Common access policy and catalog design

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Abstract

Common access policy and catalog design results are summarized here to describe the main design choices and constraints for the development and use of a platform through which pilot line services and green & digital tools are provided. Organized PL/GDT services constitute a novel, interesting form of university-industry collaboration that may also be an effective way to realize test before invest services typically requested from (European) Digital Innovation Hubs. The design and policy choices described in the deliverable are designed to facilitate and sustain this collaboration and constitute a “minimum viable design” for an online catalogue of PL/GDT (Pilot Line / Green & Digital Tool) services.

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Abbreviations

Abbreviation	Explanation
DIH	Digital Innovation Hub
EDIH	European Digital Innovation Hub
GDT	Green and Digital Tool
LUT	Lappeenranta University of Technology
PL	Pilot Line
PL/GDT	Pilot Line or Green and Digital Tool
SIE	Sustainable Industry Ecosystem
SIX	Sustainable Industry X
SME	Small and medium-sized enterprise
WP4	Work Package 4

Table of contents

List of Figures

List of Tables

1 INTRODUCTION

This deliverable discusses common access policy and catalog design of SIE project results. It summarizes the main design choices and constraints for the development and use of a platform through which pilot line services and green & digital tools are provided. These are commonly provided by research institutions by opening access to their research infrastructure as services to industry and constitute a novel, interesting form of university-industry collaboration. The design and policy choices described in the deliverable are designed to facilitate and sustain this collaboration and constitute a "minimum viable design" for an online catalogue of PL/GDT (Pilot Line / Green & Digital Tool) services. First, to provide context the project and the role that this deliverable has in it are both described in the following.

1.1 Project overview

SIE (Sustainable Industry Ecosystem) is a two-year research project supported by the Academy of Finland. The SIE project consortium integrates the expertise of six core partners: Tampere University, Tampere University of Applied Sciences, VTT, LUT University and University of Vaasa. SIE project's partnership network will support the strengthening of internationally competitive competence centres and business ecosystem in Finland by new collaboration possibilities in developing novel cross-domain product-service concepts that will give a boost to Finnish business. The international collaboration is used to strengthen the competence centres and business ecosystem further. The main aim is to increase the presence of Finnish academia and industry in international collaborative projects.

The mission of the SIE project is to support Green, Circular Economy oriented, and Sustainable Digital Transformation of Finnish Manufacturing SMEs, by linking existing ecosystems and pilot lines, integrating digital platforms and DIHs at a service of cross-border large scale experimentations, and by enriching previous results in the domain of Industry 4.0 with innovative green and digital applications and open platforms.

The scaling up of technologies is supported by the networking of pilot lines with transparent and common access policy and toolsets for realising green and digital product-service solutions cross-sector. The project will engage the Finnish research, development and innovation community, enhancing it with strong international collaboration aiming to promote knowledge-driven green and digital innovation, and release the full potential of macro-regional collaboration.

1.2 Purpose of the deliverable

This deliverable of *WP4 Pilot Lines and Green & Digital toolboxes* is a main outcome of tasks *4.3 Catalogue of pilot lines* and *4.4 Development of access policy*. It compiles and summarizes the relevant information generated within the project regarding the recommendations for designing, developing, and managing a platform that facilitates better access and utilization of extant pilot lines and green & digital tools among the digitalizing industry.

The main purpose of work package 4 is to collect information on the available and relevant pilot lines, green and digital tools as well as necessary service offerings. This information was designed to be collected via web survey, followed by categorization of the information for ease of discovery and creating mechanisms for keeping the information up-to-date via catalog. Finally, WP4 develops common access policy that together with the publication of the catalogued and mapped information enables easy discovery, transparent access and affordable use of green & digital tools, services and pilot lines for Finnish manufacturing & energy industry. Together with the prototype catalog published in the SIE final seminar (and annexed to this deliverable) on the 8th of December 2022 this deliverable represents the main results of the work package 4.

1.3 Methodology

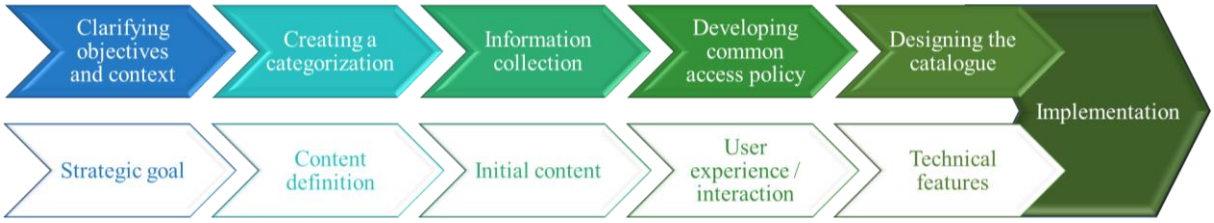

Figure 1. Methodology overview

In 2021, the process started by clarifying objectives and context within the consortium to have a clear, shared understanding of the purpose of cataloguing the pilot lines and green and digital tools by focusing on the desired impact: to facilitate the digitalization and greening of Finnish industry SMEs through better utilization of national research infrastructures and capabilities. A crucial first step here was defining the key terminology for pilot lines and green and digital tools in line with the stated objectives and industry context of the SIE project. The research consortium came together in a workshop to discuss and agree to the definitions (found in start of chapter 2) as they encompass the industry focus (manufacturing and energy) of the project partners as well as the focus of the SIE mission on industry renewal and innovation.

Still in 2021, the following phase was to create a categorization and data structure for the PL/GDT data that would be collected where an internal workshop between the SIE partners was used to gather input from the consortium partners, who each had strong experience of university-industry collaboration. This phase essentially defines the content by establishing what are the relevant aspects and dimensions of PL/GDT to collect data on and that could be also used for filtering, analyzing, and sorting the offerings in aggregate. The outcome of this phase results in the definition of data that is associated with each PL/GDT that includes information on e.g. the targeted customers, markets and customer processes, the service offering, the underlying technology as well as skills & capabilities. This content definition functioned as the basis for developing a survey tool for information collection on a national level that was implemented in late 2021 using the Webropol online survey tools. The survey was directed to an initial group of contacts that represented a comprehensive intersection of the Finnish research ecosystem. They were chosen as respondents as they have research infrastructures and capabilities that enable the offering of PL / GDT services to Finnish SMEs. The primary contacts included higher education institutions, science agencies & research organizations, regional development agencies & local science parks, as well as national Digital Innovation Hubs and European Digital Innovation Hub candidates. Following a phase of 3 months of information collection with the survey, the initial content of 24 PL/GDT was established, concluding the initial collection phase at the end of 2021. By then, the survey was sent to 230 recipients from which 117 opened the survey and 27 started answering the survey, eventually yielding 24 completed answers. The effective response rate was therefore 10,4 percent. The online survey tool is kept alive and disseminated for the remainder of the project lifetime, until end of 2022, to collect the maximum amount of PL/GDT entries to the catalogue.

With the initial content collected the next phase was the concurrent development of the common access policy and the catalogue design, finally published as this deliverable. The first digital platform (hereafter online catalog) workshop was held in January 2022. The starting point was that the online catalog should contain PL / GDT in an easy-to-browse and open format, reflecting the overall goals and mission of the SIE project. The open-ended co-creation workshop was for exploring boundaries and requirements, interpreting the project goals and estimating the current situation, content analysis and results in need statements. Through these, the purpose of the online catalog was defined as facilitating the digitalization and greening of Finnish industry SMEs through providing easy discovery, transparent access and affordable use of a comprehensive set of national research infrastructures. This was specified down to a set of four stated goals as shown in the figure 2 below.

The second online catalog workshop was held four months after the first one as it was to validate the results from previous workshop and for gap filling. The workshop showed that the interaction between the more technical design guidelines and the parts of the common access policy was difficult to outline on the basis of separate elements. We learned that there

is a need for a cohesive draft that allows for better feedback. The development of the policy and guidelines will continue iteratively from now on with the help of mock-ups, in the next step, in addition to developers and researchers, feedback will be sought from business actors (actual users). This will include rapid prototyping and experimentation, which will accelerate and concretize development through feedback.

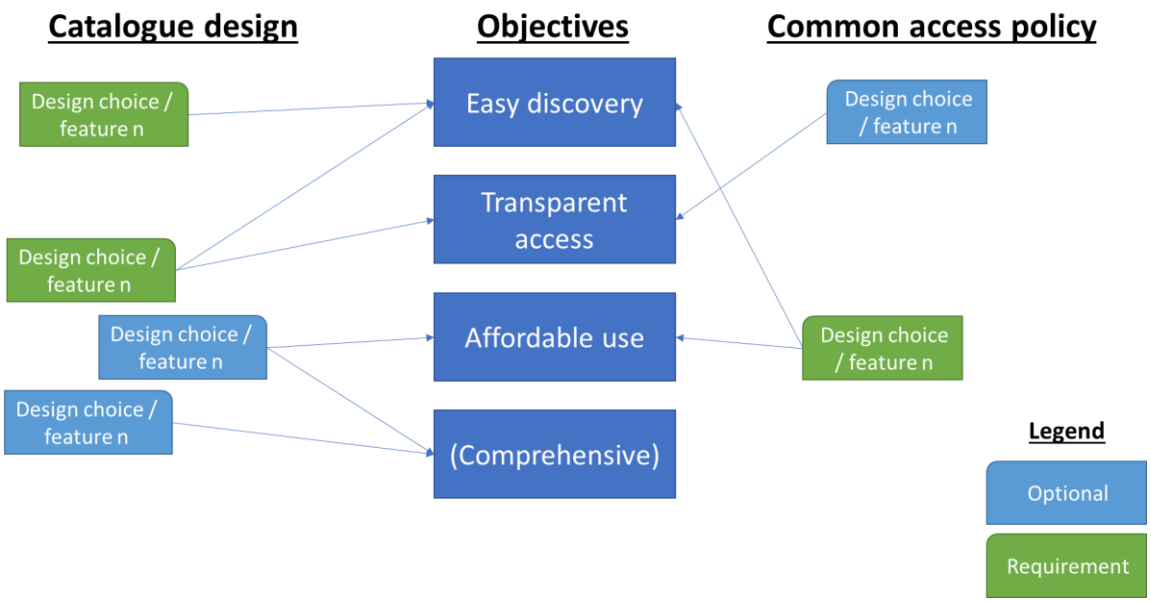

Figure 2. Objectives for the common access policy and online catalogue design

During the project a prototype of the online catalogue will be developed and populated by a collection of about 30-40 service offerings from across the Finnish research and higher education sector. This will be used to validate the results of the design process and provide the basis for future full-fledged implementation and iterative development through e.g. a European Digital Innovation Hub organization.

1.4 Structure of the deliverable

The deliverable is structured into four sections that address the common access policy from different viewpoints. Section 2 *Common access policy* contains variety of definitions regarding the developed common access policy, including different examples of interactions, roles and responsibilities, and the sustainability point of view for the platform. Section 3 *Catalog specification* outline the specification for the technical implementation of the catalog. Finally, section 4 provides the conclusions that respond to the objectives set for this deliverable.

2 COMMON ACCESS POLICY

This chapter formulates a common access policy that defines key governance issues for the platform by outlining the interaction between the digital platform and its stakeholders, establishing the processes, roles and responsibilities of the different groups as well as the steps to ensure the continuity and sustainability of the platform itself.

Definition of a pilot line:

> *"A pilot line is a pre-commercial ('test before invest') production or prototyping environment, physical or virtual that enables learning through experimentation in new product, service and business development."*

Definition of green and digital tools:

> *"Green and digital tools are tools and services that enable, accelerate and promote information-based innovation & sustainability in the energy and manufacturing industries."*

2.1 Stakeholder group definition

The SIE online catalogue is designed as a open and public digital platform that provides access to PL/GDT services to industrial SMEs in the manufacturing and energy sectors. As the services are built on servitizing existing research infrastructure that is governed by research institutions it facilitates new and deeper university-industry relationships. Individual instances of cooperation between SMEs and universities alone are not enough but need other actors beside - an ecosystem or platform to share knowledge, technology solutions and best practices. Ecosystems and digital platforms provide the necessary scaffolding for continued collaboration that is needed to scale and sustain higher levels of university industry collaboration. **Having an ecosystem and/or platform in place** provides the reasonable expectation of recurring demand for new university services thereby incentivizing the development and provision of those services (similar to solving the chicken-egg problem

found in other platform economies, see e.g. Parker & Van Alstyne, 2016). On the other side of the platform, companies have a lower threshold to exploit those services as they are better defined and communicated. In practice, this necessitates an understanding of the wide and complex range of induvial moments of interaction, not only between customer and provider (Aarikka-Stenroos & Jaakkola, 2012), but also with other actors (Hartmann, Wieland, & Vargo, 2018) participating in creating, delivering, or capturing the value (cf. Teece 2010), in service interactions (Vargo & Lusch, 2016).

In order to design the common access policy and the requirements for the catalogue, an identification and mapping of stakeholder groups and their key interactions with and around the platform needs to be done. The core interaction facilitated by the catalogue takes place between research institutions and industrial SMEs as principal providers and customers of PL/GDT services. Other relevant stakeholder types include industry associations, regional development agencies and Digital Innovation Hubs that help the platform to gain and sustain members and customers through active dissemination and promotion in their networks as well as by offering complementary services that can be bundled with PL/GDT offerings.

Table 1. Core stakeholder groups

Stakeholder	Motivation	Value gained and offered
Research institution	Closer industry links	Gains industry contacts, offers PL/GDT and associated expertise as service
SME	Specific development need	Gains expertise and infrastructure access, offers data (and payment)
Industry association	Developing innovation and competitiveness for members	Gains in ability to serve members, offers a channel for PL/GDT services
Regional development agency	Cost effective way to support regional companies	Gains useful services to offer to regional companies, offers access to the regional company network and complementary services
(European) Digital Innovation Hub	Promoting more active use of innovative services	Gains in ability to serve customers, offers channel for PL/GDT services and legitimacy

2.2 Stakeholder interaction processes

The key interactions between the provider and user form the core value creating loop facilitated by the existence and features of the platform. These are described in the following, thus outlining the most essential interactions that must be the starting point of developing and designing the catalogue for PL/GDT.

Beyond basic interactions, further interactions could be envisaged in advanced iterations. For instance, the ability to digest and **dynamically update data on offerings from external** websites, databases or other parallel providers would help to ensure the further comprehensiveness and timeliness of the information and support formation of large ecosystems. In practice, finding a common structure and format of representation and metadata assigned to the information and agreeing on interfaces and integration will be required to enable this and may involve case-specific integration efforts for each external information structure connected to.

2.2.1 Provider – adding an offering

Generally speaking, an online marketplace or catalogue that allows service providers to add offerings typically provides a simple and straightforward process for adding new services to the platform. From the service provider's viewpoint, the process should be intuitive and easy to use, with clear instructions and prompts to guide them through the process. For the online catalogue of PL/GDT services the key is that providers may **self-submit information** in a way that produces comprehensive and comparable descriptions of services.

To add a new service offering, the service provider will need to provide a description of the service, including details such as the name, categories or tags, and any relevant images or videos. To achieve comprehensive and comparable descriptions, the process queries the provider with preset categories of information, some of which are mandatory to provide to set **a minimum level of description quality** across the catalogue. Optimally this can be used to build a database of PL/GDT from which publicly visible content is dynamically created without need for manual work. Once the service has been added, it should be thus immediately visible to potential customers on the platform and available for booking or purchase.

The service provider will need to create a **profile or account on the platform**, which may involve providing personal and contact information and setting up a username and password. Once their account is set up, the service provider can access **a dashboard or control panel** that allows them to manage their offerings and track the performance of their services.

2.2.2 Provider – editing or removing offering

To edit an existing service offering, the service provider will need to access their dashboard or control panel on the platform and locate the listing for the service they wish to edit. From there, they can make changes to the listing, such as updating the description, attributes, or images, and save the changes when they are finished.

To remove a service offering, the service provider will also access their dashboard or control panel and locate the listing for the service they wish to remove. They may then have the option to delete the listing permanently or to mark it as "unavailable" or "inactive," which will prevent it from being visible to other users on the platform.

In either case, the service provider should be able to make the necessary changes quickly and easily, **without the need for extensive technical knowledge** or assistance. The platform should also provide clear confirmation of the changes that have been made, to ensure that the service provider has a clear understanding of the status of their offerings.

2.2.3 User – doing a search

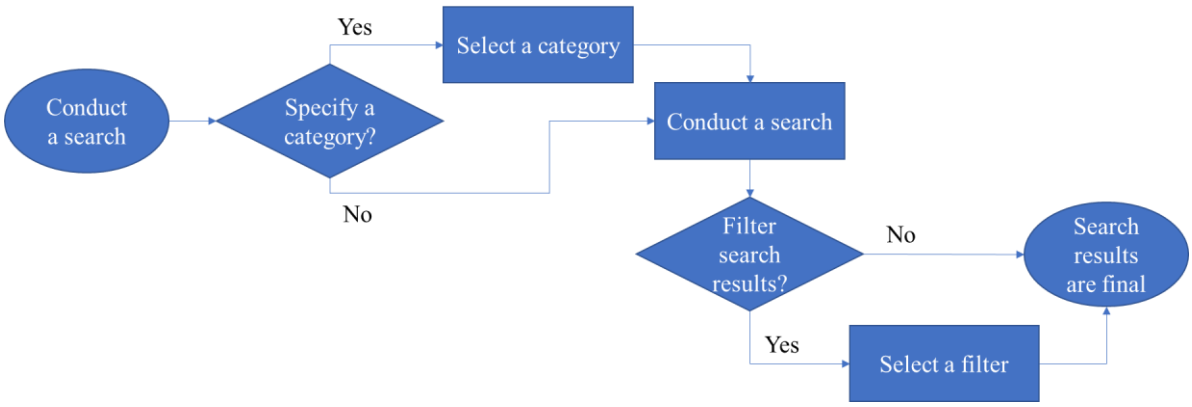

Figure 3. Simplified user process for search

A generic search function for an online portal or catalogue allows users to enter keywords or phrases into a search bar and then displays a list of results that match the search terms. The user can refine the search results by applying **filters or sorting options**, such as by relevance, date, or alphabetical order. Some portals may also offer advanced search options, such as the ability to search within a specific category or to specify the type of content (e.g., articles, images, videos) to be included in the results. When a user conducts a search for finding a PL/GDT fitting their needs, they can focus the search by specifying a filtering category at the beginning of the search, and focus only on e.g. simulation tools. With or without the selection of a category, the user is provided with search results.

From the user interaction viewpoint, the search function should be easy to access and use. This typically involves placing the search bar prominently on the portal's homepage or making

it available through a menu or search icon. Conducting a **simple search** should not require any registration or logins to the portal to keep it accessible. The search bar should also be clearly labeled and include instructions for using it, if necessary. As the user types their search terms, the portal may offer suggestions or auto-complete options to help them find what they are looking for more quickly.

Once the search is submitted, the portal should display the results in a clear and organized manner, with each result including a brief summary or excerpt of the content and a link to the full version. The user should be able to easily scan through the results and click on the ones that are most relevant to their needs. If the search does not yield any results, the portal should provide suggestions for alternative search terms or offer other options for finding the desired content.

2.2.4 User – contacting

Once the user has successfully found and selected the service and service provider from the catalogue, they will need to contact the service provider. At its simplest, a catalogue may only display the contact information for the selected service (as is the case in the SIE prototype catalog). Further advanced iterations may go further to provide e.g. templates and forms for ensuring comprehensive and **well-structured service requests** to the PL/GDT service providers.

2.3 Sustainability

The development of the policy and guidelines will continue iteratively from now on with the help of mock-ups, in the next step, in addition to developers and researchers, feedback will be sought from business actors (actual users). This will include rapid prototyping and experimentation, which will accelerate and concretize development through feedback. This will be used to validate the results of the design process and provide the basis for future full-fledged implementation and iterative development through e.g. a European Digital Innovation Hub organization.

2.3.1 Management responsibility

The primary exploitation of the prototype PL/GDT catalogue, the data on the services presented within and the common access policy guidelines will initially happen through the Sustainable Industry X (SIX) initiative and the instruments associated with that ecosystem. The results are **open and public**, so any other organization may freely utilize them as well.

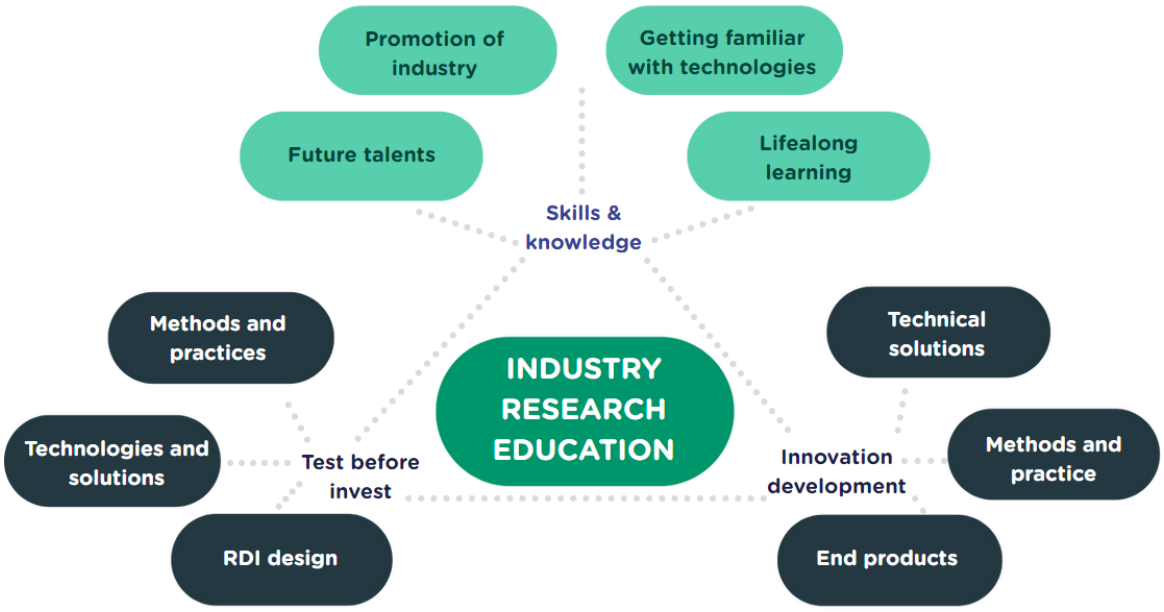

Figure 4. SIXLabs concept[1] of utilizing PL/GDT as part of EDIH activities

SIX has applied for and received a seal of excellence for the implementation of a European Digital Innovation Hub (SIX EDIH[2]), where the topic is further developed under the title of SIXLabs (see Figure 4. for a summary) to effectively provide access to test before invest services and innovation and skills development utilizing existing PL/GDT offerings. In order to utilize the catalog as the backbone for the EDIH service provision, it will need to be further developed to transform it to a dynamic tool that is integrated with external data sources to construct the catalog content and **dynamically update it** without need for manual intervention. This will be a key development in the case of SIX EDIH gaining long-term funding that will allow scaling it up from the concept level to full operational status.

2.3.2 Further development and uptake

Other possible directions for further development of the catalog and the model of its exploitation can result from becoming more central to supporting a growing ecosystem of stakeholders that actively utilize and interact with PL/GDT as part of their innovation activities. First development needs in such situations will likely relate to adding specific integrations and interfaces to connect to further data sources or specialized channels of service provision. Building on those links, a possible further step will be to **collect, monitor and analyze data** on service provision and consumption, and network analysis of the stakeholders and involve them in co-creating new services and ways of interaction to extend the role from a passive

[1] https://www.six.fi/sixlabs

[2] https://www.six.fi/edih

catalog to a more comprehensive innovation enabling platform.

The concepts presented here are **technically expansible** (with varying degrees of effort) without major barriers to fit the need of the ecosystem adapting them. Therefore the uptake and development is mainly dependent on the needs of the ecosystem and managerial constraints such as securing funding and commitment from stakeholders.

3 CATALOG SPECIFICATION

Recommendations concerning the implementation of the online catalogue can also be drawn from the stakeholder requirements towards it that contribute to the technical decisions taken in setting up the PL/GDT catalogue as a dynamic online offering listing. There are a number of technical requirements that are typically necessary for hosting any online catalog or marketplace of services, including:

1) A domain name: This is the web address that users will use to access the catalog or marketplace.
2) Web hosting: This is the service that stores the website's files and makes them accessible to users on the internet. The costs of hosting must be allocated in a long-term sustainable manner that is independent of e.g. frequency of use of the catalog.
3) A content management system (CMS): This is the software that allows the catalog or marketplace to be easily managed and updated.
4) A database: This is where the catalog or marketplace's data is stored, such as information about the services offered, pricing, and customer reviews.
5) A payment gateway: This is the system that handles online transactions and payment processing, allowing users to purchase services through the catalog or marketplace.
6) A user login system: This allows service providers and customers to create profiles and access their accounts on the platform.
7) Security measures: These may include measures such as SSL certificates, which encrypt data transmitted between the website and users, and firewall protection to prevent cyber attacks.
8) Marketing tools: These may include tools such as email marketing software and social media integration, which can be used to promote the catalog or marketplace and attract customers.
9) Analytics and tracking: These tools allow the catalog or marketplace's performance to be monitored and analyzed, providing insights into user behavior and helping to optimize the website's performance.

From these, some appear more salient than others. As the PL/GDT catalog is provided by a third party that functions as an intermediary for customizable B2B services, **delegating responsibility for payment and detailed contracting** to the providers (possibly supported by offering default contract templates as a starting point) will help to both simplify the implementation of the catalog and to promote the neutrality and trustworthiness of the catalog. Likewise, marketing tools may be expected to reside with the ecosystem in which the catalog is embedded and not necessarily developed as part of the catalog implementation.

Another key decision is in the approach to user management. While having users register and login before being able to interact with the catalog will provide the best possibility for analytics and tracking of their interactions and behavior, but will likely already impose a threshold to dissuade initial experimentation and exploration of the catalogued services. Due to this, going for **login-free use** of the catalog (basic services) is recommended as the value of the catalog as a platform is heavily dependent on network effects, i.e. number of users and service providers actively interacting with it.

3.1 User experience: search, filter and other key functions

There are several technical aspects or requirements that are key for providing an optimal user experience for an online catalogue of services, including:

1) Responsive design: The catalogue should be designed to be responsive, meaning that it should adapt to different screen sizes and devices in order to provide a seamless experience for users.
2) Fast loading times: The catalogue should load quickly and efficiently, with minimal delays or loading issues. This can be achieved through techniques such as optimizing images and other assets, using caching, and minimizing the amount of data that needs to be transmitted.
3) Easy navigation: The catalogue should be easy for users to navigate, with a clear and intuitive structure and menu options.
4) Search functionality: The catalogue should include a search function that allows users to easily find the services they are looking for, with options such as keyword search, filters, and sorting.
5) Mobile-friendliness: The catalogue should be mobile-friendly, meaning that it should be easy to use on mobile devices and provide a similar level of functionality as on desktop computers.
6) **Accessibility**: The catalogue should be accessible to users with disabilities, including those using assistive technologies such as screen readers.

7) Security: The catalogue should be secure and protect user data from potential threats, such as cyber attacks or data breaches.
8) **Personalization**: The catalogue may include features that allow users to customize their experience, such as by saving favorite services or receiving recommendations based on their past behavior.
9) User feedback and support: The catalogue should provide users with ways to provide feedback and get support, such as through a contact form or live chat function.

3.2 Links, integrations and interfaces

There are several essential issues to consider when implementing links, integrations, and interfaces to external sites, services, or databases:

1) Security: It is important to ensure that any links, integrations, or interfaces are secure and do not expose sensitive data or systems to potential threats. This may involve implementing measures such as encryption and authentication to protect data transmitted between the sites or services.
2) **Data privacy**: It is important to ensure that any links, integrations, or interfaces respect users' privacy and comply with relevant laws and regulations, such as the General Data Protection Regulation (GDPR) in the European Union.
3) User experience: It is important to consider how the links, integrations, or interfaces will affect the user experience and whether they will be seamless and intuitive for users to use.
4) **Compatibility**: It is important to ensure that the links, integrations, or interfaces are compatible with the systems and platforms they are being integrated with, and that they function as intended.
5) Maintenance and support: It is important to have a plan in place for maintaining and supporting the links, integrations, or interfaces, including addressing any issues that may arise.
6) Legal and contractual considerations: It is important to carefully review any agreements or contracts that may be required to implement the links, integrations, or interfaces, and ensure that they are legally enforceable and in compliance with any relevant laws or regulations.
7) Performance and scalability: It is important to ensure that the links, integrations, or interfaces are performant and can scale as needed, particularly if they are expected to handle a large volume of traffic or data.

3.3 Dynamic updates and open data

To provide dynamically updating content based on open data for an online catalogue of services, the following technical features or user policies may be needed:

1) Data sources: The catalogue will need to be connected to one or more open data sources that provide the content to be displayed. These sources may include APIs (Application Programming Interfaces) or other types of data feeds.
2) Data parsing and transformation: The catalogue will need to be able to parse and transform the data from the open data sources into a format that can be displayed on the website. This may involve using a programming language such as Python or Java to extract and transform the data.
3) Data storage: The catalogue will need a way to store the data locally, such as in a database or file system, in order to display it to users.
4) Data caching: To improve performance and reduce the load on the open data sources, the catalogue may implement data caching, which stores a copy of the data locally and serves it to users from the cache rather than fetching it from the open data source each time it is requested.
5) User policies: The catalogue may need to implement policies around how the data is used and displayed, such as by requiring users to attribute the data to the original source or by limiting the amount of data that can be accessed by each user. These policies may be based on the terms of use or licensing agreements for the open data sources.
6) Data visualization: The catalogue may include tools or features for visualizing the data in different ways, such as charts, maps, or graphs, in order to make it more accessible and understandable to users.
7) Data updates: The catalogue will need a mechanism for regularly updating the data from the open data sources, in order to keep the content current and accurate. This may involve using a scheduling system or triggering updates based on changes to the data.

4 CONCLUSION

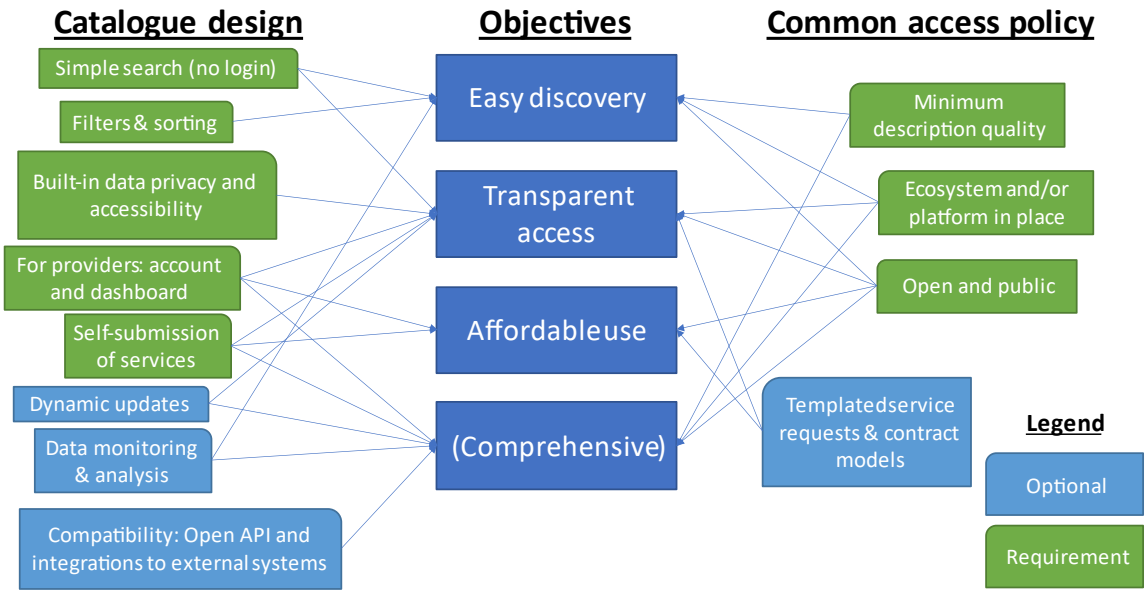

Figure 5. Summary of key design and policy choices for PL/GDT catalog

In conclusion, figure 5 summarizes the main design choices and constraints for the development and use of a platform through which pilot line services and green & digital tools are provided. The proposed choices and features are divided into requirements and optional features that generally correspond to desirable development targets in versions beyond the first implementation. Generally, it is also found that the catalog may be developed and implemented in stages to quickly iterate on each version with stakeholders. The first static implementation with a representative set of data and its representation is found annexed here. Full implementations of the catalog would necessarily be interactive online platforms that work to ease the discovery of PL/GDT services, bring transparency to their utilization, lower the associated costs for all participants and offer a comprehensive representation of the available services on the national level. An optimal candidate to oversee the development and implementation of such a platform would be for instance, a European Digital Innovation Hub like SIX EDIH.

ANNEX A PROTOTYPE CATALOG OF PL/GDT

SIE Sustainable Industry Ecosystem

Catalogue of Pilot Lines and Green & Digital Tools

What are Pilot Lines and Green & Digital Tools?

- Pilot Line is a pre-commercial ('test before invest') production or prototyping environment, physical or virtual that enables learning through experimentation in new product, service and business development

- Green & Digital Tools are tools and services that enable, accelerate and promote information-based innovation & sustainability in the energy and manufacturing industries

How to use the catalogue?

- ***Description*** describes what the pilot line or green & digital tool is for, and what is possible to accomplish with it
- ***Benefits*** describes how the customer is able to utilize the pilot line or green & digital tool, and the key benefits generated to the customer
- ***Type of the Pilot Line/Green and Digital Tool*** describes how the pilot line or green & digital tool is offered to the customer (e.g. as a technology, as a solution or as a service)
- ***Prerequisites for use*** describes what kinds of specific prerequisites are needed from a customer to utilize the pilot line or green & digital tool
- ***Contact information*** for the owner and/or person responsible for the pilot line or green & digital tool
- ***Links*** to the pilot line's or green & digital tools' website for additional information

Background

- Catalogue of Pilot Lines and Green & Digital Tools contains nationally collected and voluntarily reported Pilot Lines and Green & Digital Tools
- Pilot Lines and Green & Digital Tools are available for customers with certain prerequisites
- Current version of the catalogue has been published 8.12.2022
- Project has received funding from the Finnish Academy of Science research and innovation programme under grant agreement No. 337722

Directed Energy Deposition Pilot Line

Description

In recent years, additive manufacturing has brought a new option to manufacture and repair metal products. The directed energy deposition (DED) pilot line offers a versatile opportunity to test the possibilities of different methods.

The equipment includes both arc methods and laser-based methods. Directed energy deposition devices are connected to industrial robots or machine tools, so even industrial-scale tests are possible.

Benefits

The equipment are suitable for versatile experiments with different materials and also for making real pieces. Both AM and cladding processes are possible.

The results of the processes can be analyzed in a variety of ways using the university's research equipment. The customer receives validated information about the process and its outcomes, which it can use to develop its own processes.

TRL

Pilot line available for research collaboration and business use

Links

https://www.tuni.fi/en/research/coating-techniques#switcher-trigger-resources

Type of the Pilot Line

- Application
- Demonstrations
- Testing facility

Prerequisites for use

- Access fee
- Case specific

Keywords

Directed energy deposition, DED, Laser, Cladding

Contact information

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Composite Processing Lab

Description

Composite processing lab is the laboratory premises for developing advanced composite materials and demo parts. The premises include a synthesis room for 1-100 g polymer synthesis and fibre surface treatment solutions, lamination and adhesive bonding room with vacuum systems, infusion pumps, and ovens, and thermoplastic compounding and hot press systems hall that works in conjunction with the pilot line of thermoplastics processing. The in-house raw material storage is kept valid for around ten sqm of general-use carbon, glass and flax reinforcements as well as corresponding amount of epoxy and bio-epoxy resins for 20-50 fV% laminate development.

Benefits

Composite processing lab at Tampere University offers customers highly tailored research and development possibilities for trial run processing of composite laminates, fibre sizings and coatings, adjusted resin and compound chemistries, bio-additives, and also numerical (finite element) analysis related to the customer needs and targets. A specialty of the Composite processing lab is the tooling and knowledge of adhesive bonding. The direct connections to laboratories and pilot lines at Tampere University allows fast and efficient use of mechanical and fracture testing, thermal analysis, and fibre-matrix micro-scale testing for new composite materials or repairs and replacement purposes.

TRL

Pilot line available for use

Links

https://www.tuni.fi/en/research/plastics-and-elastomer-technology

Type of the Pilot Line

- Demonstrations
- Service
- Software
- Testing facility

Prerequisites for use

- Case specific

Keywords

Composite processing

Contact information

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Thermoplastics' Processing Lab

Description

The environment allows processing of thermoplastic polymers (drying, mixing and compounding, injection molding, extruding, thermoforming), analysis of polymers' processability (rheological measurement) and characterization of polymer properties before and after processing (thermal, mechanical, chemical and physical properties). Research projects are done in collaboration with companies to study specific use cases.

Benefits

Companies can benefit from the versatile analysis and characterization techniques to support their own decision making, development or innovation actions. Further, the expertise of the University research group is available in joint projects.

TRL

Pilot line available for use

Links

https://www.tuni.fi/en/about-us/engineering-materials-science#switcher-trigger--research

Type of the Pilot Line

- Demonstrations
- Service
- Testing facility

Prerequisites for use

- Staff effort & resource allocation

Keywords

Extrusion, Injection moulding, Rotational moulding, Thermoforming

Contact information

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Cold Spray

Description

Cold Spray facilities at Tampere University offer several cold spray coating production methods. installation called the high pressure cold spray system (HPCS) is an advanced process for coating production and additive manufacturing. The low pressure cold spray system (Dymet403) as a portable process as well as the medium pressure cold spray system (Kinetiks300) and coaxial laser assisted cold spray process (COLA) are also available. In addition to coating production methods, a spray boo a robot with a turning table and the diagnostic camera (HiWatch HR2) for particle velocity and particle measurements. Coating and substrate materials can be metals, metal alloys, ceramics, compo s, plastics and mixtures of different materials.

Benefits

Coating production demonstrations, material and coating development, testing and process optimization can be done in the cold spray facilities, which can be useful for researchers, scientists, industrial and academic collaborations. Cold Spray offers coating production facilities with novel cold spray processes and supporting methods for various research projects, research and development. Cold spray coatings or cold spraying as an additive manufacturing can offer new solutions for industrial and academic challenges.

TRL

Pilot line available for use

Links

Type of the Pilot Line

- Demonstrations
- Service
- Solution
- Testing facility

Prerequisites for use

- Case specific
- Staff effort & resource allocation

Keywords

Cold spray, Coating production, Additive manufacturing, Cold spray Research and development

Contact information

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Robolab Tampere

Description

The RoboLab Tampere has been established to facilitate the learning process of both formal a formal education, and academia-industry R&D&I collaboration. The RoboLab Tampere operates wit similar principles as e.g., Fab Labs.

The RoboLab Tampere offers a place for students, researchers and industry presentatives to wo robotic equipment and experiment without major restrictions. Robots and related technology a example industrial manipulators, a multitude of sensors (2D/3D cameras, LiDAR, GNSS, IMU, etc.) an different processing platforms (PCs, embedded PCs, Raspberry Pi, Nvidia TX2).

Benefits

The RoboLab Tampere supports both formal and informal education and industry-academy collaboration in research. From the education perspective the robotics learning environment was developed to facilitate the learning process and to allow different robotics projects originating from industry to be carried out. From the society's perspective the accessibility and visibility to the environment was made as easy as possible yet ensuring the safety of the users.

TRL

Pilot line available for research collaboration and business use

Links

https://research.tuni.fi/robolabtampere/

Type of the Pilot Line

- Application
- Demonstrations
- Physical equipment
- Testing facility

Prerequisites for use

- Access fee
- Case specific
- Free for students
- Staff effort & resource allocation

Keywords

Human-robot collaboration, HRC, Industrial robotics, Collaborative robotics, Robotics safety

Contact information

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HRC Pilot Line

Description

The HRC Pilot Line is a reconfigurable advanced robotics R&D&I platform for academics and ind create and test ideas for the future Horizon Europe and national collaboration projects. In add will be place for vocational education for special equipment, robotics programming, virtualizat based methods.

The HRC Pilot environment supports both formal and informal education and industry-academy collaboration in research. From the education perspective the robotics learning environment developed to facilitate the learning process and to allow different robotics projects originating industry to be carried out.

Benefits

HRC Pilot Line is a reconfigurable advanced robotics and Digital Twins pilot line which enables rapid and cost-effective system configuration changes according to current industry and academy needs. Thus, HRC Pilot Line serves as showroom and testbed for companies from different manufacturing sectors to explore, test and validate possible novel solutions they could transfer to their own production site. This pilot line supports SMEs to adopt the fast fail-fast design cycle. Technologies in this environment include human robot collaboration, AR/VR applications, digital twins, machine vision, and the development of AI methods for object recognition and classification.

TRL

Pilot line available for research collaboration and business use

Links

https://research.tuni.fi/hrcpilotline/

Type of the Pilot Line

- Application
- Demonstrations
- Physical equipment
- Testing facility

Prerequisites for use

- Access fee
- Case specific
- Free for students
- Staff effort & resource allocation

Keywords

Human-robot collaboration, HRC, Industrial robotics, Collaborative robotics, Robotics safety

Contact information

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Virtual FMS

Tampereen yliopisto Tampere University SIE Sustainable Industry Ecosystem

Description

The challenge of education related to large technical systems is to provide enough experience. Virtual models and visualizations make it easier to explain the behavior of those systems. For [illegible] developed a Virtual FMS, that is a digital twin of the physical education environment, FMS Train[illegible] located in the [illegible] factory floor. Virtual FMS is a digital twin developed for educational purpos[illegible]

Benefits

The goal of the VirtualFMS is to make the engineering education interesting and efficient. The efficiency in learning can be improved by utilizing a mixed reality environments.

The education environment is an example of a typical FMS existing in several Finnish companies. The actual setups in companies varies in terms of needed resources, but the principles of the environments are similar. The environment has been scaled larger compared to actual physical environment to allow the introduction of a more complex manufacturing system and how the management software has been implemented to control the environment.

TRL

Pilot line available for education use

Links

https://research.tuni.fi/virtualfms/

Type of the Pilot Line

- Application
- Demonstrations
- Testing Facility

Prerequisites for use

- Case specific
- Free for students
- Staff effort & resource allocation

Keywords

Digital twin, Virtual FMS, Manufacturing, Training

Contact information

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Virtual FMS

Tampereen yliopisto Tampere University SIE Sustainable Industry Ecosystem

Description

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Benefits

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The education environment is an example of a typical FMS existing in several Finnish companies. The actual setups in companies varies in terms of needed resources, but the principles of the environments are similar. The environment has been scaled larger compared to actual physical environment to allow the introduction of a more complex manufacturing system and how the management software has been implemented to control the environment.

TRL

Pilot line available for education use

Links

https://research.tuni.fi/virtualfms/

Type of the Pilot Line

- Application
- Demonstrations
- Testing Facility

Prerequisites for use

- Case specific
- Free for students
- Staff effort & resource allocation

Keywords

Digital twin, Virtual FMS, Manufacturing, Training

Contact information

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Optical Measurements

Description

Optical measurements infrastructure is an entity for developing optical solutions to complex m
phenomena in demanding industrial applications. Answering to demanding industrial needs,
the next generation of machine vision by combining AI, novel imaging methods and optical inn
VTT develops customized spectroscopic devices and measurement solutions for online industr
measurements, diagnostics and handheld customer applications. Our clients include the pape
steel, food, agriculture and forest industries as well as other process and manufacturing indus

Benefits

We have unique facilities for the agile development and construction of prototypes enabling us to swiftly deliver complete optical instrumentation solutions from the laboratory phase to real environment. We have decades of experience and the expertise to combine diverse spectroscopic and machine vision measurement technologies to solve customers' needs in various fields, including the steel, mining, paper, defense and process and other process and manufacturing industries.

TRL

Pilot line available for research collaboration and business use

Links

https://www.vttresearch.com/en/ourservices/industrial-sensing-solutions

Type of the Pilot Line

- Application
- Demonstrations
- Service
- Solution
- Testing facility

Prerequisites for use

- Case specific
- Facilities
- Software & applications
- Staff effort & resource allocation
- Tools, instruments & equipment

Keywords

Spectrometers, Machine vision, Optical measurements, Characterization, Sensor integration

Contact information

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Materials Performance

Description

Platform is for gaining knowledge to understand failure and ageing mechanisms, quantify mat
performance, and predict component and structural behavior in operation targeting to develop
material solutions for extended lifespan and improved operational efficiency. Key technology a
equipment include powder piloting, metallography and microscopy, additive manufacturing, ce
materials, corrosion and water chemistry, tribology, destructive-and non-destructive testing and
capabilities for advanced materials modelling. The unit is located in Espoo and Tampere.

Benefits

Materials Performance (VTT) covers the whole lifecycle from material development to manufacturing and from operation and maintenance to ageing and lifetime extension. The target is to develop sustainable material solutions for extended lifespan and improved operational efficiency. The platform covers materials from metals and ceramics to cementitious materials and provides solutions for a wide range of industrial demands, from nuclear operation & waste, process & energy, marine & offshore industry, aerospace to civil engineering.

TRL

Pilot line available for research collaboration and business use

Links

https://www.vttresearch.com/en/ourservices/industrial-3d-printing

Type of the Pilot Line

- Demonstrations
- Service
- Software
- Solution
- Testing facility

Prerequisites for use

- Access fee
- Case specific
- Expertise, skills & capabilities
- Facilities
- Staff effort & resource allocation

Keywords

Materials modelling, Materials testing, Failure analysis, Additive manufacturing, Powder piloting

Contact information

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Metrology

Description

Reliable and accurate measurements are vital for global industry, commerce and safety. New r solutions and technologies benefit digitalization and the circular economy. VTT MIKES, the Nati Metrology Institute of Finland, realizes the SI units, performs high-level metrological research, develops measuring solutions in partnership with industry, and provides expert services and calibration equipment. The infrastructure includes several high-accuracy measurement systems located in high performa laboratory rooms and large flow facilities. The infrastructure provides most accurate measurem Finland. The platform is part of the European and global metrology networks EURAMET and CIP at the Espoo and Kajaani in Finland.

Benefits

VTT MIKES can help in validating measuring equipment, or when, for example, developing a measurement system or process for quality control. VTT MIKES provides the most sophisticated metrology laboratory environment for measurement related R&D and metrology. It provides high-level measurement innovations, capabilities and tools for demonstrating quality of measurements, and worldwide recognized measurements and calibrations.

TRL

Pilot line available for research collaboration and business use

Links

https://www.vttresearch.com/en/ourservices/vtt-mikes

Type of the Pilot Line

- Service
- Solution
- Technology licensing
- Testing facility

Prerequisites for use

- Case specific
- Expertise, skills & capabilities
- Facilities
- Staff effort & resource allocation
- Tools, instruments & equipment

Keywords

Metrology, Calibration, SI unit, Characterization, Quality, Measurement accuracy

Contact information

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Secured Connectivity

Description

The platform provides enablers for future 6G/5G and cybersecurity research and testing. It includes carrier-grade mobile network and separate Open RAN platform enabling performance and cybersecurity testin The environment enables end-to-end communication network testing, core network and service performance and energy efficiency testing, quality of service measurement and testing, and cyb testing of devices, services and connectivity. Infrastructure provides enablers to build proof-of-concept implementations and technology demonstrations combined with commercial solutions and testing of commer products. The application areas for infrastructure include, e.g., critical infrastructures, defense automotive, industrial systems, energy, smart cities, public safety, and health & wellbeing. The main site location are in Espoo and Oulu.

Benefits

Increasing digitalization has made connectivity and cyber security the fundamental requirement for societies and organizations. We assist our clients in utilizing efficiently new telecommunication solutions and preparing for cyber threats and develop efficient solutions for dealing with cyber risks. We have a solid background in solving cyber security and connectivity challenges, especially in the energy, industry and mobile telecommunications sectors.

VTT's Cyber Range and 5G test network environments enable cyber security testing of networks, devices and software. These environments expedite tangible experiments and provide new information about the performance and security of innovations.

TRL

Pilot line available for research collaboration and business use

Links

https://www.vttresearch.com/en/ourservices/cybersecurity

Type of the Pilot Line

- Demonstration
- Service
- Solution
- Testing facility

Prerequisites for use

- Case specific
- Expertise, skills & capabilities
- Facilities
- Staff effort & resource allocation
- Tools, instruments & equipment

Keywords

5G/6G, Cybersecurity, Connectivity, Mobile network, Radio access networks

Contact information

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Maturity Self-Assessment Tools

Description

Triplet of free maturity web tools for assessing position in digitalization, applying artificial inte or reaching Industry 4.0 or even beyond (VTT). A maturity tool is useful when an organization is progress towards a goal but does not know how to proceed. An effective tool will give a comm understanding of the necessary viewpoints, the current status and comparison to others. The t help to find the potential development areas and initiate the discussion in the organization. T self-assessment tools is available for commercial use in both Finnish and English. The AI maturi dedicated for EIT AI action, https://eit.aimaturity.vtt.fi/ is available in seven language EN, ES, FI , DE, IT, PL.

Benefits

Free of cost service, customers self-assessment of current state, comparison to other similar responses, future development planning. These web tools are available for assessment. After registration, the user will answer questions simply by selecting from the prewritten response options. The immediate result illustrates both the present state, the potential development needs and variation between other respondents. From the result diagram it is easy to pick potential development issues to proceed with the self-assessment, it is possible to have a results discussion or, workshop with VTT and even consider for further development projects.

TRL

Green & Digital Tool available for research collaboration and business use

Links

https://digimaturity.vtt.fi,
https://ai.digimaturity.vtt.fi
https://manumaturity.vtt.fi

Type of the Green & Digital Tool

- ce (AI)
- g-to
- Application
- Service

ll also
let of

Prerequisites for use

- Free use
- Expertise, skills & capabilities
- Software & applications

Keywords

Digitalization, AI, Industry 4.0, Maturity tool, Self-assessment

Contact information

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Bioruukki: Pressurised extraction and down stream processing

Description

Pressure reactor: 300 litre reactor, batch and flow through extractions, working pressure 20 bar, temperature range 200 ºC for pressurized hot water extraction (PHWE)
Supercritical fluid extraction (SFE) and supercritical fluid precipitation. Chemtur Engineering Supercritica Fluid Pilot Plant, capacity 0,5 kg, CO_2 or CO_2 combined with Ethanol, Ethanol-water
Membrane filtration: 2 x B1 tubular modules, one module: length 2.44 m, area 1.75 m^2, modifie membrane: pH 1-12, max pressure 30 bar, max temperature 80 ºC

Benefits

Bioruukki offers an easy and quick way to pilot new production processes and increase the refining and utilization rate of biomass. In Bioruukki, companies can do piloting and production effectively without having to build their own piloting equipment. Testing done in the pilot scale reduces the risks associated with the transition to actual production. Anticipating the production issues speeds up the process scaling up.

TRL

Pilot line available for research collaboration and business use

Links

https://www.luke.fi/en/expert services/bioruukki-piloting-center/

Type of the Pilot Line

- Piloting
- Service
- Technology licensing

Prerequisites for use

- Co-operation

Keywords

Pressurized Hot Water Extraction (PHWE), Supercritical Fluid Extraction (SFE), Membrane filtration, Cascade use

Contact information

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Biopaja: Solutions for the circular bioeconomy

Description

Biopaja is Luke's experimental facility in Jokioinen. In Biopaja, various solutions can be tested demonstrate the nutrient and organic matter recycling of different biomasses. Luke works with companies in developing and adopting recycled fertilizers, renewable energy and added value products. Biopaja services are customized according to the specific needs of each customer. Ex our services are e.g., biogas production research, manufacturing and utilization experiments fertilizers, pyrolysis experiments and research of pyrolysis products. Biopaja conducts research development projects in cooperation with universities, research institutions and companies.

Benefits

In Biopaja, the processing of biomasses into new valuable products by means of biogas, pyrolysis and nutrient recovery technologies, can be demonstrated in laboratory and pilot scale. Furthermore, Biopaja enables the assessment of varying processing chains and the production of multiple products from various biomasses and side streams. By cascading use of processing technologies, we can enhance the use of biomasses to get the most value out of them. Experiments on a laboratory and pilot scale ensure the effectiveness of processes and reduce investment risks.

TRL

Pilot line available for research collaboration and business use

Links

https://www.luke.fi/en/services/biopaja solutions-for-the-circular-bioeconomy

Type of the Pilot Line

- demonstrations
- Service
- Testing facility

Prerequisites for use

- Co-operation

Keywords

Circular bioeconomy, Nutrients, Biogas, Pyrolysis, Biomass processing

Contact information

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FeedPilot - Animal feed processing

Description

Feed ingredients tested can be processed prior mixing and pelleting of the feed. Pre steps can be grinding, heat treatments, extrusion, coating or encapsulation. After mixing the ingredients, further processed by pelleting, coating and cooling before packing and transportation.

Benefits

Luke's FeedPilot enables testing of different animal feed processing conditions on the quality of feed, specifically on the inactivation of antinutritional factors, digestibility of feed, lipid oxidation, protein denaturation, flavor and appearance and stability of feed supplements (e.g. enzymes, probiotics, vitamins). FeedPilot helps customers to test different feed processing approaches and conditions in pilot scale before proceeding to industrial scale production. The proximity to Luke's animal research facilities and laboratories enables further feed quality assessment by animal feeding trials and laboratory analyses.

TRL

Pilot line available for research collaboration and business use

Links

https://www.luke.fi/en/services/expertise areas/livestock-and-feed

Type of the Pilot Line

- Service
- Testing facility

Prerequisites for use

- Co-operation

Keywords

Feed, Processing, Pelleting, Quality, Stability

Contact information

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FoodPilot - Solution for processing healthy and safe food

Description

Luke's FoodPilot services include testing and optimization of food processes (for example extrusi heating, microbial and enzymatic processing), product development, recovery and batch produc bioactive compounds, scale up of separation processes from product development laboratory to pi production, scale down analysis of industrial production processes, as well as process and equi consulting. Also, services include laboratory analysis of samples: microbiological and chemica bioactive and functional properties, sensory evaluation.

Benefits

FoodPilot test facility in Jokioinen provides customers with access to equipment and services for food research and side stream upgrading. Process development and testing on a pilot scale enables new innovations and reduces risks associated with the transfer to actual production. Identifying possible bottlenecks in production beforehand speeds up the transfer of processes to industrial production. New processing technologies can be tested before making any investments. The material generated during test production enables comprehensive further studies.

TRL

Pilot line available for research collaboration and business use

Links

https://www.luke.fi/en/services/jokioinen foodpilot-new-food-technologies-to-support research-and-development

Type of the Pilot Line

- Service
- Testing facility

Prerequisites for use

- Co-operation

Keywords

Food processing, Fermentation, Drying, Heating, Enzymatic processing, Filtration, Product development

Contact information

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Extrusion Center - Solution for extrusion processing

Description

Luke's Extrusion Center was established in 2021. There are two twin screw extruders and a new generation extruder, a multi screw extruder (Planetary Roller Extruder = PRE). Capacity of extruders PRE 0.3-10 kg/h, the twin screw for food applications 10 kg/h and for feed applications 70 kg/h. Through new multi extrusion, we improve our research and service facilities to cover cereals, feed, specialty crops berries, straw, wood, sawdust, peat and other biomass and products such as chaff, bark fraction and mill by products. The most important features of PRE are continuous operation, efficient ma heat transfer, precise optimization of temperature and pressure, and stability under reaction c Also, services include laboratory analysis of samples: microbiological and chemical analyzes, functional properties, sensory evaluation.

Benefits

Extruder Center test facility in Jokioinen provides customers with access to equipment and services for food, feed and circular economy products research and side stream upgrading. Process development and testing on a pilot scale enables new innovations and reduces risks associated with the transfer to actual production. New processing technologies can be tested before making any investments and extrusion methods can be transferred to larger production classes linearly. The material generated during test production enables comprehensive further studies.

TRL

Pilot line available for research collaboration and business use

Links

Type of the Pilot Line

- Service
- Testing facility

Prerequisites for use

- Co-operation

Keywords

Extrusion, Extruder, Planetary roller extruder, Twin screw extruder

Contact information

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FieldLab, Pilot line I: The testbed and capability creation for Industry 4

Description

FieldLab is practical industrial testbed environment where businesses and knowledge institut… test and implement Smart Industry solutions in a targeted way. In addition, it allows people to… apply these solutions. FieldLab also strengthens the links between research, education and p… relation to a specific Smart Industry theme and transfers knowledge to other businesses. Data… connectivity are the essential enablers for Industry 4.0. FieldLab is equipped with state-of-the… collection capabilities, enabling pilots and deep divest also with… examples. Target audience: FieldLab offers a testing and learning environment for companies, … them on applying the best Industry 4.0 practices in a feasible and effective way. FieldLab also supp… TAMK's educational goals by acting as a learning environment for skilled future workforce.

Benefits

FieldLab offers a testing and learning environment for companies, supporting them on applying the best Industry 4.0 practices in a feasible and effective way. FieldLab also supports TAMK's educational goals by acting as a learning environment for skilled future workforce.

TRL

Pilot line available for research collaboration and business use

Links

https://sites.tuni.fi/fieldlab/

Type of the Pilot Line

- Demonstrations
- Testing facility

Prerequisites for use

- Access fee
- Case specific
- Staff effort & resource allocation

Keywords

Industry 4.0

Contact information

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FieldLab, Pilot line II: Additive manufacturing of large biocomposite structures with an industrial robot

Description

TAMK has years of experience in 3D printing of large structures. We have… various structure using biocomposite material, for example, a footbridge. Latest development steps have taken … scale additive manufacturing (LSAM) environment to a new level:

- The new extruder printhead enables efficient 3D printing with high variety on output per ho…
- Ability to 3D print large structures with an industrial robot mounted on linear track (5m)
- The system is connected to an IoT server according to Industry 4.0 for data collection and AI… development.

Benefits

FieldLab LSAM environment is servicing all companies and other parties that are interested in Deep Dives and POCs related to large scale 3D printing. As process is also very versatile from the data generation point of view, it gives also great test bed for machine learning and AI… product and service development for different stakeholders.

TRL

Pilot line available for research collaboration and business use

Links

https://sites.tuni.fi/fieldlab/

Type of the Pilot Line

- Demonstrations
- Service
- Testing facility

Prerequisites for use

- Access fee
- Case specific

Keywords

Additive manufacturing, 3D printing

Contact information

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Design for Additive Manufacturing

Description

Concept design can be started with topology optimization. In topology optimization algorithm fi optimum distribution of material inside design space. Objective for the optimization can be for minimum mass design. Manufacturing method of the part can be considered by manufacturabi constraints. For example, overhang angles can be controlled to reduce the need for support s parts, which are going to be manufactured by 3D printing. Additional weight reduction can be a using lattice structures, which are impossible to manufacture, except if 3D printing is used. Prin can be simulated and e.g., support structures and print orientation can be optimized to reduc It's also possible to compensate the distortions by modifying the digital model based on the s results. Simulation can therefore reduce the amount of wasted material and time.

Benefits

Digital Design and Simulation reduces the amount of wasted material and time.

TRL

Green & Digital Tool available for research collaboration and business use

Links

Type of the Green & Digital Tool

- Demonstrations
- Service
- Testing facility

Prerequisites for use

- Access fee
- Case specific

Keywords

Topology optimization

Contact information

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J. Hyneman Center

Description

J. Hyneman Center is a proto lab at the LUT Lappeenranta campus for all LUT group students. Th create new ideas and give recourses for both building and testing prototypes. The lab brings together students, LUT research and companies with a common goal to solve problems with creating. JH equipped with a wide variety of tools and 330 square meters JHC premises include metal paint, and electronics workshops. The workforce of JHC are students, and work done at JHC is connect studies.

Benefits

Low-cost channel to prototype building and testing. JHC brings together students from different disciplines and working on different courses. Besides the wide selection of existing courses, the company assignment can also be formulated into a building challenge where many student teams are focusing on the same challenge. LUT group students also represent customers of the future, meaning the feedback given has strategic significance.

TRL

Pilot line available for use

Links

https://jhynemancenter.com/

Type of the Pilot Line

- Service
- Solution
- Testing facility

Prerequisites for use

- Case specific
- Free for students

Keywords

Multidisciplinary, Problem solving, Prototype building

Contact information

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Metal 3D Printing Lab

Description

The University of Vaasa's 3D metal printing laboratory conducts high-quality research. The laboratory is also used for teaching. In addition, the laboratory makes it possible to design and print parts for companies in various industries, such as the automotive and other manufacturing industries, as well as SMEs. The equipment purchased for the laboratory in Seinäjoki is one of the best in the industry. The laboratory guarantees that the parts printed on the equipment are of high quality and safe. The laboratory has a Prima Additive Print Sharp 250 3D metal printer, which works by the powder bed method (selective laser melting SLM). The powder bed method is the most common 3D printing method for metals, in which the metal is melted in layers with a laser beam.

Benefits

3D printing revolutionizes industrial manufacturing and offers new opportunities for research and development. In the new 3D metal printing laboratory of the University of Vaasa, the Metal Additive Manufacturing Lab, digital 3D models are printed layer by layer directly into finished metal parts. The range of printing possibilities is wide: from simple spare parts to very complex and geometrically demanding components. 3D printing is also known as additive manufacturing (AM).

TRL

Pilot line available for research collaboration and business use

Links

https://www.uwasa.fi/fi/tutkimus/tutkimusyksikot/metalliadditivemanufacturing-lab

Type of the Pilot Line

- Demonstration
- Physical equipment
- Service
- Solution
- Testing facility

Prerequisites for use

- Staff effort & resource allocation

Keywords

3D printing, Additive manufacturing, Metal 3D printing

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