



A circular economy approach for lifecycles of products and services

Data Management Plan - #3

Deliverable10.4.

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Summary

The Horizon 2020 FAIR Data Management Plan (DMP) is designed to be applicable to any Horizon 2020 project that produces, collects or processes research data. CIRC4Life consortium has developed a single DMP for the project to cover its overall approach.

Deliverable 10.4, the CIRC4Life DMP#3, has been produced following a review of the CIRC4Life DMP#2 (D10.3). Deliverable 10.3 outlines the project's approach to the management of research data in accordance with Article 29.3 of the Grant Agreement. It details what data the project has generated, whether and how it has been exploited or made accessible for verification and re-use, and how it has been curated and preserved. Deliverable 10.4, the CIRC4Life DMP#3, therefore offers a status update as to the implementation of the plan. There are no significant revisions required to the project's research data management (RDM) strategy. At the point of writing Deliverable 10.4, there are no known changes or restrictions to data sharing as initially reported in Deliverable 10.3. Therefore, much of the plan remains unchanged. However, more information is now offered about the data that has been generated by the project under this reporting period (M19-M42).

A list of revisions is summarized as follows compared to DMP#2 (D10.3):

- Overview of the project data generated and used in this reporting period (Table 2.1; Section 2).
- The Sharing Systems for project results are clarified in Section 6.
- Overview of the ethical related practices in this reporting period (Section 7).

The present DMP is also the final version showing the final state of consortium's agreements regarding data management, exploitation and protection of rights and results.

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Acronyms and abbreviations

Abbreviation	Description
CEBM	Circular Economy Business Model
CSV	Comma-separated values
DMP	Data Management Plan
DOI	Digital Object Identifier
EC	European Commission
EEE	Electrical and Electronic Equipment
EPCIS	Electronic Product Code Information Services
EPC	Electronic Product Code
FAIR	Findable, Accessible, Interoperable and Re-usable
FNC	File Naming Convention
GDPR	General Data Protection Regulation
ICT	Information and Communications Technology
IR	Institutional Repository
IP	Intellectual Property
OIC	Open Innovation Camp
PC	Project Coordinator
RDM	Research Data Management
WP	Work Package
XML	Extensible Markup Language

1 Introduction

CIRC4Life project complies the FAIR data management concept to develop this DMP. FAIR data management requires the project data should be 'FAIR', that is findable, accessible, interoperable and re-usable. These principles precede implementation choices and do not necessarily suggest any specific technology, standard, or implementation-solution.

Deliverable 10.4 is not intended as a strict technical implementation of the FAIR principles; it is inspired by FAIR as a general concept. The following documents have been referred in order to develop the CIRC4Life DMP:

- Guidelines on FAIR Data Management in Horizon 2020 (EC, no date)
- FAIR data principles (FORCE11, no date)
- FAIR principles (Wilkinson et al., 2016)

The FAIR DMP template (EC, no date) is a set of questions that should be answered with a level of detail appropriate to the project. The DMP is intended to be a living document in which information can be made available on a finer level of granularity through updates as the implementation of the project progresses and when significant changes occur. Therefore, DMPs should have a clear version number and include a timetable for updates. As a minimum, the DMP should be updated in the context of the periodic evaluation/assessment of the project. If there are no other periodic reviews envisaged within the grant agreement, an update needs to be made in time for the final review at the latest.

2 Data Summary

The CIRC4Life project involves an ICT (Information and Communications Technology) solution using a variety of technologies, which are important to provide the means to implement and assess the effectiveness of the Circular Economy Business Model (CEBM). These technologies have driven the data generation and collection processes and help inform the testing against the proposed methodologies of using an eco-point approach, sustainable product design and production, real-time tracking and monitoring technology based on EPCIS (Electronic Product Code Information Services), information logistics sharing infrastructure across the supply chain and associated data security and privacy.

The project process tasks have included full documentation on barcode code types, and EPCIS; and with regards the latter the EPC (Electronic Product Code) Core Business Vocabulary identifiers used. The documented descriptions have also contained an explanation on why particular identifiers or models were used for all the tracking technologies used, and how they related to the intended outcomes.

Example datasets with these descriptions have been supplied in an XML as well as Microsoft Word DOCX format for the descriptions, and example tracking datasets are in CSV and Microsoft Excel XLSX format that have to be compatible with as many software applications as possible.

Subsequent research has benefited from analysing the chosen identifiers used in attempting to improve the sustainability performance model. A clear description of the identifiers used, as well as the accurate documentation and example datasets of tracking technologies used, would be critical to this type of analysis.

With regards anticipating the expected size of data to be produced, the nature of the CIRC4Life project involving a number of collaborators makes an accurate guess difficult at this early stage, but it is proposed that the data generated has to be in the order of Gigabytes (approx. 100), rather than Terabytes.

The importance of making these datasets FAIR (Findable, Accessible, Inoperable and Reusable) is recognised and planned for, but taking into account the demands of the 'living' nature of a data management plan as the project progresses, the final form of the datasets cannot yet be declared in detail, but the Project Coordinator (PC) can offer an outline of the data that has been collected.

To date, research activity has primarily focussed on intelligence gathering and project scoping. There now exists a subset of project data associated with the development of models, techniques and processes. These have been reported in the following project deliverables already submitted to the EU portal (See Table 2.1). Each of these deliverables and their associated data are contributing to the further project activities of the relevant Work Packages (WPs).

The project is also collecting data directly from consumers via online surveys and Living Labs in this reporting period. For example, consumer attitudes to reuse & recycling LED lighting products and the eco-points System have been measured using Survey Monkey, an online survey tool. A complete overview of the data collected, and an analysis of these results is reported in Deliverable 3.4 - Report on consumer satisfaction survey (M18).

Publicly available information about the project and some data are made available via the CIRC4Life Project Website, available at: <https://www.circ4life.eu/>.

The CIRC4Life SharePoint Site stores all project data for the duration of the grant (see Section 5.1). Data is grouped and organised under each WP. The following table gives a summary of the data that has been collected to date; and their relation to the WPs and corresponding deliverables. These datasets have been utilised as each WP progresses to inform the development and/or creation of future project outputs.

Table 1 Overview of CIRC4Life collected data in this reporting period (M19-M42)

Tasks/Tools/Activities related to data	Data Format	Work Package	Related deliverables in this reporting period (M19-M42)	Responsible Partner(s)
CIRC4Life Eco Account	JSON	WP6	D6.2 - On site demonstration of CEBM for tablets	NTU, ICCS
CIRC4Life Master Product Data	JSON-LD	WP4	D4.4 - Development of Escrow database, Core Brokerage component, security and access control D4.5 - Report on the development of a standardised n-step maturity level model with needed skills for CE collaboration	ENV, ICCS
CIRC4Life Live Product Data	JSON-LD	WP5	D5.3 - Report on the implementation of Traceability Solutions in three CEBMs and Interface development for ICT platform integration D5.4 - Report on validation and evaluation of Traceability Solution	EECC, ICCS
Open Innovation Camp	.doc	WP7	D7.2 - Report of implementing living labs and ACSI-events and recommendations in the future circular economy efforts	LAU
Stakeholder contact list	.csv	WP9	D9.3 - Report on communication tools, including project logo, flyer, poster, newsletters and conference	MMM, NTU

3 FAIR Data

3.1 Making Data Findable, Including Provisions for Metadata

Through the active phase of the project, data management has included simple organisational measures such as following a file naming convention (FNC), which has taken the form of CIRC4Life_ DocumentName_ ResponsiblePartner_ YYYYMMDD_ Version.docx. Document filenames have been kept short to avoid unnecessarily long paths, always include the last institution to edit the document, and a version indicator.

For example, CIRC4Life_ProjectManagementPlan_NTU_20181009_V0.1.docx

All project documentation has been stored in a Microsoft project SharePoint site (as part of an Office 365 for Business cloud service instance) that has enabled full control over editing permissions of project participants. SharePoint as a collaboration and document management platform also offers good functionality for platform-wide metadata control of content.

For additional knowledge management, an Excel file has been included and promoted that contains a list of keywords, and the accepted definitions to be used by all the participating project partners. It has also acted as a controlled vocabulary to ensure consistent knowledge organisation that has aided subsequent retrieval and reuse. This document has been easily accessible for project collaborators using the project SharePoint site.

Project data has been made discoverable through the inclusion of a detailed descriptive record that has been added to NTU's institutional repository. This service is indexed in Google and Google Scholar; therefore, the records has been retrieved when anybody searches for the keywords associated with the CIRC4Life project. Further information about this is provided in the section below. A data availability statement has also been included in the project's published outputs to direct readers to a full overview of project data, as well as the terms and conditions of accessing and using publicly available data. This method has helped increase the visibility of the data and make it easier for people to locate and access them.

3.2 Making Data Openly Accessible

The final datasets to support published outcomes has been deposited in Arkivum (the license is managed by NTU), the NTU instance of the Archive-as-a-Service data safeguarding and long-term lifecycle management solution. A Digital Object Identifier (DOI) has been minted using DataCite service, a global provider of DOIs for research data, and included in the description (with additional metadata) in the NTU Institutional Repository (IR) to facilitate persistent identification and discovery. The metadata included in the IR record has identified the file formats the datasets are available in, which has indicated to potential users the software application required to effectively use the datasets. Any software code has also been described in the IR and archived, but intellectual property (IP) implications may restrict access. The development of the ICT solution has been accompanied by software documentation that has provided instructions for reuse, and these has been archived and made available with the proviso again of potential IP implications. Selected data samples have been made available to the public repository Zenodo: DOI: <https://doi.org/10.5281/zenodo.5530274> (Koutsokeras, 2021) for the need of project's exploitation purposes presented in CIRC4Life Deliverable 8.3. As described in D8.3, the provision of data to public repository does not concern private data (such as identities and contact details of people participating in workshops, project events and Living Labs) and algorithms and tools used for the generation, image annotation or flood modelling, many of which fall under the IP of the project's industrial partners (according to the consortium agreement).

NTU uses DataCite Metadata Schema to describe the data and is actively updated and promoted by interactively coordinating with community standards, like ORCID (<https://schema.datacite.org/>). Access to datasets have been opened and currently available as a request/mediated service via the Library Research Team at NTU, which has necessarily identified the individual requiring access to the datasets and provide

statistical information on dataset usage. However, availability has always been determined by licence conditions, and that has allowed for some granularity of access (including restrictions) to be potentially specified by different project collaborators. DataCite also has a reciprocal dataset registry service to aid discoverability and potential reuse of datasets that have been determined to be openly available. The data has been preserved for a minimum of ten years in the Arkivum service, or in any other subsequent solution used.

Access to project documentation and data is only available to those who have access to the SharePoint site, which is determined by the PC and implemented by NTU research staff participating in the project. Additional backup and data restore procedures have been agreed using this solution full functionality. A further backup has been performed daily to an on-premise storage solution hosted by NTU.

As stated NTU has a long-term storage solution (i.e. Arkivum), available to enable preservation and curation. It is an Archiving-as-a-Service solution that combines a hybrid local and cloud storage synchronised combination that guarantees data integrity and redundancy with full security. This ensures that funder, institutional or publisher retention compliance is satisfied, as is the authenticity of the original data for open data requirements or post research review if necessary.

3.3 Making Data Interoperable

NTU uses DataCite metadata schema as DataCite looks to community practices that provide data citation guidance. The PC has foreseen that the project SharePoint has included appropriate mandatory DataCite metadata elements for project files. Such as (Creator, Title, Description, Access to the dataset, Data Collection Method, Data Processing/Preparation Activities), and are included as mandatory metadata classification fields for file inclusion on the SharePoint site.

Using standard vocabularies for all data types is not initially anticipated as the data definition is integral to the tracking technologies of barcodes and the EPCIS Standard already. It has been clearly stated what barcodes code type used, and EPCIS Standard used.

However, the PC has ensured that any datasets that are included as CSV have a description definition for all the data elements included, and these are mapped to the industry standard description of the identifiers used for the different tracking technologies.

3.4 Increase Data Re-use (Through Clarifying Licences)

All openly available data has been offered on a CC-BY SA share-alike basis, so attribution has been required and that any repurpose, or re-use has been shared on the same basis. IP requirements may determine that some datasets are not open and has remained closed but archived in Arkivum. The description of the individual datasets in the NTU IR has made the conditions of the licence clear.

Archival in Arkivum is for ten years, and will always be available, allowing for licence conditions, for external viewing during that period.

During the active phase of the project, data quality assurance process has been organised by the PC (responsible individual for data management) to discover inconsistencies and other anomalies in the data, as well as performing data cleansing activities (e.g. removing outliers, missing data interpolation) to improve the data quality. It is foreseen that this has involved sampling datasets initially, with a thorough assessment of particular grouped datasets if significant inconsistencies are discovered.

4 Allocation of Resources

The costs of using Arkivum Archiving-as-a-Service solution available at NTU at the end of the project is £0.50 per GB of archived data, which will be covered by the NTU budget. As the projected final amount of data is expected to be in the order of 100 (estimation) Gigabytes, this will cost approximately £50 per year, or £500 for ten years.

NTU has supported the archiving of funded research datasets to promote the open access and data agenda.

The responsibility of data management on the CIRC4Life project is the PC of the leading collaborating institution (NTU). Everyday workflow tasks have been delegated, but the PC has ensured that consistent data management is performed for the duration of the project and has conducted six monthly reviews on the use of controlled vocabulary, file naming and versioning conventions and that the organisational logic of the SharePoint site is adequate.

Preservation has supported publication outcomes, research deemed of long-term value, as well as project communication channels dissemination output and literature. Should personal details be included in the data preserved, then anonymity need to be maintained, but traceable should there be a need for source data verification.

Any data deemed to be not worth saving in the active and archival stage needs to be destroyed in accordance with NTU Information Systems data destruction policy.

5 Data Security

As described in Section 3.2, the long-term security and preservation of project data has been managed by NTU using the Arkivum appliance, known publicly as The NTU Data Archive. This section details the security arrangements for project data during the grant period. Data has been moved from the Circ4Life SharePoint site to Arkivum at the end of the project, or before if data is released simultaneously with scientific publications.

5.1 Data Security Policies in CIRC4Life ICT Platform

All CIRC4Life data has been collected, stored, protected, shared, retained and destroyed, upholding state-of-the-art security measures and in full compliance relevant EU legislation, bearing in mind the demands of crowdsourcing and flood modelling contexts. As a general rule, this data has been stored on paper and/or computer files protected by state-of-the-art physical and logical security measures: the archives containing the paper folders are locked; the computer files are stored in computers and hard disks, accessible only by authorized personnel (within the relevant CIRC4Life partners) through password. This data has not been in any case shared with or disclosed to anyone outside the research team until data has been finalised for publication and approved for release by the Consortium.

A data minimisation policy is adopted by CIRC4Life, which means that only data strictly necessary for running the participatory and demonstration activities is collected and processed. Personal data, if any, collected and stored within CIRC4Life and for the purpose of the project aforementioned activities has been permanently and irrevocably erased on the project completion. Nevertheless, only if an individual participant has provided his/her free, specific and informed consent, name, age, professional occupation and professional views have this data be included in project outputs. If such a consent is not provided by the individual participant, only information that may be processed in a way that inhibits tracing his/her opinions back to him/her (anonymised information) have been a part of the activities.

In particular and with respect to access control and data protection, CIRC4Life data (including data from all the input sources) have been collected by the CIRC4Life ICT platform (hosted in ICCS premises) which has stored them in the relevant databases. This platform and the associated data repository system provides the means for deploying access control policies as described in Task 4.3. These are flexible and fine-grained means to assign permissions to roles and users in such a manner that access to resources can be controlled sufficiently for all eventualities. Moreover, the system has provided secure access to data repository by using security protocols such as OAuth2 for authorization and secure encrypted HTTPS calls. More specifically an open source software, KeyCloak, is used for the access to the ICT platform and the authentication for all the applications.

5.2 CIRC4Life End Users Personal Data

CIRC4Life ICT platform data has been stored in the ICCS data repositories. These are secure servers with limited access to Internet (with established filtering rules allowing access only for specific web requests or for authorized personnel through a VPN network). Security provisions are also taken for the physical infrastructure (rooms) where these servers reside. Furthermore, a specific encryption with the usage of KeyCloak has provided an additional level of security to the personal data.

5.3 Data Anonymization

Data anonymization refers to the processing of personal data in such a manner that the personal data can no longer be attributed to a specific data subject without the use of additional information, provided that such additional information is kept separately and is subject to technical and organisational measures to ensure that the personal data are not attributed to an identified or identifiable natural person.

However, the explicit introduction of anonymization is not sufficient by itself to preclude any other measures of data protection. Therefore, security policies for data protections should always be enforced as strictly as possible. The controllers of the CIRC4Life ICT Platform should require that data anonymization is enforced before any dataset is uploaded to the ICT Platform.

6 Sharing Systems

The sharing systems have been included mainly - but not only - the following platforms:

CIRC4Life website: The consortium disseminated all applicable data on CIRC4Life's website (<https://www.circ4life.eu/>), which was regularly updated by MMM and NTU. The website, setup and maintained by NTU, has been a front-end platform to disseminate knowledge and public data developed within CIRC4Life.

CIRC4Life European platform: This is for the European Commission to share the CIRC4Life project data and results with the public via CORDIS platform (<https://cordis.europa.eu/project/id/776503>).

CIRC4Life EU Project on YouTube: This site stores videos produced by the CIRC4Life project partners to disseminate the project outcomes with open access.
(https://www.youtube.com/channel/UCjybbG1Fq7GQJ_VE-kbGJQ)

7 Ethical Aspects

Any personal data gathering within the CIRC4Life project has conformed to informed consent expectations that are expected with regards current Data Protection legislation, and the EU General Data Protection Regulation (GDPR) that started to implement on 25th May 2018.

The project team has developed the CIRC4Life Ethical Clearance Checklist. This must be completed by each team whose responsible task involves ethical issues. This checklist addresses aspects associated with data use and data retention. It requests confirmation that the team is familiar with GDPR and that the activity has been designed through close consideration of the issues surrounding Data Protection. The archive of signed checklists from each team (see Table 2) are placed in the CIRC4Life SharePoint Site to provide administrative oversight to the project management of all ethical aspects of RDM. All participant information sheets explain how data has been used during the project. This is provided in language of the participants and is written in clear and straightforward language. The CIRC4Life Survey Privacy Notice is an example of this. These are available here: <https://www.circ4life.eu/survey-privacy-policy>.

An 'Ethics requirements' Work Package, which has been developed, as Deliverable D11.2, D11.3, D11.7 and D11.8 of Work Package 11, have been submitted in order to addresses the ethics requirements of the CIRC4Life project.

Table 2 CIRC4Life Ethical Clearance Checklist in this reporting period (M19-M41)

WP/Task name	Signed by	Signed time	Brief description on the activities and objectives
Task 6.3. - Demonstration of CEBM with tablets (M19-M41)	REC	07/05/2019	<p>A pilot test has been conducted in the Basque Country (Spain), specifically in Getxo municipality. For that, Getxo's inhabitants has employ the APP developed in the project and the intelligent containers placed in Getxo for disposing their devices. The participants of this test pilot has conducted it voluntarily and their number is unknown. Any personal data has be linked to the APP and has comply the GDPR.</p> <p>-Real life test: it was performed with real end-users that agreed to take part in the activity according to permissions collected in the corresponding Deliverable by Laurea. No personal data were used in the test or analysis.</p> <p>-Schools: Awareness sessions were performed in three schools in Getxo, and the intelligent bin was in them for some weeks in order to collect waste from students and their families. For using the app/ICT platform only one email address owned by the school was used, so no personal data were gathered. The test in schools only accepted non-economic incentives (tree planting), instead of economical ones (discounts in shops).</p>
Task 7.2 - Implementation living labs (M10-M33)	ALIA	29/03/2019	<p>During the second half of the project, ALIA has organized several workshops and testing activities. In total, two testing at fairs of the sustainable products, three donations' events of the sustainable products to the sanitary workers of the public hospital Rafael Méndez, members of the civil protection team of the municipality of Lorca, and the Mental Health Association Lorca and region (ASOFEM) and several workshops and real-life testing activities for the biowaste collection both, in the municipality of Abarán and the municipality of Lorca.</p> <p>In addition, two showcases' events were conducted. The first one was focused on the academia and the second one in the citizenship and industry.</p> <p>The participants did it voluntarily and any personal data complied with the GDPR.</p>
WP7 - Stakeholder Interaction and End-user Involvement (M1-M41)	LAU	19/10/2018	<p>First Innovation Camp event 2018 included 70 participants, out of which 40 external participants. External participants were selected based on the procedures and selection criteria described in D11.1 section 2.2. Participants were classified based on the Quadruple Helix type (academia, business consumer, policy) and selected to ensure transparent and fair participation of QH types, as well as gender and geographical balance.</p> <p>Second Innovation Camp 2021 included 70 participants, out of which 28 external participants. Respectfully to the first OIC, External participants were selected based on the procedures and selection criteria described in D11.1 section 2.2. Participants were classified based on the Quadruple Helix type (academia, business consumer, policy) and selected to ensure transparent and fair participation of QH types, as well as gender and geographical balance.</p>

Task 8.4 - Policy alignment (M2-M39)	CEPS	03/04/2019	<p>The interviews for the first sub-task (analysis of policies and regulations) were conducted between October and December 2018. The team collected information through interviews with companies involved in the demonstration of the project's circular business models but also with other companies involved in the electronics and food value chains in order to collect additional perspectives and information.</p> <p>During the phase 2 of the project the team conducted interviews with 31 companies from the EEE sector and 10 from the agri-food sector, including the ones involved in CIRC4Life, to collect qualitative data on barriers and enablers for Deliverable 8.2 – Policy Alignment. To collect the data, the team designed a research process of collecting data through online interviews due to the COVID-19 restrictions in line with the EU GDPR rules. Specifically, for this process a consent form was prepared by the team presenting the objectives of CIRC4Life and this assessment as well as explaining that data will be presented in the reports in an anonymous way. This form was sent to each expert that agreed to take part in this process in order to sign it and thereby give her/his consent.</p>
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8 Conclusions

With regards, conducting research project NTU expects staff and students involved in research to adhere to the policies pertaining to 'Code of Practice for Research', 'Research Ethics Policy' and the 'Research Data Management Policy'. NTU has also sought to follow the requirements and recommendation of Horizon 2020 EU funding as described in this document. Lastly, as a UK High Education organisation, NTU has provided support for research active members to be aware of national guidelines on open data, and to follow the principles wherever possible.

The DMP is the guide document for project's data treatment and management. As has been seen, the DMP describes which and how data is collected, processed or generated, but also outlining the methodology and standards used. Furthermore, the DMP explains whether and how this data is shared and/or made open, and how it is curated and preserved.

9 References

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