



User-Centered Innovation and Transformation in Higher Education & Beyond!

**Digitale TU Graz Marketplace**

Handlungsfeld Forschung

Institute of Interactive Systems and Data Science



# Business Innovation Canvas: **Laboratory Notebook and Database Extensions (LabNDB-Ext)**

**Jakob Harden**

## **Abstract:**

The main idea is to collect, manage, store, analyse and reuse results from material testing processes in laboratory. This is mandatory to create a scientific body that supports transparency and reusability in the research and publication process. Therefore a well structured and accessible data structure is needed that supports data aggregation and data analysis.

The goal of LabNDB-Extensions is to extend the existing prototype to a pre-production version including all features of a state-of-the-art laboratory management system. This can be achieved by integrating the knowledge and experience of laboratory staff and scientists into the development process. Furthermore additional features (e.g. rawdata preview, message board, ...) are implemented by the developers, reviewed and tested by the end-users. To foster sustainability, end-user trainings and a proper documentation of the solution are planned.

This project is a cooperation of the Institute of Technology and Testing of Construction Materials (IMBT/TVFA), the Institute of Biomechanics (BioMech) and the Institute of Electron-Microscopy and Nanoanalysis (FELMI-ZFE). In addition, a cooperation with the Institute of Solid State Physics (IF) is planned.

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## **Customer Segments:**

*For whom are we creating value?*

*Who are our most important customers?*

Laboratory staff and scientists at TU-Graz (IMBT/TVFA, BioMech, FELMI-ZFE).

The most important customers are the end-users (laboratory staff, scientific staff, administrators) of the collaboration partners mentioned above.

## **Value Proposition:**

*What value do we deliver to the customer?*

*Which one of our customer's problems are we helping to solve?*

*What bundles of products and services are we offering to each Customer Segment?*

*Which customer needs are we satisfying?*

The value delivered by this project is a web-based, database-driven software solution.

The features of the existing solution (LabNDB, demo version available) allow customers to handle common tasks of daily laboratory work, such as:

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- manage materials, samples, devices and laboratory facilities
- store, manage and reuse data from test processes
- book devices and workbenches
- allow for data export to files or other RDM facilities like CyVerse

This project is aiming to extend the existing solution by the following new features:

- **Device data handling, preview:** import rawdata from devices with known formats into the database, provide a quick preview of the rawdata on screen
- **Message board, notifications:** exchange information between laboratory staff and scientists, notify users about laboratory process events
- **Booking calendar:** graphical representation of the booking calendar used for devices and workbenches
- **Reports:** feature prototype used to create simple test reports of laboratory tests in PDF format
- **Authorization, permissions:** role-based authorization and access permission model based on the data security plan
- **CSV import:** import of existing data of devices and laboratory facilities from TUG-Online inventory and room management
- **Tutorials, end-user documentation:** the end-user documentation is provided in form of an inline-documentation in the user-interface, introductory video-tutorial presenting the core features of the solution
- **Testing, feedback, training:** Integration of end-users in the development process. End-users are invited to participate in topic related workgroups to share their experience about existing workflows. Workgroups are hosted by the members of the project team. This allows for completeness and usability of the solution but is also a good starting point of end-user training.
- **Export to TU-Graz repository:** data export to the repository server of TU-Graz using invenioRDM's restAPI (optional feature)

**Channels:**

*Through which Channels do our Customer Segments want to be reached?*

*How are we reaching them now?*

*How are our Channels integrated?*

*Which ones work best?*

*Which ones are most cost-efficient?*

*How are we integrating them with customer routines?*

**End-users**

End-users are the most important for this project. They are integrated in the project work by topic related workgroups. These workgroups are used to gather information from the future end-users. This allows the project team to create a usable solution that reflects the laboratory workflows. The communication channels used for this purpose are personal interviews, workgroup meetings and training sessions.

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**RDM Team**

The communication between the project and the RDM team is maintained by the project manager. The means of communication are personal meetings, workshops and the Marketplace barcamps. Additionally, the project team has to provide an intermediate report and an end report to the RDM-Team.

**Other collaborators (FELMI-ZFE, IF)**

Contributions from other RDM project teams (FELMI-ZFE, "LabLOG 2.0") and institutes (Institute of solid state physics) are also of interest for this project. Collaborators are invited to participate in personal interviews but also in the project development workshops.

**Public area**

The project is presented to the public using the online platform "eLearning Toolbox". This allows the public area to access information about the project.

**Customer Relationships:**

*What type of relationship does each of our Customer Segments expect us to establish and maintain with them?*

*Which ones have we established?*

*How are they integrated with the rest of our business model?*

*How costly are they?*

**Collaboration with laboratory staff and scientists from IMBT/TVFA, BioMech, FELMI-ZFE**

- relationship: collaboration partner
- interviews with persons involved in laboratory processes to gather requirements and information regarding the usability of the solution
- topic related workgroups are already established, each workgroup consists of participants from different institutes of different faculties
- provide a working version of the solution (Release)
- continuously integrating ideas and suggestions into the solution (CI/CD)
- communication between the collaboration partners is well established (developer workshops, SCRUM meetings, workgroup meetings) and is shaped by the spirit of community

**Collaboration with other laboratories and institutes**

- relationship: informative
- exchange experience between laboratory staff and scientists from other lab's (IF)
- collaboration with the Institute of solid physics still needs to be established
- get information on required features and usability of the solution

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- provide a working version of the solution for testing purposes
- provide help on RDM and how to integrate LabNDB in existing workflows
- communication with IF is expected to be friendly and fruitful

**Collaboration with RDM Team**

- relationship: informative, organizational
- get information about collaboration tools, RDM tools and available infrastructure
- provide information about the current state of the project, intermediate report, end report
- communication with the RDM Team was established in the last project (LabNDB) and will continue in the well known friendly way

The collaboration in topic related workgroups is mandatory and fully integrated into all phases of the project. We assume that this workgroup based collaboration will take us about 20% of the total project costs.

**Impact – Results – Sustainability:***Which impact and results should be reached?**Will the results be used in future?**Can there be follow up projects?**How can the processes found be integrated in research?*

The basis for the planned extensions is LabNDB. LabNDB is a robust, open-source-based web-application including all features of a start-of-the-art laboratory data management system.

In the course of LabNDB-Extensions we are going to extend and enhance the features of LabNDB:

- **Testing, feedback, training:** Topic related workgroups are used to gather information on the experience and knowledge of laboratory- and scientific staff in the development process at an early stage. Workgroup members are encouraged to test newly implemented features and to share feedback on their experience with the solution to the developer team.
- **Communication extension:**
  - new message board feature to exchange information between users
  - new event notification feature
- **Security enhancement:** integration of a role-based authorization and access permission model based on the data security plan
- **DSGVO readiness:** integrate requirements of the DSGVO to avoid data abuse (person tracking, person profiling) in coordination with the works council and the data protection advisory board

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- **Device data handling, preview:** new feature to import rawdata from measurement devices into the database for often used file formats and a quick on-screen data preview
- **Data import extension:** new feature to import existing data from TUG-Online inventory and room management from CSV files (import and update)
- **Data export extensions:**
  - new feature prototype to create simple laboratory test reports in PDF format
  - new feature to export data and metadata export to TU-Graz repository using invenioRDM's restAPI (optional feature)
- **Booking calendar:** enhance existing feature for device- and workbench booking with a graphical booking calendar
- **Tutorials, end-user documentation:**
  - enhance feature to provide context related help directly in the web-application
  - provide introductory video-tutorial for the core features of the solution
  - workshops to train end-users (laboratory staff, scientific staff, administrators) on the solution

**Sustainability:**

- Open solution with modular structure that allows for future enhancements
- Export functions make use of open file formats well known in research
- Based on open source software (FOSS) to minimize licensing issues in further development
- Further development at IMBT/TVFA
- Further development at Institute of Biomechanics (Biomech)
- The solution can be used as a basis of a follow-up project but also as a spin-off

**General remarks:**

New features and feature enhancements shall bring the solution to a robust pre-production state, yet versatile and open for future enhancements.

**Key Resources:***What Key Resources do our Value Propositions require?**Our Distribution Channels? Customer Relationships?**Impact – Results – Sustainability?***Resources**

- Developer team (IMBT/TVFA and Biomech)
  - 3 developers (students)
- Contributors from other institutes
  - laboratory staff and scientists from Institute of Biomechanics (Biomech)
  - scientist from Institute of electron microscopy and nanoanalysis (FELMI-ZFE)

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- scientist from Institute of solid state physics (IF)
- iRODS (Cyverse)
  - data export target for scientific research
  - access to the iRODS server via icommands
- Database/File server
  - virtual machine running on KVM-host used to host the webserver, file and database services
- Open source software (postgresql, apache2, python, Django, gunicorn)
  - postgresql used to host the database-backend of the solution
  - apache2 used to host the web-frontend
  - python programming language for all kind of tools needed along the development process
  - Django web-framework (based on python) is the main tool to create the web-frontend and the database-backend
  - gunicorn acts as a localhost web-server to provide the web-frontend (behind apache2 reverse-proxy)
- Existing data
  - material information from an existing MS Access database
  - TUG-Online inventory and room management

**Distribution channels**

- The web-based software solution is deployed for all collaborators as a demo/test version on the application server of IMBT/TVFA.
- The second value we create are end-user documentation and training. It is planned to distribute this value in form of workshops and training sessions.

**Key Activities:***What Key Activities do our Value Propositions require?**Our Distribution Channels?**Customer Relationships?**Impact - Results - Sustainability?*

Key activities are divided into two parts. Activities needed to maintain and supply the solution to our customers and activities related to the new features we plan to implement.

**Maintenance and supply:**

- Maintain database/file server
  - update operating system and software
  - implement and update IT security measures
  - platform for tests and demonstration of the solution
  - continuous deployment of the latest working version

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- main distribution channel of the solution for the customers
- Maintain eLearning toolbox
  - update content (presentations, information about the project)
  - main communication channel with the public area
- Project management
  - start project with a project management workshop (project organization)
  - write **project handbook** (a guide to the entire project work and organization)
  - milestone meetings (project controlling)
  - create intermediate report and end-report for the RDM Team
- participation in Marketplace Barcamps
  - provide information about the project in the form of interviews
  - end project with a project closing workshop (lessons learned)

**Activities related to new features:**

- Topic related workgroups
  - define topics for workgroups
  - ask laboratory staff and scientists to participate in workgroups
  - establish communication channels
  - planning meetings, debug- and training sessions
  - documentation of workgroup outcomes and information required for the software development
- Implementation of new features
  - features: device data handling and preview, message board and notifications, booking calendar, role-based authorization and permissions, CSV import, report prototype, export to repository
  - plan implementation of required features (developer workshops)
  - write and debug code
  - present new features to end-users, incorporate feedback
- DSGVO readiness
  - gather required information from workers committee and data protection advisory board
  - create data security plan
  - create an implementing directive for the software development
  - implementation, assessment and testing
- Training, tutorials
  - preparation and planning of training sessions, train laboratory staff and scientists
  - create introductory video-tutorial (user interface)
  - create contents for context help (user interface)

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**Key Partners:***Who are our Key Partners?**Who are our key supporters?**Which Key Resources are we acquiring from partners?**Which Key Activities do partners perform?***Partners:**

- RDM Team
- BioMech
- FELMI-ZFE

**Supporters:**

- Laboratory staff and scientific staff (IMBT/TVFA)
- Laboratory staff and scientific staff (BioMech)
- Scientific staff (FELMI-ZFE)
- Scientific staff (IF)

**Activities:**

- BioMech: participation in the project team
- RDM Team: outreach, money, networking
- FELMI-ZFE: supply information on required features, testing, feedback
- IF: consulting and feedback

**Cost Structure:***What are the most important costs inherent in our business model?**Which Key Resources are most expensive?**Which Key Activities are most expensive?***Most important costs:** developer team, 100% of the project costs**Most expensive activities:**

- gathering information from topic related workgroups
- implement device data storage and preview
- design and implementation of a role-based authorization and permission model

Beside the funding from RDM Marketplace additional inkind is needed to perform all the activities we planned. This additional inkind is supplied by the collaboration partners (IMBT/TVFA, BioMech) and is at an amount of at least € 15.000,-- (globally paid working hours and money from the institutes for the project employees).