal measures taken by each project's partner authorities, or due to positive Covid-19 cases amongst the members of the research team.
- Considerable delay on the manufacturing and delivery of the equipment for the robotic separation of the Construction and Demolition Wastes (CDW) from the successful tenderer. This had as a result the delay of the overall progress of WP 3. The Coordinator asked for a modification of the WP3 end month, along with the preparation and submission deadline of the corresponding deliverables. The request was approved from the RIF.
- Limited or delayed supply of specialised consumables from local or international suppliers. This had also negative effect on the progress of WPs 3, 4 and 5.
- Increased prices of consumables and other project related expenses due to transportation issues and/or limited availability.
- Cancellation of international conferences in which the research team was planning to present parts of the DEFEAT project's obtained results (e.g. 2nd International Conference on Circularity in the Built Environment, CiBEn).
- Cancellation of scheduled visits in the premises of the Foreign Research Organisation, i.e. the

Katholieke Universiteit Leuven for the needs of the project.

- The majority of the consortium's meetings were conducted online, instead of with physical presence of the participants.

The management of Intellectual Properties was jointly supervised by the HO (FRC) and PA5 (Stratagem Energy) of the project, which both have extensive experience on this aspect. The Consortium Agreement that was prepared at the beginning of the project and signed by all partners, governs the rules and procedures for the management of IP. It defines among others, the rules for decision-making and conflict resolution procedures, addressing confidentiality-related aspects. The consortium agreement also addresses the rules regarding knowledge generated during the course of the project (Results) and confidentially related issues; the results to be disseminated or exploited based on the analysis of end-user requirements and potential market. Nevertheless, the PUDR (Plan for Use and Dissemination of the Project Results) will govern these issues addressing both Strategy and Implementation of IPR and, in a broader eagle-eye view the Knowledge Management.

All the deliverables related to WP1 were prepared on time and revised by the assigned internal peer-reviewers, according to the described quality assurance plan. The list of the deliverables prepared under WP1 during the first 18 months of DEFEAT is summarized in the section below. The remaining deliverables of WP1 for the second half of the project are:

D1.5: Final Report. (M36)

D1.6: Minutes of Meetings. (M24, M30, M36)

Deliverables

List and describe the Deliverables of this WP for the reporting period.

D1.1: Consortium Agreement. **(M1)**

D1.2: Project Management Plan: A plan that will contain the different tools for the management as well as who will be involved in the steering committee and general assembly. **(M2)**

D1.3: Risk and Mitigation Plan: A plan that includes possible risks that may occur during the project and possible mitigation measures that can be applied in each case. **(M3)**

D1.4: 18 Month Report: Midterm report with the progress of the project. **(M18)**

D1.6: Minutes of Meetings. **(M1, M6, M12, M18)**

Work Package Number:	2	Start Month:	1	End Month:	36
Work Package Title	Dissemination Activities, Exploitation & Innovation Management				
Work Package Leader	Stratagem				
Partner Role	HO	PA1	PA2	PA3	PA4
Person Months	3	3	3	2	3
Partner Role	PA5	PA6	PA7	PA8	
Person Months	7	3	0.5	0.5	

Work Package Objectives as described in Annex I of the Contract.

Briefly describe the objectives of the WP and the work carried out during the reporting period towards the achievement of each listed objective.

WP2 targets to define strategies for the exploitation and the dissemination of the DEFEAT project results. Exploitation objectives include: (a) the constant and up-to-date awareness about the project, products and concepts similar to the ones developed in the project; (b) the creation of market opportunities; (c) the elaboration of a market strategy for the industrial exploitation of the system and its verification, within 24 months from the project ending. Dissemination activities and communication measures aim at a wide promotion of the project results across Cyprus, the EU and worldwide.

Work Description and Expected Key Results

Describe the activities regarding the dissemination of research results (e.g. Publications, Scientific Information Days, Conference Presentations etc.). Where possible, provide quantitative information on activities and results.

Where appropriate, give details of the work carried out per task by each beneficiary involved, indicating the lead partner.

Describe any problems encountered and how they were resolved. Include explanations for tasks not fully implemented, critical objectives not fully achieved and/or not being on schedule.

WP2 is leaded by PA5, i.e. Stratagem Energy, with the support and the active involvement of all the consortium partners. Mr. Thomas Parisis and Ms. Stavroula Panagiotidou have the overall responsibility for the smooth implementation of all the dissemination, communication and exploitation activities, along with the management of the project's innovation and knowledge output. Towards this important and crucial objective, Stratagem is supported by the project coordinator, the DEFEAT project's committees, the HO's administrative mechanisms, the WP and the Tasks' leaders and all the other consortium partners.

Within the frame of WP2 the research team was aiming to implement the requirements and obligations arising under each one of the four following Tasks:

- Task 2.1: Exploitation of the project results
- Task 2.2: Dissemination and communication of the project results
- Task 2.3. Innovation management
- Task 2.4. Knowledge management

An overall review of the activities implemented in the frame of WP2 during the first half of the project

will be summarised below.

Several meetings have been organised even before and after the official beginning of the project, in an effort to organise the activities of WP2. The leaders of WP2 had regular meetings with the Project Coordinator to be updated regarding the overall project progress. In parallel, Stratagem worked closely with all project partners towards the preparation of the WP2 deliverables. Specifically, during the course of the project, the research group prepared the following documents:

- "DEFEAT Dissemination and Communication Activities Planning": An excel document describing all the completed and/or planned activities related to the dissemination and communication of the results. The document was filled by all the members of the consortium and was subsequently merged in one single file. The filled "DEFEAT Dissemination and Communication Activities Planning" file was used for the preparation of "D2.1: Initial Dissemination Plan (Strategy)".
- "DEFEAT WPXX Data Set": A document describing the data expected to be obtained from the implementation of each separate WP. The document was filled by the corresponding leader of each WP and/or Task. The filled "DEFEAT WPXX Data Sets" were used for the preparation of "D2.5: Data Management Plan".
- "DEFEAT Contact List": A document including the names and contact details of stakeholders and other beneficiaries with potential interest in the project results. The filled "DEFEAT Contact List" was used for the widest possible dissemination and communication of the project results.
- "DEFEAT Project Team Directory": A document including the names and contact details of all the members of the research team. The filled "DEFEAT Project Team Directory" was used for the best possible communication amongst the consortium members.

The DEFEAT website was launched during the first 3 months of the project. The aim of the website page is to increase the visibility of the project to a range of stakeholders and also to the wider public and provide them with a reference point for receiving updates during the project activity period and beyond. The website page is also developed to decrease the amount of paper used during the dissemination process. It provides information on the reasons for undertaking the project, its objectives, background on the technology the project intends to utilize, the work conducted and the expected outcomes. There will be a continuous update of the website during and after the runtime of the project. The web address (http://defeat.frederick.ac.cy/) was advertised and it is expected to be of interest to potential end-users.

A considerable number of non-scientific articles prepared and published during the first 18 months, aiming to provide updates on DEFEAT project to the scientific community, the stakeholders and the wider public. Specifically, the following articles were prepared:

- 2 Newsletters
- 1 Leaflet
- 7 Press Releases
- 1 Article in Philelefteros Newspaper
- 1 Interview of the Project Coordinator in Cyprus Mail Newspaper

The aforementioned articles can be found in the project's website.

Furthermore, social media accounts for DEFEAT were developed aiming to contribute to the

establishment and maintenance of public engagement with the project. LinkedIn, Twitter, Facebook and YouTube accounts have been developed to approach a broader audience, to open/join discussions in geopolymerisation technology, etc., and to further promote the results of the project. The social media accounts are available for access through the project's website and vice versa. The links for the social media accounts are provided below:

- Twitter: https://twitter.com/DEFEAT85269725
- LinkedIn: https://www.linkedin.com/company/67711893
- Facebook: https://www.facebook.com/DEFEAT-105407267904655
- YouTube: https://www.youtube.com/channel/UCwmVxkiHDbq4ZBWx1Uevh0g?guided_help_flow=5

A project video describing the concept and objectives of DEFEAT project was also developed in order to be disseminated to a broader audience. The video is featured on the project's website, social media and YouTube channel.

During the reporting period, one journal article was published in a high-profile peer-reviewed journal. The reference for the published article is provided below:

- Luhar, S., Nicolaides, D. and Luhar, I. Fire resistance behaviour of geopolymer concrete: An overview. Buildings, 11, 82, 2021.

The research team was planning to participate in the 2nd International Conference on Circularity in the Built Environment that was organized by Delft University. The full paper entitled "Optimization of mix formulation and strength evaluation comparison of casted and 3D printed geopolymer specimens" was submitted and accepted for oral presentation. However, due to the uncertainties regarding the spread of Covid-19 and the recurring measures set by governments to reduce the infection rate and the disease's spread the organisers decided to postpone the conference from November 24-26, 2021 to July 13-15 2022.

Abstracts related to the DEFEAT research were sent to the following conferences that will be organised within 2022:

- fib International Congress. Oslo 12-16 June 2022
- 6th International Conference on Concrete Repair, Rehabilitation and Retrofitting. Cape Town, 03-05 October 2022
- Concrete Solutions 8th International Conference on Concrete Repair, Durability and Technology. Leeds, United Kingdom, 11-13 July 2022
- 3rd RILEM International Conference on Digital Fabrication with Concrete. Loughborough, United Kingdom, 27-29 June 2022

The majority of the DEFEAT project's publications are expected to be produced during the project's second half.

Members of the consortium participated in the following wide public events, presenting the idea and objectives of DEFEAT and its impact on citizens' daily lives:

- European Researchers' Night, 27 November 2020
- European Researchers' Night, 24 September 2021
- Information event in the frame of the "European Week for Waste Reduction", 23 November 2021
- 3rd Cyprus Conference for the Design and Construction of Structures, 11 November 2021

The research team organized the following workshops:

- Exploitation and IP Management Workshop: Stratagem Energy organized 4 sessions during October 2021 aiming to provide the essential fundamental knowledge regarding the innovation management and how to prepare the exploitation, dissemination and communication strategy of the project's results.
- Stakeholders' Workshop to finalize contents and format of drafted questionnaires: Frederick Research Center organized a workshop in the frame of WP10, aiming to establish contact with stakeholders, introduce the draft survey tool (questionnaire) to the stakeholders, invite the stakeholders' opinions/input and discuss on the questionnaire development. The workshop was organized on May 19, 2021.

Last, the DEFEAT project sought to establish links with other research consortia, aiming to organise joint events in the future. The following relevant research projects were identified:

- "BAM: Blast and Fire-Resistant Material", 2022-2024
- "RAPCON: Recycled Aggregates for the Production of Concrete", 2019-2022
- "DIAVAL: Valorization of Diabase Mud for the Development of Innovative Building Materials", 2019-2022
- "Invalor101: A network for joint valorization of material flows in tourist areas", 2017-2022
- "3D Printed Houses", 2019-2023

All the deliverables related to WP2 were prepared on time and revised by the assigned internal peer-reviewer, according to the described quality assurance plan. The list of the deliverables prepared under WP2 during the reporting period is summarized below. The remaining deliverables of WP2 for the second half of the project are listed below:

D2.3: Final Plan for Use and Dissemination of the Results (PUDR). (M36)

D2.5: Final Data Management Plan. (M36)

D2.6: Scientific Information Day. (M34)

Deliverables

List and describe the Deliverables of this WP for the reporting period.
Provide information regarding the publications submitted to open access journals and deposited in relevant repositories.

D2.1: Initial Dissemination Plan (Strategy): An initial document giving the strategy and the means which will be developed and followed in order to disseminate DEFEAT within Cyprus, across the EU and globally. **(M6)**

D2.2: 1st Interim Plan for Use and Dissemination of the Results (PUDR): An intermediate Plan for Use and Dissemination of the Results (PUDR) covering issues like the management of knowledge and intellectual

property, an exploitation and dissemination plan both during the 1st year of the project and afterwards and information relating to all press releases, publications, Social Media profiles and any other communication activities. **(M18)**

D2.4: Project Website: A project website will be developed and also continuously updated with project progress information. "No personnel or other costs will be charged to the project". **(M3)**

D2.5: Data Management Plan: The plan will describe ways to manage all research data and metadata, during and after the project duration. A DMP will be developed in month 6 including the strategy which will be followed and a Final DMP will be developed in month 36 including all data. **(M6)**

Work Package Number:	3	Start Month:	01	End Month:	26
Work Package Title	Construction and Demolition Waste Separation				
Work Package Leader	FRC / Netiatis				
Partner Role	HO	PA1	PA2	PA3	PA4
Person Months	9	9	1	16	1
Partner Role	PA5	PA6	PA7	PA8	
Person Months	-	-	1	-	

Work Package Objectives as described in Annex I of the Contract.

Briefly describe the objectives of the WP and the work carried out during the reporting period towards the achievement of each listed objective.

WP3 targets to the optimization of the separation of the CDW aiming to the production of "clean" wastes through the image processing technology and the production of recycled concrete aggregates.

Work Description and Expected Key Results

Describe the activities implemented in the frame of this specific WP. Where possible, provide quantitative information on activities and results.

Where appropriate, give details of the work carried out per task by each beneficiary involved, indicating the lead partner (including Foreign Research Organisations).

Describe any problems encountered and how they were resolved. Include explanations for tasks not fully implemented, critical objectives not fully achieved and/or not being on schedule.

WP3 is aiming to apply a novel method for the optimization of the separation of the CDW in order to receive "clean" materials after the CDW collection. On this purpose the technology of image processing will be applied to optimize the separation process. Image processing is a method to convert an image into digital form and perform some operations on it in order to get an enhanced image or to extract useful information. The image processing is going to be performed with Machine Learning techniques (such as Neural Networks), which will be trained on a set of images that will be annotated with the waste type in which they belong. The result will be a model that will be able to classify a given waste image to the type it belongs. By applying the abovementioned technology on the CDW separation the following benefits arise: a) reduction of the potential risks, b) provision of homogeneous raw material, c) achievement of lower energy consumption and d) delivery of clean raw materials (concrete, ceramic, metal, plastic, wood) which can then be recycled. The method aims to improve the current separation method applied by the industrial partner PA3 of the project, based on manual sorting of CDW, thus opening the route to drive in more applications and technologies for the waste management, since the products from the separation will be easily then recycled due to the absence of impurities in each raw material.

In the frame of Task 3.1. the HO in collaboration with PA3 prepared Deliverable 3.1, namely "Report on the data characteristics of each stream derived from the CDW". This deliverable describes the procedure being currently employed for waste separation at PA3 premises, provides an analysis of the different incoming waste types and gives an overview of the automatic separation procedure that will be

developed, detailing the process that will be followed for the development of the machine learning system that will classify material into waste types. The deliverable was successfully submitted with small delay due to the applied lockdown in Cyprus at that time.

Task 3.2. was the one mostly affected by the ongoing Covid-19 pandemic. Specifically, the following important problems were encountered:

- Difficulty in communication with potential suppliers of the robotic separation system equipment. The identified companies were located in Italy and United Kingdom, which both countries were enforced on extended lockdowns, due to the severity of the pandemic situation.
- Considerable delays on the preparation and delivery of the robotic separation system equipment by the contractor. Due to the specialised nature of the equipment, its several components (i.e. 3D camera, robotic arms and conveyor) were manufactured by different companies around the world and then sent to the UK contractor for the final check and delivery to the consortium. This had as a result the delayed arrival of the equipment and therefore the unavoidable delay on the assembling of the system by the consortium.
- It is estimated that the overall delay in the progress of Task 3.2 due to the abovementioned problems exceeds the 12 months.

The project coordinator was in constant communication (oral and written) with the funding agency regarding this issue. Eventually, the project's steering committee decided the request of an extension regarding the submission deadlines of all the deliverables (i.e. D3.2-D3.8) related to the usage of the robotic separation system and that were affected by the extensive delay. The request was approved by the funding agency. In parallel, the steering committee in close collaboration with the WP3 leader proceeded in reallocation of the consortium's human resources, in an effort to achieve the submission of the related deliverables by the approved new deadlines. Furthermore, the steering committee in close collaboration with all the WP leaders discussed and identified ways to minimise and/or eliminate the impact of WP3 delays on the progress of the rest of the project's WPs. The progress of WP3 is closely monitored by the project's management authorities.

The research team has now completed the assembling of the system (Figure 3.1) and is working on the programming of the cameras and the robots towards the separation of the CDW.

Figure 3.1: Installed robotic system for CDW separation.

Finally, despite the fact that based on the approved extension for submission of deliverable D3.3 the research team managed to complete Task 3.3: Separated Concrete Rubbles Treatment and Reuse well ahead of time. The task was aiming to maximize the benefit from the separation and recycling process, by collecting, treating for the partial removal of the adhered mortar and using concrete rubbles for the production of concrete. The recycled concrete aggregates (RCA) were added in a modified concrete truck mixer for various time intervals. During this process, water was added in order to remove and wash out smaller particles, dust and the weaker adhering mortar (Figure 3.2). This method, which resembles a prolonged Los Angeles test, decreased significantly the adhered mortar and discarded the weaker or fractured aggregates, keeping only the stronger and sounder ones.

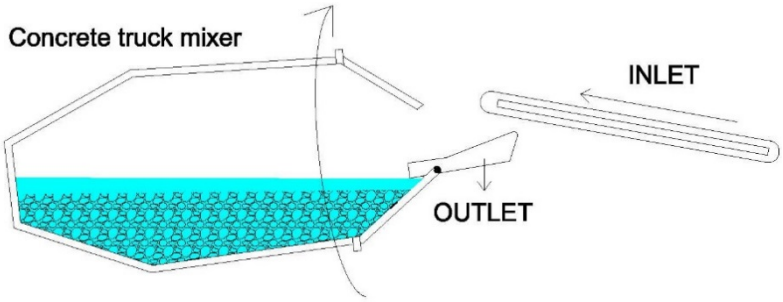


Figure 3.2: Modified concrete mixer for RCA treatment.

Deliverables

List and describe the Deliverables of this WP for the reporting period.

D3.1: Report on the data characteristics of each stream derived from the CDW. A report that will include all the crucial data for each waste steam of the CDW. **(M8)**

D3.3: Recycled concrete aggregates. **(M20)**

Work Package Number:	4	Start Month:	3	End Month:	8
Work Package Title	Raw Materials Characterization				
Work Package Leader	UCY				
Partner Role	HO	PA1	PA2	PA3	PA4
Person Months	5	11	2	1	2
Partner Role	PA5	PA6	PA7	PA8	
Person Months	-	-	1	-	

Work Package Objectives as described in Annex I of the Contract.

Briefly describe the objectives of the WP and the work carried out during the reporting period towards the achievement of each listed objective.

WP4 targets to the 'in-lab' full characterization of the waste concrete and ceramics derived from the CDW separation. The characterization will be carried out in 5 different batches of the received waste, in order to cover a range of the existed elements.

Work Description and Expected Key Results

Describe the activities implemented in the frame of this specific WP. Where possible, provide quantitative information on activities and results.

Where appropriate, give details of the work carried out per task by each beneficiary involved, indicating the lead partner (including Foreign Research Organisations).

Describe any problems encountered and how they were resolved. Include explanations for tasks not fully implemented, critical objectives not fully achieved and/or not being on schedule.

PA1 leaded the overall tasks included in WP4 and ensured a robust output of the deliverables. Two technical reports have been prepared, namely a full characterization report (D4.1) and a CDW material data sheet (D4.2).

Report D4.1 includes results from a set of analytical techniques, namely:

- X-Ray Diffraction (XRD);
- X-Ray Fluorescence (XRF);
- Particle Size Analysis;
- Density Measurements;
- Dissolution Tests.

on thirteen samples of each of the following three as-received CDW materials (Figure 4.1):

- Brick (waste ceramic);
- Tiles (waste ceramic);
- Concrete (waste concrete).

Figure 4.1: The raw materials as received from CDW (from left to right: waste bricks, tiles and concrete).

Report D4.1 provides a comprehensive understanding of the physio-chemical and mineralogical properties of the examined materials, based on parameters and variables (such as source) which were not ascertained. The characterization of the above, as received materials, involved both qualitative and quantitative approaches when analyzing the samples. Both approaches are essential for full and accurate output of results and for a valid discussion on the values obtained. Each analytical technique is presented in the report along with the relevant background, the sample preparation procedure and the output results.

Along with the report (D4.1), a data sheet (D4.2) has been also prepared in line with the outputs and deliverables of WP4.

WP4 was completed with small delay, due to the following reasons:

- The enforced measures applied in Cyprus at that period, aiming to reduce the Covid-19 spread.
- Technical problems of PA1 (i.e. University of Cyprus) equipment that was necessary for the characterization of the raw materials. For that reason, a budget modification was requested and approved by the RIF. Details regarding the budget revision are given in Section B.1.

Deliverables

List and describe the Deliverables of this WP for the reporting period.

D4.1: Full characterization of the separated waste concrete and ceramics. **(M7)**

D4.2: Data sheet with the results on the characterization of the waste streams. **(M8)**

Work Package Number:	5	Start Month:	5	End Month:	24
Work Package Title	Design and Development of the Composite Material				
Work Package Leader	RECS / FRC				
Partner Role	HO	PA1	PA2	PA3	PA4
Person Months	9	8	2	1	10
Partner Role	PA5	PA6	PA7	PA8	
Person Months	-	-	3		

Work Package Objectives as described in Annex I of the Contract.

Briefly describe the objectives of the WP and the work carried out during the reporting period towards the achievement of each listed objective.

WP5 targets to the development of a prototype that combines the fire resistance and the insulation coming from the CDW.

Work Description and Expected Key Results

Describe the activities implemented in the frame of this specific WP. Where possible, provide quantitative information on activities and results.

Where appropriate, give details of the work carried out per task by each beneficiary involved, indicating the lead partner (including Foreign Research Organisations).

Describe any problems encountered and how they were resolved. Include explanations for tasks not fully implemented, critical objectives not fully achieved and/or not being on schedule.

WP5 is dedicated on the design and development of the DEFEAT thermal and fire insulation composite material. The implementation of WP5 was also affected from the Covid-19 pandemic, due to:

- Several disruptions on the progress of the experimental work, either due to the enforced lockdowns by the Cyprus Government for a considerable period of time, or due to limited access to the laboratories due to internal measures taken by FRC and RECS authorities, or due to positive Covid-19 cases amongst the members of the research team.
- Limited or delayed supply of specialized consumables from local or international suppliers.
- Increased prices of consumables and other project related expenses due to transportation issues and/or limited availability.
- Cancellation of international conferences in which the research team was planning to present parts of the DEFEAT project's obtained results (e.g. 2nd International Conference on Circularity in the Built Environment, CiBEn).
- Cancellation of scheduled visits in the premises of the Foreign Research Organisation, i.e. the Katholieke Universiteit Leuven for the needs of the project.

FRC (HO) and RECS (PA4) and all the other involved consortium partners (i.e. PA1, PA2, PA3, PA7) have a very efficient collaboration towards the implementation of the tasks assigned under WP5. Despite the fact that WP5 will be officially completed in month 24 of the project (i.e. end of June 2022), the properties of the developed material (by the time of submission of this interim report) are very good,

thus nearly meeting the targeted values. The research team is confident that by the completion time of WP5 all the scientific and technical objectives will be successfully implemented.

Deliverable D5.1 describes in detail all the theoretical and experimental work conducted towards the development of the 2 individual materials, i.e. the thermal insulation and the fire-resistant ones, which eventually will be combined for the production of the final DEFEAT composite. The report includes a large number of figures (38), tables (16) and references (134), in an effort to provide a detailed analysis of the work progress and the obtained results. Specifically, D5.1 presents the following:

- Relevant Literature Review
- Raw Materials Characterization and Experimental Methods (Figure 5.1)
- New Materials' Mix Designs
- Experimental Results – Evaluation and Discussion (Figure 5.2)

Figure 5.1: Milled raw materials for preparation of DEFEAT composite.

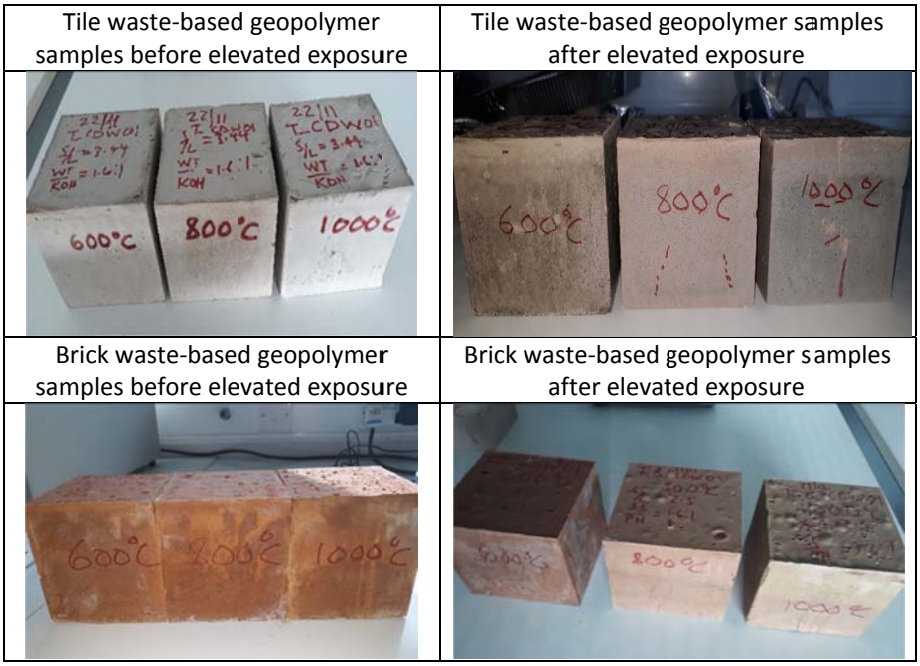


Figure 5.2: Visual appearance of geopolymer samples before and after temperature exposure.

Deliverable 5.1. also includes part of the work conducted by the The Katholieke Universiteit Leuven (KUL), i.e. the Foreign Organisation of the consortium, in the frame of DEFEAT project. KUL, with great expertise on the development of fire resistant geopolymeric materials, conducted a parallel experimental program to the Cyprus consortium, aiming to provide additional necessary information and/or to validate and confirm experimental results. Part of the work conducted by KUL (i.e. the part relevant to Deliverable D5.1) by the time of submission of the project's interim report is provided as Appendix in Deliverable D5.1. The work by KUL will be extended in several other aspects of the DEFEAT project.

The research consortium early prepared a review paper entitled "Fire Resistance Behaviour of Geopolymer Concrete: An Overview", that was published in an open access Scopus cited journal, in February 2021. The preparation of the particular paper was aiming to:

- Update the research group with the latest and the most important publications in the field of fire resistant geopolymer materials.
- Serve as future reference for similar research papers and projects, thus enhancing the visibility of the DEFEAT work.
- Satisfy the project requirement towards the preparation of deliverable D5.2.

Despite the fact that the contractual obligation for WP5 refers to the publication of 2 journal papers (i.e. in months 17 and 24), the consortium aims on the preparation of 3 in total journal manuscripts. The 2nd manuscript is already completed (draft version can be provided upon request) and is expected to be submitted in MDPI Materials Journal (IF: 3.623) for evaluation in February 2022, whereas the 3rd paper is planned to be submitted according to the project's timeframe (i.e. in month 24).

As it has been aforementioned, the research team was planning to participate in the 2nd International Conference on Circularity in the Built Environment that was organized by Delft University, Netherlands. The full paper entitled "Optimization of mix formulation and strength evaluation comparison of casted and 3D printed geopolymer specimens" was submitted and accepted for oral presentation, in partial fulfilment of the obligations deriving from deliverable D5.4 of the project. However, due to the uncertainties regarding the spread of Covid-19 and the recurring measures set by governments to reduce the infection rate and the disease's spread the organizers decided to postpone the conference from November 24-26, 2021 to July 13-15 2022. It is the aim of the consortium to participate in the particular conference and present part of the project's results.

Deliverables

List and describe the Deliverables of this WP for the reporting period.

D5.1: Report on the fire and insulation design. **(M16)**

D5.2: Publication in open access journal. **(M17)**

D5.4: Presentation in conference. **(M18)** (Proof of submission and acceptance of paper in CiBEn conference will be submitted as deliverable - No personnel, travelling or other specific costs were charged to the project for D5.4).

Work Package Number:	6	Start Month:	11	End Month:	25
Work Package Title	Material and Properties Engineering				
Work Package Leader	RECS				
Partner Role	HO	PA1	PA2	PA3	PA4
Person Months	7.5	9	2	0.5	5
Partner Role	PA5	PA6	PA7	PA8	
Person Months	-	-	2	-	

Work Package Objectives as described in Annex I of the Contract.

Briefly describe the objectives of the WP and the work carried out during the reporting period towards the achievement of each listed objective.

WP6 targets to: a) the engineering of the properties for the material production, and b) full characterization of the developed material in terms of physical, mechanical and thermal properties.

Work Description and Expected Key Results

Describe the activities implemented in the frame of this specific WP. Where possible, provide quantitative information on activities and results.

Where appropriate, give details of the work carried out per task by each beneficiary involved, indicating the lead partner (including Foreign Research Organisations).

Describe any problems encountered and how they were resolved. Include explanations for tasks not fully implemented, critical objectives not fully achieved and/or not being on schedule.

WP6 consists of 2 important and distinct tasks, namely:

- Task 6.1: Design of Properties of the Geopolymeric Materials
- Task 6.2: Characterization and Properties Measurement

In order to support the planned work, the DEFEAT team has done a thorough research on state-of-the-art 3D printing machines for cement-based materials currently available on market. A number of companies and research institutions were contacted for the purchase and installation of a 3D Printing machine suitable for the requirements and the planned activities within DEFEAT. After evaluating the situation, the project team decided for the purchase of a DELTA WASP 3MT 4.0 LMD 3D Printing machine with manual extruder, including 3D printing and modelling software (Figure 6.1). The equipment was installed successfully in March 2021, despite restrictions and difficulties due to the pandemic.

Figure 6.1: DELTA WASP 3MT 4.0 LMD 3D printing machine.

The DEFEAT team has performed successful trial runs on the 3D printing equipment (Figure 6.2) and is currently performing a parameter study for selecting appropriate process parameters on the machine (i.e. feeding speed and deposition rate, layer height and deposition patterns – Figure 6.3) in conjunction with the composite materials composition, so as to reach initially satisfying mechanical properties. This preparatory work for the Task 6.1 will be enhanced accordingly with the purpose to create a selective porosity during the material deposition with minimum required mechanical strength, in order to increase thermal insulation of the 3D created specimens. As a concluding result, boards of industrial related dimensions will be 3D printed in the context of Task 7.2 (WP7) for demonstrating the rendered results on the recyclability and reusability of construction and demolition waste.

Figure 6.2: Initial 3D printing trials with the new equipment at Frederick Research Center (FRC) laboratories on two different materials: cement based (left) and brick based (right).

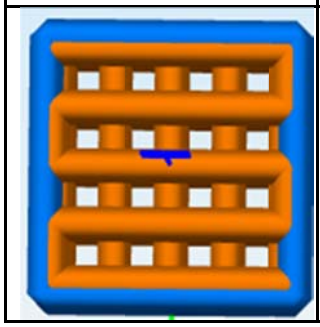
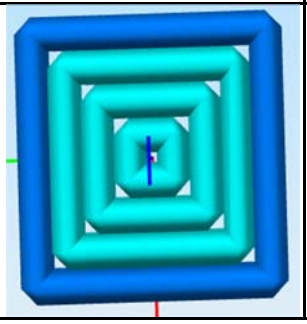
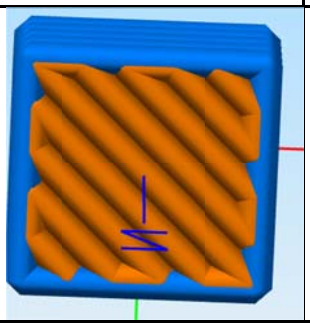
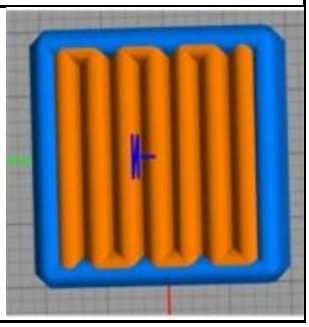
Pattern 1	Pattern 2	Pattern 3	Pattern 4
			

Figure 6.3: Pattern variation for selected 3D printing process parameters.

Task 6.2 dedicated on the characterization and properties measurement of the developed materials, is still at a very preliminary stage.

Despite the fact that the official deadlines for the submission of deliverables related to WP6 are scheduled at a later stage, the consortium has already drafted the following:

D6.1: Preliminary report on the material engineering of the production method.

D6.4: Draft paper for publication in open access journal.

Draft version of both D6.1 and D6.4 can be provided upon request.

Deliverables

List and describe the Deliverables of this WP for the reporting period.

Deliverables of WP6 are scheduled to be prepared and submitted at a subsequent stage of the project (i.e. Months 22-25).

Work Package Number:	7	Start Month:	18	End Month:	30
Work Package Title	Production and Pilot Application of the Material				
Work Package Leader	Latomia Pharmakas				
Partner Role	HO	PA1	PA2	PA3	PA4
Person Months	7	6	9	-	6
Partner Role	PA5	PA6	PA7	PA8	PA9
Person Months	-	-	1	-	

Work Package Objectives as described in Annex I of the Contract.

Briefly describe the objectives of the WP and the work carried out during the reporting period towards the achievement of each listed objective.

WP7 targets to the production and application of the materials in pilot scale.

Work Description and Expected Key Results

Describe the activities implemented in the frame of this specific WP. Where possible, provide quantitative information on activities and results.

Where appropriate, give details of the work carried out per task by each beneficiary involved, indicating the lead partner (including Foreign Research Organisations).

Describe any problems encountered and how they were resolved. Include explanations for tasks not fully implemented, critical objectives not fully achieved and/or not being on schedule.

WP7 has not started by the time of submission of this interim report.

Deliverables

List and describe the Deliverables of this WP for the reporting period.

Deliverables of WP7 are scheduled to be prepared and submitted at a subsequent stage of the project (i.e. Months 24-32).

Work Package Number:	8	Start Month:	20	End Month:	32
Work Package Title	Technoeconomic Evaluation, LCA Analysis and Business Model				
Work Package Leader	RECS				
Partner Role	HO	PA1	PA2	PA3	PA4
Person Months	2,5	6	5	2	12
Partner Role	PA5	PA6	PA7	PA8	PA9
Person Months	2	-	-	-	

Work Package Objectives as described in Annex I of the Contract.

Briefly describe the objectives of the WP and the work carried out during the reporting period towards the achievement of each listed objective.

WP8 targets to the technoeconomic evaluation of the material, the LCA analysis and the business model that will make the proper commercialization. Also, WP8 will undertake the activities of the patent submission.

Work Description and Expected Key Results

Describe the activities implemented in the frame of this specific WP. Where possible, provide quantitative information on activities and results.

Where appropriate, give details of the work carried out per task by each beneficiary involved, indicating the lead partner (including Foreign Research Organisations).

Describe any problems encountered and how they were resolved. Include explanations for tasks not fully implemented, critical objectives not fully achieved and/or not being on schedule.

WP8 has not started by the time of submission of this interim report.

Deliverables

List and describe the Deliverables of this WP for the reporting period.

Deliverables of WP8 are scheduled to be prepared and submitted at a subsequent stage of the project (i.e. Months 28-34).

Work Package Number:	9	Start Month:	24	End Month:	36
Work Package Title	Activities for the Commercialization of the Material				
Work Package Leader	Latomia Pharmakas				
Partner Role	HO	PA1	PA2	PA3	PA4
Person Months	2	6	9	1	3
Partner Role	PA5	PA6	PA7	PA8	
Person Months	2	1,5	-	-	

Work Package Objectives as described in Annex I of the Contract.

Briefly describe the objectives of the WP and the work carried out during the reporting period towards the achievement of each listed objective.

WP9 aims at: (i) the activities for better and faster commercialization of the composite material, including patenting and accreditation, and (ii) design of an industrial manufacturing plant.

Work Description and Expected Key Results

Describe the activities implemented in the frame of this specific WP. Where possible, provide quantitative information on activities and results.

Where appropriate, give details of the work carried out per task by each beneficiary involved, indicating the lead partner (including Foreign Research Organisations).

Describe any problems encountered and how they were resolved. Include explanations for tasks not fully implemented, critical objectives not fully achieved and/or not being on schedule.

WP9 has not started by the time of submission of this interim report.

Deliverables

List and describe the Deliverables of this WP for the reporting period.

Deliverables of WP9 are scheduled to be prepared and submitted at a subsequent stage of the project (i.e. Month 36).

Work Package Number:	10	Start Month:	01	End Month:	36
Work Package Title	Development of Guidelines for a Strategic Action Plan for Recycled CDW Reuse				
Work Package Leader	FRC				
Partner Role	HO	PA1	PA2	PA3	PA4
Person Months	6	5,5	5	0,5	4
Partner Role	PA5	PA6	PA7	PA8	
Person Months	-	4	2	2	

Work Package Objectives as described in Annex I of the Contract.

Briefly describe the objectives of the WP and the work carried out during the reporting period towards the achievement of each listed objective.

WP10 seeks to identify and report possible mechanisms that can assist in the successful implementation of a recycled CDW reuse scheme in Cyprus.

Work Description and Expected Key Results

Describe the activities implemented in the frame of this specific WP. Where possible, provide quantitative information on activities and results.

Where appropriate, give details of the work carried out per task by each beneficiary involved, indicating the lead partner (including Foreign Research Organisations).

Describe any problems encountered and how they were resolved. Include explanations for tasks not fully implemented, critical objectives not fully achieved and/or not being on schedule.

WP10 is progressing according to the original timeframe of the project. By the time of submission of this interim report the following tasks have been fully or partially accomplished:

Task 10.1: A thorough review of the national, the European, and the international literature. This is a continuous and ongoing process from the beginning of the project.

Task 10.2: Development and implementation of a targeted opinions and perceptions survey to be conducted among main stakeholder groups in the CDW field. The completion of this task dictates the following sub-tasks:

Subtask 10.2.1: Development of Survey Questionnaire

Questionnaires were prepared to solicit the opinions / perceptions of important stakeholders of a CDW reuse program. Affected individuals included CDW contractors, construction companies, waste management experts, private organizations and agencies, as well as related governmental entities. The demographic characteristics of the sampled population, their education and income levels, as well as the social status of these individuals were considered. The character and content of the questionnaire for each target group category was modified according to the characteristics of the group investigated. The

questionnaires were divided into different sections; general information, social, economy, feasibility, environment, political, technical, awareness and participation, CDW recycling and reuse. The questions were mainly structured so that the resulting analysis generally follow standard statistical approaches.

A stakeholders' workshop (i.e. D10.1) was conducted online on May 19, 2021, aiming to discuss and finalize the contents and format of the drafted questionnaires. The research group recorded the comments and recommendations of the 22 participants, and then modified accordingly the original version of the questionnaire. The revised version was sent again to the workshop's participants for their final comments and approval on June 29, 2021.

Figure 10.1: Stakeholders' workshop participants.

Subtask 10.2.2: Collection of Survey Data

The questionnaires prepared in Task 10.2.1 were distributed to almost 500 people in Cyprus in Fall 2021. Eventually, 186 questionnaires were sent back duly completed. The final number of 187 samples exceeded the original target of 100 questionnaires mentioned in the approved proposal. The sampling procedure took the form of representative stratified sampling and it covered the most important stakeholders of a CDW recycling and reuse program. Sampling was done both via mailing of questionnaires (accompanied by pertinent instructions and mail-return material), as well as via arranged meetings with various groups. These meetings also served as events during which dissemination of the work undertaken took place.

Subtask 10.2.3: Statistical Analysis of Collected Data

Microsoft Excel is used for data entry and management and statistical analysis of the quantitative data. Exploration of the data mainly includes 3 distinct types of analysis, namely (a) a descriptive analysis, (b) exploration of associations and (c) inter-relationship of factors and identification of common concepts. The general description of the main dataset of responses involves calculation and presentation of frequencies either in tabular or diagrammatic form in a series of histograms and/or pie charts of the percentage of participants that agree or disagree with certain aspects, concepts and risks regarding CDW recycling and reuse. Despite the fact that the official deadline for the submission of deliverable D10.3 is scheduled at a later stage (i.e. month 19), the consortium has already prepared and submitting the following:

D10.3: A report with a series of statistical tables and figures that summarize the findings from the analysis of the data.

Subtask 10.2.3 also aims at the following:

- Development of an Action Plan that will be produced especially for, and made available to, pertinent CDW management-related authorities and entities of the Government of the Republic of Cyprus, or other public organizations. Through this report, the consortium will suggest possible ways that the results of this study can help to change current practices regarding CDW reuse in Cyprus. (Deliverable D10.4, Deadline Month 27)
- Preparation of an Executive Report detailing the best implementation mechanisms, identified, that can be utilized for successful CDW reuse implementation schemes in Cyprus. (Deliverable D10.5, Deadline Month 36)
- Participation in conference. (Deliverable D10.6, Deadline Month 36)

Deliverables D10.4, D10.5 and D10.6 are scheduled to be prepared and submitted at a subsequent stage of the project.

Deliverables

List and describe the Deliverables of this WP for the reporting period.

D10.1: A Stakeholders' Workshop. This workshop finalized the contents and format of the drafted questionnaires. **(M8)**

D10.2: Survey Questionnaires. **(M14)**

D10.3: Report with Statistical Tables and Figures that summarize the findings from the analysis of questionnaires. **(M19)**

A.4. TABLE OF WORK PACKAGES

		Contract		Actual Implementation	
Work Package	Work Package Title	Start Month	End Month	Start Month	End Month
WP1	Project Management	1	36	1	36
WP2	Dissemination Activities, Exploitation & Innovation Management	1	36	1	36
WP3	Construction and Demolition Waste Separation	1	16	1	26
WP4	Raw Materials Characterization	3	8	3	8
WP5	Design and Development of the Composite Material	5	24	5	24
WP6	Material and Properties Engineering	11	25	11	25
WP7	Production and Pilot Application of the Material	18	30	18	30
WP8	Technoeconomic Evaluation, LCA Analysis and Business Model	20	32	20	32
WP9	Activities for the Commercialization of the Material	24	36	24	36
WP10	Development of Guidelines for a Strategic Action Plan for Recycled CDW Reuse	1	36	1	36

B.1. ADDITIONAL INFORMATION (OPTIONAL)

Provide, where deemed necessary, any additional information regarding the Project.

Include explanations on deviations of the use of resources between actual and planned use of resources based on the project contract (if applicable).

Include explanations on transfer of costs between categories (if applicable).

During the first reporting period the consortium proceeded in the request of two project amendments, as following:

- 29-01-2021: Major project activity change related to the postpone of the submission deadlines of all the deliverables (i.e. D3.2-D3.8) related to the usage of the robotic separation system and that were affected by the extensive delay described in WP3 above. The request was approved by the funding agency.

Deliverables	Approved New Deadlines
D3.1: Report on the data characteristics of each stream derived from the CDW. **(M5)** **D3.2**: Report on applying the image processing technology. **(M12)** **D3.3:** Recycled concrete aggregates. **(M12)** **D3.4**: Small scale application of the image processing on the CDW separation. **(M12)** **D3.5**: Demonstration video of the operation of the innovative separation method. **(M14)** **D3.6**: Two Publications in open access journal. **(M12/M14)** **D3.7**: Presentation in two conferences. **(M12/M14)** **D3.8**: Organization of workshop with stakeholders for exploiting the results of image processing. **(M15)**	**D3.1: (M8)** **D3.2: (M26)** **D3.3: (M20)** **D3.4: (M23)** **D3.5: (M23)** **D3.6: (M24/M26)** **D3.7: (M24/M26)** **D3.8: (M24)**

- 27-04-2021: Budget revision related to the originally allocated budget of PA1, i.e. UCY. PA1 requested the transfer of part of its budget from other categories (i.e. consumables, equipment and travelling) in the category of External Services. The request was deemed essential due to technical problems of the partner's equipment that was necessary for the characterization of the raw materials (i.e. WP4). The problems (i.e. fixing of equipment) were practically impossible to be resolved within a reasonable timeframe due to the Covid-19 pandemic and its consequences (e.g. visit of the equipment suppliers' technical staff from abroad, equipment parts unavailable in the market, etc.). Therefore, PA1 decided the assignment of part of this task to an external contractor, in order to avoid important delays in the completion of WP4. The request was approved by the funding agency.

The project's progress is unavoidably affected by the ongoing Covid-19 pandemic. The research team is putting considerable effort to prevent any further delays and complete the assigned tasks on time. Nevertheless, this was proved to be practically impossible on several occasions.

The project's coordinator will inform the funding agency for the overall project's progress and the possibility for an extension need.

Notes:

Collection and processing of personal data is carried out according to the RIF's Policy for the Protection of Personal Data. The RIF's Policy is posted on IRIS.

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