

Data Management Plan Overview

1. General Project Information	
Name Grant Holder & ORCID	Sander Teck (https://orcid.org/0000-0003-2405-7979)
Contributor name(s) (+ ORCID) & roles	Jef Peeters (https://orcid.org/0000-0003-1356-6508) - Supervisor Pieter Vansteenwegen (https://orcid.org/0000-0002-5646-669X) – (Co)supervisor Giovanni Lugaresi (https://orcid.org/0000-0001-9625-6622) – (Co)supervisor
Project number ¹ & title	Development of an adaptive scheduling framework for multi-robot-human re- and demanufacturing.
Funder(s) GrantID ²	1237325N - Fonds voor Wetenschappelijk Onderzoek – Research Foundation Flanders (FWO)
Affiliation(s)	<input checked="" type="checkbox"/> KU Leuven <input type="checkbox"/> Universiteit Antwerpen <input type="checkbox"/> Universiteit Gent <input type="checkbox"/> Universiteit Hasselt <input type="checkbox"/> Vrije Universiteit Brussel <input type="checkbox"/> Other: ROR identifier KU Leuven: 05f950310

¹ “Project number” refers to the institutional project number. This question is optional. Applicants can only provide one project number.

² Funder(s) GrantID refers to the number of the DMP at the funder(s), here one can specify multiple GrantIDs if multiple funding sources were used.

Please provide a short project description	<p>Facilitating the transition to a circular economy is pivotal in achieving the commitments of the European Union to lead the way toward a more sustainable and more competitive Europe. Herein, original equipment manufacturers (OEMs) play a crucial role, as they are expected to organize the reuse, repair, remanufacturing, and recycling of end-of(-first)-life products. Currently, Flemish OEMs lack a well-defined approach for efficiently and cost-effectively managing such re- and demanufacturing practices. To address this challenge, innovative technologies are increasingly available for the human collaborative (semi-)automated inspection, handling and disassembly. However, ensuring the seamless compatibility and effective integration of these technologies is of paramount importance for these processes to be economically viable in Europe. Therefore, I aim to develop an efficient control framework for the flexible allocation of tasks among different robotic cells and operators in a human-centric and adaptive re- and demanufacturing environment. In addition, the framework will consider human-robot-collaboration. The developed algorithms will be integrated and demonstrated on the systems of our partner organizations. Furthermore, I will validate the developed algorithms and quantify the potential gains of the envisaged industry 5.0 technologies through several industrial validation cases with increasing complexity, involving various products as defined by the industrial steering group.</p>
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2. Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data ³.

				ONLY FOR DIGITAL DATA	ONLY FOR DIGITAL DATA	ONLY FOR DIGITAL DATA	ONLY FOR PHYSICAL DATA
Dataset Name	Description	New or Reused	Digital or Physical	Digital Data Type	Digital Data Format	Digital Data Volume (MB, GB, TB)	Physical Volume
HDD dataset	A dataset on hard disk drive characteristics used to generate large scale problem instances for the optimization framework.	Generate new data	Digital	Numerical / Textual / Images	.csv & .json	< 100 GB	NA
Company dataset	A dataset on a test case provided by a company to generate realistic problem instances for the optimization framework.	Generate new data	Digital	Numerical / Textual / Images	.csv & .json	< 100 GB	NA
Human operator dataset	A dataset on human operator processing time distributions. Thesis student will develop a systematic framework and physical setup to measure the variability of the inherent stochasticity of human workers.	Generate new data	Digital	Numerical / Textual / Audiovisual	.csv	< 100 GB	NA
Deterministic optimization framework	A software package containing a simulation environment, scripts, and algorithms for the deterministic optimization of multi-actor semi-automated de- and remanufacturing systems.	Generate new data	Digital	Software	.py	< 1 GB	NA
Stochastic optimization framework	A software package containing a simulation environment under uncertainty, scripts, and algorithms for the stochastic optimization of multi-actor semi-automated de- and remanufacturing systems.	Generate new data	Digital	Software	.py	< 1 GB	NA
Training dataset	Pre-processed training data for the prediction model.	Generate new data	Digital	Numerical	.json	< 100 GB	NA
Predictive model	A software package containing scripts for the predictive model used to cope with the inherent uncertainty in real-world de- and remanufacturing.	Generate new data	Digital	Software	.py	< 1 GB	NA

³ Add rows for each dataset you want to describe.

GUIDANCE:
The data description forms the basis of your entire DMP, so make sure it is detailed and complete. It includes digital and physical data and encompasses the whole spectrum ranging from raw data to processed and analysed data including analysis scripts and code. Physical data are all materials that need proper management because they are valuable, difficult to replace and/or ethical issues are associated. Materials that are not considered data in an RDM context include your own manuscripts, theses and presentations; documentation is an integral part of your datasets and should be described under documentation/metadata.
[RDM Guidance on data](#)

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type.	NA
Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? If so, refer to specific datasets or data types when appropriate and provide the relevant ethical approval number.	<input checked="" type="checkbox"/> Yes, human subject data; provide SMEC or EC approval number: <input type="checkbox"/> Yes, animal data; provide ECD reference number: <input type="checkbox"/> Yes, dual use; provide approval number: <input type="checkbox"/> No Additional information:
Will you process personal data ⁴ ? If so, please refer to specific datasets or data types when appropriate and provide the KU Leuven or UZ Leuven privacy register number (G or S number).	<input checked="" type="checkbox"/> Yes (provide PRET G-number or EC S-number below) <input type="checkbox"/> No Additional information:
Does your work have potential for commercial valorization (e.g. tech transfer, for example spin-offs, commercial exploitation, ...)? If so, please comment per dataset or data type where appropriate.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If yes, please comment: The optimization framework can be of interest to companies aiming to improve their de- and remanufacturing businesses. The software packages have the highest potential for commercial valorization.
Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material/Data transfer agreements, research collaboration agreements)? If so, please explain to what data they relate and what restrictions are in place.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If yes, please explain: The data from the 'company dataset' will have some 3 rd party restrictions, although with proper anonymization the dissemination of this data will be possible.
Are there any other legal issues, such as intellectual property rights and ownership, to be managed related to the data you (re)use? If so, please explain to what data they relate and which restrictions will be asserted.	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, please explain:

⁴ See Glossary Flemish Standard Data Management Plan

3. Documentation and Metadata

Clearly describe what approach will be followed to capture the accompanying information necessary to keep **data understandable and usable**, for yourself and others, now and in the future (e.g. in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, Codebook.tsv etc. where this information is recorded).

[*RDM guidance on documentation and metadata.*](#)

A layered documentation approach will be implemented. GitLab repositories will be created for the software packages. Python scripts within these repositories will be documented and commented, with version control maintained through Git. For the dataset generation, raw and processed data will be stored locally as well as stored in the database structure provided by the affiliated de- and remanufacturing research group, organized in a well-documented file tree where each folder contains a README.txt specifying data format and processing steps. This multi-faceted approach, including project-level READMEs, code documentations, version control, structured file organization, ensures data and methods are understandable and (re-)usable for us and others, now and in the future.

Will a metadata standard be used to make it easier to **find and reuse the data**?

If so, please specify which metadata standard will be used. If not, please specify which metadata will be created to make the data easier to find and reuse.

REPOSITORIES COULD ASK TO DELIVER METADATA IN A CERTAIN FORMAT, WITH SPECIFIED ONTOLOGIES AND VOCABULARIES, I.E. STANDARD LISTS WITH UNIQUE IDENTIFIERS.

☐ Yes

☒ No

If yes, please specify (where appropriate per dataset or data type) which metadata standard will be used:

If no, please specify (where appropriate per dataset or data type) which metadata will be created:

No specific metadata standard will be used, but we will create rich metadata documented in README files. This will include the title, creator, creation data, description, keywords, methodology, data format, and licensing information. This detailed metadata will ensure the data is easier to find, understand, and reuse.

4. Data Storage & Back-up during the Research Project

Where will the data be stored?

Consult the [*interactive KU Leuven storage guide*](#) to find the most suitable storage solution for your data.

- ☐ Shared network drive (J-drive)
- ☒ Personal network drive (I-drive)
- ☐ Teams
- ☒ Sharepoint online
- ☐ Sharepoint on-premis
- ☐ Large Volume Storage
- ☒ ManGO
- ☐ Digital vault
- ☒ Other: GitLab (software code)

<p>How will the data be backed up?</p> <p><i>WHAT STORAGE AND BACKUP PROCEDURES WILL BE IN PLACE TO PREVENT DATA LOSS?</i></p>	<p><input checked="" type="checkbox"/> Standard back-up provided by KU Leuven ICTS for my storage solution</p> <p><input type="checkbox"/> Personal back-ups I make (specify)</p> <p><input type="checkbox"/> Other (specify)</p>
<p>Is there currently sufficient storage & backup capacity during the project? If yes, specify concisely. If no or insufficient storage or backup capacities are available, then explain how this will be taken care of.</p>	<p><input checked="" type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p> <p>For both the data and software packages, that are foreseen to be developed, enough storage capacity is available.</p> <p>If no, please specify:</p>
<p>How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?</p> <p><i>CLEARLY DESCRIBE THE MEASURES (IN TERMS OF PHYSICAL SECURITY, NETWORK SECURITY, AND SECURITY OF COMPUTER SYSTEMS AND FILES) THAT WILL BE TAKEN TO ENSURE THAT STORED AND TRANSFERRED DATA ARE SAFE.</i></p> <p>Guidance on security for research data</p>	<p>During the research, writing rights to the data will be limited to myself and the supervisors. Access will be granted to researchers from the research group and to people who request the data. The writing rights for the GitHub repositories are limited to my own account, unless other collaborators are explicitly invited by me.</p>
<p>What are the expected costs for data storage and backup during the research project? How will these costs be covered?</p>	<p>There are no additional costs expected for the back-ups and storage of the data and software packages.</p>

5. Data Preservation after the end of the Research Project	
<p>Which data will be retained for at least five years (or longer, in agreement with other retention policies that are applicable) after the end of the project? In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).</p> <p>Guidance on data preservation</p>	<p><input checked="" type="checkbox"/> All data will be preserved for 10 years according to KU Leuven RDM policy</p> <p><input type="checkbox"/> All data will be preserved for 25 years according to CTC recommendations for clinical trials with medicinal products for human use and for clinical experiments on humans</p> <p><input type="checkbox"/> Certain data cannot be kept for 10 years (explain)</p>

<p>Where will these data be archived (stored and curated for the long-term)?</p> <p><i>Dedicated data repositories are often the best place to preserve your data. Data not suitable for preservation in a repository can be stored using a KU Leuven storage solution, consult the interactive KU Leuven storage guide.</i></p>	<p><input checked="" type="checkbox"/> KU Leuven RDR</p> <p><input type="checkbox"/> Large Volume Storage (longterm for large volumes)</p> <p><input type="checkbox"/> Shared network drive (J-drive)</p> <p><input type="checkbox"/> Other (specify):</p>
<p>What are the expected costs for data preservation during the expected retention period? How will these costs be covered?</p>	<p>No additional costs for data preservation are expected during the retention period as this is a service provided by the KU Leuven.</p>

6. Data Sharing and Reuse

<p>Will the data (or part of the data) be made available for reuse after/during the project?</p> <p>Please explain per dataset or data type which data will be made available.</p> <p><i>NOTE THAT 'AVAILABLE' DOES NOT NECESSARILY MEAN THAT THE DATA SET BECOMES OPENLY AVAILABLE, CONDITIONS FOR ACCESS AND USE MAY APPLY. AVAILABILITY IN THIS QUESTION THUS ENTAILS BOTH OPEN & RESTRICTED ACCESS. FOR MORE INFORMATION: HTTPS://WIKI.SURFNET.NL/DISPLAY/STANDARDS/INFO-EU-REPO/#INFOEU-REPO-ACCESSRIGHTS</i></p>	<p><input checked="" type="checkbox"/> Yes, as open data</p> <p><input type="checkbox"/> Yes, as embargoed data (temporary restriction)</p> <p><input type="checkbox"/> Yes, as restricted data (upon approval, or institutional access only)</p> <p><input type="checkbox"/> No (closed access)</p> <p><input type="checkbox"/> Other, please specify:</p>
<p>If access is restricted, please specify who will be able to access the data and under what conditions.</p>	<p>NA</p>

<p>Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)? Please explain per dataset or data type where appropriate.</p>	<div data-bbox="728 156 1102 347"> <input type="checkbox"/> Yes, privacy aspects <input type="checkbox"/> Yes, intellectual property rights <input type="checkbox"/> Yes, ethical aspects <input type="checkbox"/> Yes, aspects of dual use <input type="checkbox"/> Yes, other <input checked="" type="checkbox"/> No </div> <p data-bbox="728 384 958 411">If yes, please specify:</p>
<p>Where will the data be made available? If already known, please provide a repository per dataset or data type.</p>	<div data-bbox="728 486 1093 579"> <input checked="" type="checkbox"/> KU Leuven RDR <input type="checkbox"/> Other data repository (specify) <input type="checkbox"/> Other (specify) </div>
<p>When will the data be made available?</p>	<div data-bbox="728 617 1155 710"> <input checked="" type="checkbox"/> Upon publication of research results <input type="checkbox"/> Specific date (specify) <input type="checkbox"/> Other (specify) </div>
<p>Which data usage licenses are you going to provide? If none, please explain why.</p> <p data-bbox="69 882 680 1070"><i>A DATA USAGE LICENSE INDICATES WHETHER THE DATA CAN BE REUSED OR NOT AND UNDER WHAT CONDITIONS. IF NO LICENCE IS GRANTED, THE DATA ARE IN A GREY ZONE AND CANNOT BE LEGALLY REUSED. DO NOTE THAT YOU MAY ONLY RELEASE DATA UNDER A LICENCE CHOSEN BY YOURSELF IF IT DOES NOT ALREADY FALL UNDER ANOTHER LICENCE THAT MIGHT PROHIBIT THAT.</i></p> <p data-bbox="69 1077 696 1169"><i>Check the RDR guidance on licences for data and software sources code or consult the License selector tool to help you choose.</i></p>	<div data-bbox="728 782 1216 941"> <input checked="" type="checkbox"/> CC-BY 4.0 (data) <input type="checkbox"/> Data Transfer Agreement (restricted data) <input checked="" type="checkbox"/> MIT licence (code) <input type="checkbox"/> GNU GPL-3.0 (code) <input type="checkbox"/> Other (specify) </div>

<p>Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, please provide it here.</p> <p><i>INDICATE WHETHER YOU INTEND TO ADD A PERSISTENT AND UNIQUE IDENTIFIER IN ORDER TO IDENTIFY AND RETRIEVE THE DATA.</i></p>	<p><input type="checkbox"/> Yes, a PID will be added upon deposit in a data repository</p> <p><input type="checkbox"/> My dataset already has a PID</p> <p><input checked="" type="checkbox"/> No</p>
<p>What are the expected costs for data sharing? How will these costs be covered?</p>	<p>No additional costs for data sharing are expected.</p>

7. Responsibilities	
Who will manage data documentation and metadata during the research project?	Data documentation and metadata will be managed by myself.
Who will manage data storage and backup during the research project?	Data storage and backup will be managed by myself.
Who will manage data preservation and sharing?	Data preservation and sharing will be managed by myself.
Who will update and implement this DMP?	Updating and implementing the DMP will be through myself.