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TEKNOAX 2.0

TEKNOAX 2.0: BRINGING INTELLIGENCE ONTO AXLES OF THIRD MILLENNIUM FARMING TRAILERS

Deliverable D 1.1
Data Management Plan

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This document is only for use among the Partners of TEKNOAX 2.0

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1 Introduction

The scope of TEKNOAX 2.0 project is to answer to agriculture increasing demand for intelligent components in the market of axles for farming trailers, going beyond the state of the art and filling the existent gap with precision farming needs. As a matter of fact, TEKNOAX 2.0 will define a new generation of products by bringing intelligence onto axles, enabling unique traceability and condition based maintenance through a collaborative platform.
The present document, named “Data Management Plan”, was prepared in the context of WP1 concerning project management. The main objective of the data management plan is to consider the different aspects of data management at the very first stages of the project to ensure that outcomes are well-managed in the present and prepared for preservation in the future. This document intends to foresee, even at this early stage of the project (M6), what kind of data will be generated, whether and how it will be exploited or made accessible, and how it will be treated and preserved, in compliance with the guidelines released by the European Commission about data management policy.
The present Data Management Plan has to be intended as a living document, as data will be generated throughout the whole duration of the project. Any potential update or change in data management policy will be included in periodic reports or will be specified in the deliverables concerning the related tasks. It is worth to underline that TEKNOAX 2.0 project has been funded in the framework of Fast Track to Innovation (FTI) scheme that provides funding for bottom-up proposals for close-to-market innovation activities: actually, it is expected at most 36 months from grant to market. In this context, a proper management of the data generated in the framework of the project is vital in order do not jeopardize the results of the project in a competitive market.

2 Research Data

Before illustrating the approach followed by the TEKNOAX 2.0 project with respect to data management, it is worth to define research data and the key principles for research data management. As a matter of fact, research data refers to data that is collected, observed, or created within a project for purposes of analysis and to produce original research results. Data are plain facts. When they are processed, organized, structured and interpreted to determine their true meaning, they become useful and they are called information.
In a research context, research data can be divided into different categories, depending on their purpose and on the process through which they are generated. It is possible to have:

- **Observational data**, which are captured in real-time, for example, sensor data, survey data, sample data.
- **Experimental data**, which derive from lab equipment and tests, for example resulting from fieldwork
- **Simulation data**, generated from physical or numerical models
- **Derived / compiled data**, which involves using existing data points, often from different data sources, to create new data through some sort of transformation, such an arithmetic formula or aggregation.

Research data may include all of the following formats: text or word documents, spreadsheets, laboratory notebooks, field notebooks, diaries, questionnaire, transcripts, codebooks, audiotapes, videotapes, photographs, films, test responses, slides, artifacts, specimen, samples, collection of digital objects acquired and generated during the research process, data files, database contents, models, algorithms, scripts, contents of software application such as input, output, log files, simulations, methodologies and workflows, standard operating procedures and protocols[1].

In order to guarantee open access to research results, no confidential data generated within the project could be made available in digital form.

2.1 Key principles for research data management

According to the "*Guidelines on FAIR Data Management in Horizon 2020*", research data must be *findable*, *accessible*, *interoperable*, *re-usable* [2].
The FAIR guiding principles are reported in the following table[3].

FINDABLE	**F1** (meta)data are assigned a globally unique and eternally persistent identifier **F2** data are described with rich metadata **F3** (meta)data are registered or indexed in a searchable resource

[1] https://www.bu.edu/datamanagement/background/whatisdata/
[2] European Commission. Guidelines on FAIR Data Management in Horizon 2020, retrieved from http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-data-mgt_en.pdf
[3] http://www.nature.com/articles/sdata201618

	F4 metadata specify the data identifier
ACCESSIBLE	**A1** (meta)data are retrievable by their identifier using a standardized communications protocol **A1.1** the protocol is open, free, and universally implementable **A1.2** the protocol allows for an authentication and authorization procedure, where necessary. **A2** metadata are accessible, even when the data are no longer available
INTEROPERABLE	**I1** (meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation **I2** (meta)data use vocabularies that follow FAIR principles **I3** (meta)data include qualified references to other (meta)data.
RE-USABLE	**R1** meta(data) have a plurality of accurate and relevant attributes. **R1.1** (meta)data are released with a clear and accessible data usage license **R1.2** (meta)data are associated with their provenance **R1.3** (meta)data meet domain-relevant community standards.

2.2 Roadmap for data sharing

According to the aforementioned aspects, data management could be based on the next elements[4]:

- **Data set reference and name:** Identifier for the data set to be produced. In particular, in the framework of TEKNOAX 2.0, the technical data related to the laboratory tests of the new generation of axels, according to the internal ADR practices will be referred by using a code composed by the year and three progressive numbers (i.e 17-XXX-RP, 18-YYY-RP). A report will be associated to the data (in the code the presence of the report is identified by the acronym “RP”).
- **Data set description:** The data that will be generated or collected during TEKNOAX 2.0 project execution will be described, as well as its origin (in case it is collected), nature and scale and to whom it could be useful. Information on the existence (or not) of similar data and the possibilities for integration and reuse will be also included (see previous point, RP report).
- **Standards and metadata:** Reference to existing suitable standards of the discipline. If these do not exist, an outline on how and what metadata will be created has to be given. In the report, the standards used for the tests are mentioned. In particular, as far as the axels are concerned, standards are followed for the braking system whereas for the axles, internal non official procedures and custom made test machines will be used.
- **Data sharing**: Description of how data will be shared, including access procedures, embargo periods (if any), outlines of technical mechanisms for dissemination and necessary software and other tools for enabling re-use, and definition of whether

[4] https://www.openaire.eu/opendatapilot

access will be widely open or restricted to specific groups. The repository where data will be stored will be identified, if already existing, indicating in particular the type of repository (institutional, standard repository for the discipline, etc.). In case the dataset cannot be shared, the reasons for this should be mentioned (e.g. ethical, rules of personal data, intellectual property, commercial, privacy related, security-related). This point has a remarkable importance being the scope of TEKNOAX 2.0 project to launch a product into the market by 12 months after the end of the project, dataset will be in most of the case confidential in order do not provide a competitive advantage to competitors.

- **Archiving and preservation (including storage and backup):** Procedures that will be put in place for long-term preservation of the data shall be described. Indication of how long the data should be preserved, what is its approximated end volume, what the associated costs are and how these are planned to be covered.

Since at month six not all data set has been generated yet (in particular, the overall dataset related to the laboratory tests on axles will be completed by the end of November 2017), the previous list has to be intended as a guideline for data generated in the future. Obviously, the sharing of data will be strictly linked to the level of confidentiality of the data itself.

3 Open access

Before deepening the aspects related to TEKNOAX 2.0 research data in chapter 5, in the following, an overview of "open access" and the consequent contractual obligations are provided.
Open access can be defined as the practice of providing on-line free of charge access to scientific information related to project outcomes. In the context of R&D "scientific information" mainly refers to

- **peer-reviewed scientific research articles**, if projects results are going to be disseminated in academic journals
- **research data**, that means not only data underlying the aforementioned scientific publications, but also any other data related to project activities, both processed or raw.[5]

Although there are no legally binding definitions of open access, authoritative definitions appear in key political declaration such as the *2002 Budapest Declaration* and the *2003 Berlin Declaration*. Under these definitions, "access" includes the right to read, download and print, but also to copy, distribute, search, link, crawl and mine the aforementioned data, provided that obligations to confidentiality, security and protection of personal data are ensured and the achievements of TEKNOAX 2.0 objectives, including the future exploitability of results, are not jeopardized.
Open access is not a requirement to publish, but it is seen by the European Commission as an approach to facilitate and improve the circulation of information in the European research area and beyond. Open access to data generated in projects funded by the European commission is the key to lower barriers for accessing publicly-funded research, as well as to demonstrate and share the potential of research activities supported with the help of public funding.

3.1 Open Access in the Grant Agreement

The importance given by the European Commission to the open access issue is clearly outlined in the TEKNOAX 2.0 Grant Agreement. Particularly, Article 29.2 and 29.3 states the responsibilities of beneficiaries and the actions to be undertaken in order to ensure open access to scientific publications and to research data respectively. The text of the aforementioned articles is reported below[6]

Article 29.2: Open access to scientific publications

Each beneficiary must ensure open access (free of charge, online access for any user) to all peer-reviewed scientific publications relating to its results.

In particular, it must:

a) as soon as possible and at the latest on publication, deposit a machine-readable electronic copy of the published version or final peer-reviewed manuscript accepted for publication in a repository for scientific publications;

[5] EU definition of Open Access, as reported in the Progress Report "Communication from the commission to the council and the European Parliament" - European Research Area (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0575&from=EN)
[6] TEKNOAX 2.0 GA 737848

Moreover, the beneficiary must aim to deposit at the same time the research data needed to validate the results presented in the deposited scientific publications.
b) Ensure open access to the deposited publication — via the repository — at the latest:
I. on publication, if an electronic version is available for free via the publisher, or
II. within six months of publication (twelve months for publications in the social sciences and humanities) in any other case.
c) Ensure open access — via the repository — to the bibliographic metadata that identify the deposited publication.
The bibliographic metadata must be in a standard format and must include all of the following:
-the terms "European Union (EU)" and "Horizon 2020"
-the name of the action, acronym and grant number;
-the publication date, and length of embargo period if applicable, and
-a persistent identifier.

Article 29.3: open access to research data

Regarding the digital research data generated in the action ('data'), the beneficiaries must:
a) deposit in a research data repository and take measures to make it possible for third parties to access, mine, exploit, reproduce and disseminate — free of charge for any user — the following:
I. the data, including associated metadata, needed to validate the results presented in scientific publications as soon as possible;
II. other data, including associated metadata, as specified and within the deadlines laid down in the data management plan (see Annex I);
b) provide information — via the repository — about tools and instruments at the disposal of the beneficiaries and necessary for validating the results (and — where possible — provide the tools and instruments themselves).

It is relevant to underline also the following clauses:

This does not change the obligation to protect results in Article 27, the confidentiality obligations in Article 36, the security obligations in Article 37 or the obligations to protect personal data in Article 39, all of which still apply.
As an exception, the beneficiaries do not have to ensure open access to specific parts of their research data if the achievement of the action's main objective, as described in Annex 1, would be jeopardized by making those specific parts of the research data openly accessible. In this case, the data management plan must contain the reasons for not giving access.

The confidentiality aspects have been duly taken into account in the preparation of this document in order to not compromise the protection of project results and legitimate interests of project partners. Special attention in this context has been paid in particular by the project coordinator ADR whose objective is to launch thanks to TEKNOAX 2.0 innovative axles in the market in the near future after the end of the project.

3.2 Open Access Research Data Pilot

Projects starting from January 2017 are by default part of the Open Research Data Pilot, launched by the EC in the context of the Horizon 2020 framework programme. The aim of the pilot is to improve and maximise access to and re-use of data generated by research projects, which are usually small sets, spread across repositories all over Europe.

The pilot is an excellent opportunity to stimulate and nourish the data-sharing ecosystem and has the potential to connect researchers interested in sharing and re-using data with the relevant services within their institutions (library, IT services), data centres and data scientists. The pilot is intended to promote the value of data sharing to both researchers and funders, as well as to forge connections between the various players in the ecosystem.

Being part of the ORDP, the TEKNOAX 2.0 consortium commits itself to undertake all the necessary actions where possible to be compliant with the aforementioned principles by respecting on the other side the IPR protection constrains.
A brief description of such provisions is provided in the next section.

3.2.1 Enabling projects to register, discover, access and re-use research data

In order to comply with the principles which underpin the Open Research Data Pilot, researchers are expected to provide answers to key issues such as “what”, “where”, “when”, “how” and “who”.[7]
WHAT: The Open Data Pilot covers all research data and associated metadata resulting from EC-funded projects, if they serve as evidence for publicly available project reports and deliverables and/or peer reviewed publications. To support discovery and monitoring of research outputs, metadata have to be made available for all datasets, regardless of whether the dataset itself will be available in Open Access. Data repositories might consider supporting the storage of related project deliverables and reports, in addition to research data.
WHERE: All research data has to be registered and deposited into at least one open data repository. This repository should: 1) provide public access to the research data, where necessary after user registration; 2) enable data citation through persistent identifiers; 3) link research data to related publications (eg. journals, data journals, reports, working papers); 4) support acknowledgement of research funding within metadata elements; 5) offer the possibility to link to software archives; 6) provide its metadata in a technically and legally open format for European and global re-use by data catalogues and third-party service providers based on wide-spread metadata standards and interoperability guidelines. Data should be deposited in trusted data repositories, if available. These repositories should provide reliable long-term access to managed digital resources and be endorsed by the respective disciplinary community and/or the journal(s) in which related results will be published (e.g., Data Seal of Approval, ISO Trusted Digital Repository Checklist).
WHEN: Research data related to research publications should be made available to the reviewers in the peer review process. In parallel to the release of the publication, the underlying research data should be made accessible through an Open Data repository. If the project has produced further research datasets (i.e. not necessarily related to publications) these should be registered and deposited as soon as possible, and made openly accessible as soon as possible, at least at the point in time when used as evidence in the context of publications.
HOW: The use of appropriate licenses for Open Data is highly recommended
WHO: Responsibility for the deposit of research data resulting from the project lies with the project coordinator (delegated to project partners where appropriate).

[7] http://sito.entecra.it/portale/public/documenti/horizon_2020_open_data_pilot.pdf

3.3 Research Data Repositories

The TEKNOAX 2.0 project website is provided with a Private Document Section (http://www.teknoax2dot0.eu/private-documents) representing a repository that includes all the main project documents produced by the consortium in their consolidated version, and any other private document exchanged by partners. Only registered users (project partners) can access this area and new users can be generated only by administrator.
The private area of the TEKNOAX 2.0 project website facilitates and enhances the information flow among the partners. Particular attention will be paid to the confidential and/or sensitive data and the consortium will not disclose or share this information to third parties. For very sensitive data, ADR will use internal repositories and if not necessary, this data will not be shared even with the consortium but relative data will be provided instead (e.g percentage of improvement etc.).

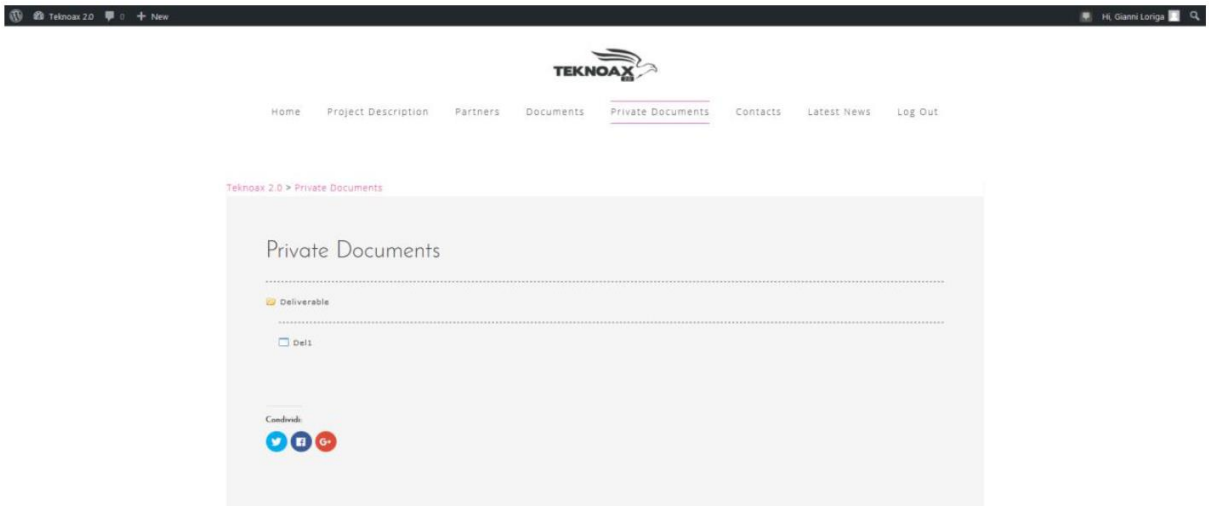

Figure 3-1 Private Documents Page

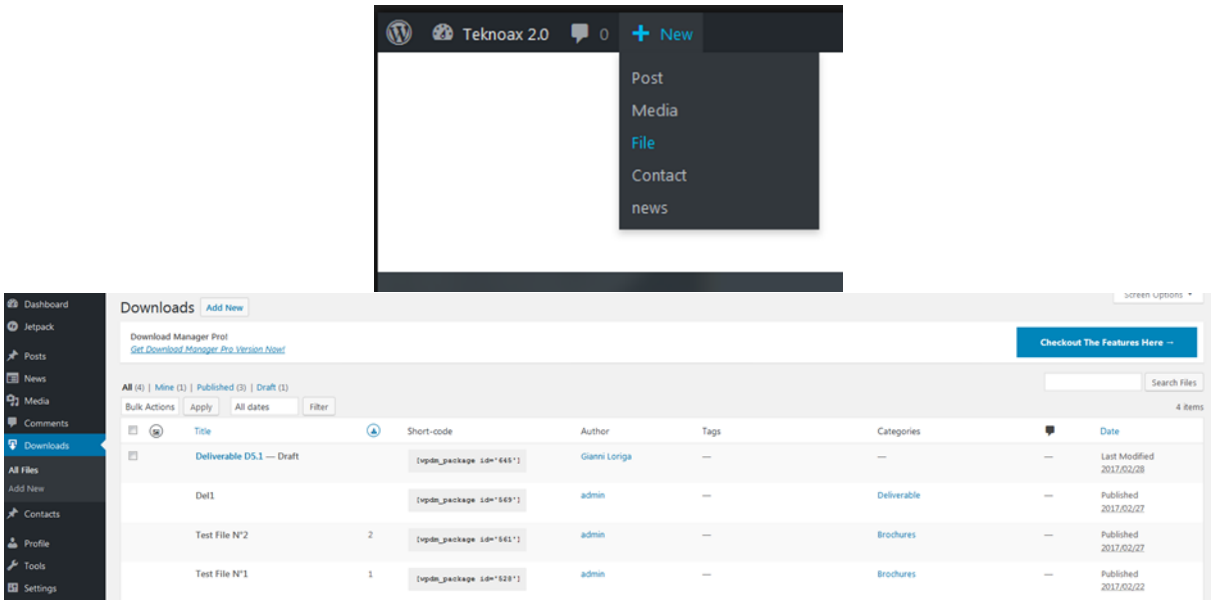

Figure 3-2: Management of Data/file/documents

Concerning the open access of discoverable data, an analysis of the potential options was carried out by the TEKNOAX 2.0 consortium.
One of the possibilities is to use **ZENODO** (http://www.zenodo.org/), the cost free open access repository of **OpenAIRE** (the Open Access Infrastructure for Research in Europe, https://www.openaire.eu/). The goal of OpenAIRE portal is to make as much European funded research output as possible available to all. Institutional repositories are typically linked to it. Moreover, dedicated pages per project are visible on the OpenAIRE portal, making research output (whether it is publications, datasets or project information) accessible through the portal. This is possible due to the bibliographic metadata that must accompany each publication.

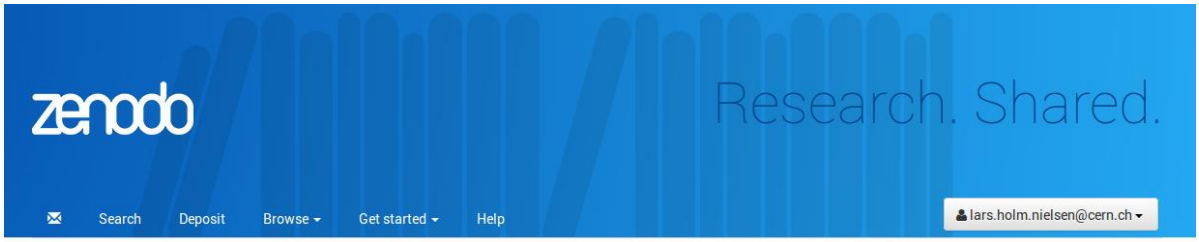

Figure 3-3 Zenodo homepage

Other possible repositories will be investigated at subsequent stage of the project, depending on the particular characteristics of the dataset by taking advantage of the **re3data** search engine (http://www.re3data.org/). Re3data.org is a global registry of research data repositories that covers research data repositories from different academic disciplines. It presents repositories for the permanent storage and access of data sets to researchers, funding bodies, publishers and scholarly institutions.

4 Publications

According to the TEKNOAX 2.0 Grant Agreement, participants have the obligation to disseminate their results as soon as possible, unless it goes against their legitimate interests and according to any necessary restriction aimed to protection of results and confidentiality. Protecting results is indeed crucial, since their premature disclosure can destroy the participants' chances of being granted intellectual property rights, in particular when dealing with patents and utility models that require novelty. No scientific publication on peer reviewed journals are foreseen within the TEKNOAX 2.0 project. Actually, the consortium does not include Universities of Research Centers being the project oriented to bring together complementary expertise able to launch in the market new products/services (new generation of axels and platform enabling innovative services) by 36 months from the grant.
However, in order to disseminate project results, some articles will be published in topic-specific journals in order to pave the way to the future exploitation and commercialization.
Prior to any dissemination activity and/or publication other partners shall be consulted in order for them to exercise their right to object in the case where such dissemination could cause significant harm to their background or results. In particular, at least 45 days prior notice of any dissemination activity shall be given to the other beneficiaries concerned who, within 30 days, may object about the dissemination activity.
The publications will be made available in apposite repositories in order to have the maximum impact.

5 Teknoax 2.0 research data

TEKNOAX 2.0 project is funded by the Fast Track to Innovation Pilot scheme, which provides funding for bottom-up proposals for close-to-market innovation activities. Being the main objective of this funding scheme to bring on the market the innovation proposed within three years from the beginning of the project, even more attention must be paid to the kind of data shared while the project is still ongoing, in order to not jeopardize market uptake and exploitation of project outcomes.
In section 1.3 of TEKNOAX 2.0 DoA (Description of Actions), it is stated that the innovation potential and market competitive advantage of the solution proposed lies in the combination of three different innovations, listed below

- A monolithic hollow shape axle obtained through an innovative mechanical production process
- A system bringing intelligence onto axles
- A collaborative ICT Platform and communication system as interface of end-users with manufacturers

Research data linked to the development and testing phase of the aforementioned innovations will not be made accessible in order to not compromise the exploitation of results. This aspect is reflected also in the dissemination level of the corresponding deliverables, which remain confidential until the end of the project.

However, it is worthwhile to point out that the project focuses more on the manufacturing and testing process of the intelligent axles than on the production of research or observational data and so the amount of Research Data that are going to be produced is limited, at least at this stage of the project.

In the next section, a tentative description of the expected project datasets is provided, together with a preliminary indication on their confidentiality.

5.1 Research data types

The following table reports a tentative list of the research data types that will be produced by the TEKNOAX 2.0 project. A description of each dataset is given in the following sections of the present document.

WP	Main Activities	Research Dataset	Confidential
2	• Definition of end users needs and features to be considered for further development and customization of the novel axle • Test campaigns to set optimal values for manufacturing processes	Axles technical specifications	no
		End user needs, market demand and future development	no

	• Re-design of the clamping system • Check of the new technology compliance with technical standards	Test results on axles for the refinement and optimization of the manufacturing process	yes
3	• To define TEKNOAX 2.0 platform architecture and specifications of its main components • To test platform functionalities in a laboratory environment • To validate platform lab results in an operating environment	Platform sensing and functional requirements	yes
		Data collected by axles	yes
		Test procedures and results	yes
4	• To perform tests on a trailer equipped for trials in real working conditions • To circulate surveys and to perform training sessions in order to collect feedbacks from end users on axles and platform performances	Validation of performances: test results in relevant operational environment	no

Any change in the expected results will be reported directly in the deliverable associated to the specific task or in the periodic report.

5.1.1 Axles technical specifications and optimization of manufacturing process

This dataset consists of:

- Requirements from the point of view of the axles manufacturers (production-related) and end-users
- Market needs
- Mechanical requirements and technical specifications
- Laboratory testing:
  - vertical fatigue tests
  - spindle tests
  - 3 or 4 point bending tests
  - Hub Endurance tests
  - Life test for Bearing

The above dataset are considered confidential except for the market needs

5.1.2 Platform sensing and functional requirements

This dataset consists of:

- Tests and data connected to the repository of the TEKNOAX 2.0 Platform (confidential)

5.1.3 Validation of performances

This dataset consists of:

- Data related to on-field testing (confidential)
- Data related to validation in relevant operational environment (public)

6 Conclusions

The present document has intended to outline a preliminary strategy for the management of data generated throughout TEKNOAX 2.0 project. Considering that this deliverable is due at month six, few data sets has been generated yet, so it is possible that in the future some aspects outlined in the present document will need to be refined or adjusted. This initial data management plan has however demonstrated that the consortium fully commits itself to comply with open access requirements. Moreover, a tentative list of dataset has been generated, showing the soundness of the concepts that the projects aims to develop and demonstrate.

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