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## Plan Overview

*A Data Management Plan created using DMPTuuli*

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### Project abstract:

Printed intelligence is a technology dealing with the development of printing methods to produce and apply functional devices and integrated systems. It is considered as a key enabler for next generation technology products such as flexible, thin, light-weight and cost- and resource-efficient electronics and photonics. Printed intelligence infrastructure (PII) is established to provide world-class research and development environment to researchers and technology developers in academy and industry. It offers easy access to a modern research and pilot-manufacturing infrastructure covering the whole research/development path from (i) materials via (ii) functional printing, (iii) components and devices to (iv) circuits and systems. Available processes include synthesis of novel materials, formulation of inks, manufacturing from large-area roll-to-roll processes to hybrid integration, and finishing steps for functional systems for internet-of-everything, diagnostics, sensors, on-skin electronics, and 5G/6G

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## Data management policy

### General description of data

The data collected will consist of results from experiments, theoretical work and numerical modelling within all aspects of materials, process and application design, characterization, development, description and validation. Experiments are based on both home-made specialized set-ups while some rely on standardized instruments and protocols.

Most of the data can be collected in standard file formats. Most data related to characterization of physical properties of materials, processes and devices are typically stored as text files that can be read via office tools. However, certain instruments may use proprietary formats. Even then, the data will be exported to standard formats if possible. The aim is that the data can be opened using widely-used software packages.

We will use standard quality control methods and protocols for capturing and evaluating data. These include, but are not limited to, taking repetitive measurements from different samples, use of reference measurements and samples, all aiming at increasing the data quality. Standard instruments will be calibrated as required by the manufacturer. Software for numerical modelling will be debugged extensively using well-known standard cases as reference. All data that will be published will be peer-reviewed as a final assurance of quality.

We foresee that the organizations have enough storage space for data that will be generated during the research (estimated as 3 Tbit) available for free.

The infrastructure is not collecting sensitive personal data. However, some data (such as patients' vital data) will be collected using devices produced by the infrastructure. These data can include sensitive personal data. To process these data, appropriate data privacy protection measures will be taken into use (such as data pseudonymization and access control based on data needs). When necessary, personal data processing risk assessments and data privacy impact assessments will be carried out as well. However, majority of the collected data are not considered personal data.

In case of research data that includes personal data which possibly also includes sensitive personal data of users the advice is as following:

- For the studies including hospitalized patients, a favorable statement of the ethical review board of hospital will be applied to the research plans and the records of processing activities (GDPR Art. 30). All the research data will be processed as either anonymized or pseudonymized and the personal details (name, social security ID, contact information etc.) will not be delivered outside the hospital. This personal information will be accessed only by the medical doctors or nurses working in the hospital and treating the patients. The registers that list the patients participating in the studies will be stored and destroyed according to the patient and research data policy of the hospital and will not be delivered outside the hospital. Possible restrictions set by ethical review board and/or authorities related to the sharing of anonymized research data will be respected.
- The measurements related to the performance and feasibility of the printed sensors and conducted with healthy volunteers, a favorable statement of ethical review board (either the ethical review board of hospital or the Ethics Committee of the region/organization) will be obtained and the anonymized measurement data related to these measurements is made public similarly as the data from the measurements containing hospitalized patients.

### Agreements on rights of use and license

The consortium agreement for the infrastructure defines the user rights and obligations, as well as IPR management. Every organization owns and guides the rights-of-use of their own data, according to the guidelines set by the respective organization and the recommendations in this policy.

For shared data, Creative Commons licenses (e.g. CC BY 4.0) or other licenses more suitable depending on data type are recommended to ensure responsible re-use. The infrastructure will guide user to improve and share best practices between the different organizations.

The steering committee of the infrastructure is committed to develop and implement the fairdata practices and this will be done by making a more detailed handbook for users. This will be implemented during the year 2021.

### Opening or sharing data

Data is produced in four different categories of openness within the project:

| Category of project        | Openness of data    | Handling of raw- and metadata                                                    | Note:                                                                                       |
|----------------------------|---------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| 1. Fully open              | Fully open data     | Raw- and metadata is recommended FAIR compatible after publication               | The data are available for everyone to download.                                            |
| 2. Partial confidentiality | Discretionary open  | Data open and accessible after publication upon request                          | In order to download files, the user must request permission to do so.                      |
| 3. Classified              | Embargo             | Data open for consideration after confidentiality period has expired             | The data will be available for everyone to download from a specified "Date Available" date. |
| 4. Industrial projects     | Industrial projects | Classified, unless data owner has given written consent, according to agreements |                                                                                             |

The partners are committed to increase openness, visibility and availability of their scholarly output by promoting open access and transparency in the management of research data and metadata.

The infrastructure is committed to make data which will be published shared in Fairdata IDA or in subject-specific or general repositories. Users are instructed to use the national infrastructure available for fairdata. We will use the Qvain service (<http://qvain.fairdata.fi>) for publishing and documenting metadata, IDA for storing data: <https://www.fairdata.fi/en/ida/> and thereby searchable via the Etsin service (<https://etsin.fairdata.fi/>). The recommendation will be that the data should be accessible and open when receiving a DOI for an accepted publication. Researchers actively publish in scientific journals and deposit parallel copies at institutional repositories. The repositories offer free of charge online access to scientific journal articles and reports in pdf format.

The results published in peer-reviewed scientific journals will receive digital object identifiers (DOI) according to the publisher's procedure and can be found using search engines. When applicable, we will publish data sets along with these articles in the supplementary information.

Use of the infrastructure should be acknowledged as "Support for the work from the Printed Intelligence Infrastructure through ...". The infrastructure will obtain an Uniform Resource Name identifier for proper addressing.

The infrastructure is also acknowledging the open data policy at each organization, which can be found under the following links:

Oulu University: <https://www.oulu.fi/university/node/43683#Data>

Tampere University: <https://www.tuni.fi/en/research/responsible-research/open-science>

Åbo Akademi University: <http://blogs2.abo.fi/opensciencepolicy/2017/03/02/open-science-at-aau-university/>

VTT: VTT Executive Leadership Team approved VTT Open Science principles in June 2018. That document can be found in the intranet Handbook. All the scientific articles and conference papers produced at VTT should be published according to open access principles. VTT internet pages are currently under update process and the link will be added later. Prior the completion of the webpages, the document will be provided upon request.

## Documentation & metadata

Fairdata Qvain will be used to create standardized metadata and persistent identifier (URN or DOI) for datasets.

For all data, each file and metadata file will be named by date, time and a brief descriptive statement. The data files will be saved in appropriate folders of the storage structure.

The infrastructure will prepare a guide for infrastructure specific metadata. Before the end of 2021, or during the first six months of operation, a handbook for opening data will be available through the web-site of PII. We will use Directory Interchange Format (DIF) meta-data standard or Metadata schema of Fairdata Qvain as a starting point for infrastructure specific recommendations.

## Storage, backup & access control to data

We will use organizations' own servers for raw-data storage and recommendations for long-term storage. Each organization's data archive services will be used if needs for long-term data preservation are identified during the research. The access level is shown in the Table above for different types of data.

The responsible PI will control access and secure that data will remain accessible also for later use through the project specific DMP. Users of the infrastructure are required to prepare a public project specific DMP in the Tuuli-service and shared with the infrastructure. At least 5 years storage of data is required.

Institutional and national data services do provide adequate level of data storage services for the infrastructure. The national service is provided by the Center for Scientific Computing (CSC) through the fairdata IDA platform.