



EDIH4UrbanSAVE

TBI Service Blueprint: Establishment of services and description
(updated Version)

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EDIH

For urban interconnected supply and
value Ecosystems



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TBI Service Blueprint: Establishment of services and description (updated Version)

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Executive summary

This deliverable describes the services developed and run in the connecting to the Test before Invest (TBI) pillar on the regional, national and EU-wide level for the European Digital Innovation Hub for urban interconnected supply and value Ecosystems¹ (EDIH4UrbanSAVE) to bring value to the target group by the implementation of Test before Invest services to easily test digital innovations.

The **Test before Invest Service Blueprint** is based on what was described in the proposal and Grant Agreement (GA). The document is structured in two steps: first the TBI service catalogue and second the blueprints of existing TBI services. [The deliverable is a revised version in month 18 of the project.](#)

¹ In the following text, EDIH4UrbanSAVE is also referred to as EDIH Hamburg.

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1. Introduction

The EDIH will prepare the European society and economy and place Europe at the forefront of sustainable tech development and the twin transition. In particular, the *Test before Invest* pillar (TBI) of this EU-wide funding of local small and medium enterprises (SMEs) and public authorities (PAs) offer the advantages of risk mitigation, cost efficiency, impact assessment, innovation promotion, strengthened due diligence, and valuable feedback and support.

1.1 Intended Audience

This deliverable is aimed at two main audiences: 1) Consortium members, 2) the commission services and independent reviewers of the project. As a sensitive deliverable, its content is not intended to be made available to other interested parties.

1.2 Structure of this Deliverable

After the description of the goal of this deliverable in Section 1.3 the pillar Test before Invest is shortly presented. This consists of the three levels of the pillar and the service catalogue. The blueprints for this pillar are presented in the following chapters. [Changes to the initial deliverable are marked in blue to make changes easier to recognize.](#)

1.3 Goals

Developing blueprints for the services of the pillar Test before Invest brings benefits such as standardization, efficiency, quality assurance, replicability, knowledge transfer, stakeholder alignment, and adaptability. These benefits contribute to a more robust and effective evaluation process, leading to informed investment decisions and better outcomes for SMEs and PA. [The revised version incorporates the experience gained from the initial implementation of the services and reflects it in the blueprints.](#)

2. Services for Test before Invest

The service portfolio, depicted in Figure 1, is divided into three levels, in which different types of interaction, learning and cooperation with the intended target groups (Logistics, Aviation-, Transportation-, Maritime-Industry, Services, Crafts & Food Industry and the public administration, integrated via the Public Private Partnerships (PPP)) are promoted. These are information formats for different skill levels (e.g. events, use cases development or Joint Proof of Concepts), in which the target groups are rather inspired and “consume”, up to hands-on implementation and education formats, in which the competencies are imparted through concrete “doing” (e.g. identifying use- and business cases, testing, trying out, implementing, experimenting) in the joint innovation laboratories such as the ARIC “AI Lab/Showroom”, “Cyber Security Portfolio”, “Creative Space for Technical Innovations”, “Homeport Lab” or the “Digital Logistics Lab” and other training facilities (e.g. Institute for “Responsible AI”) that will be established.

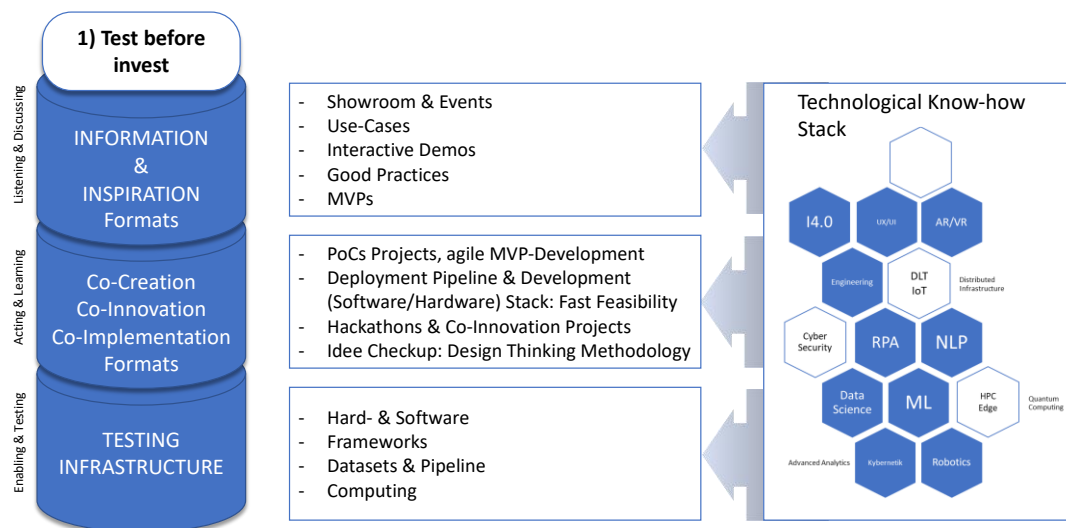


Figure 1: EDIH Hamburg service portfolio for Test before Invest

The first level of services is formed by “Listening & Discussing” formats that focus on expert lectures about good practices and interactive demos in showrooms. The second level is formed by “Acting & Learning”. The focus of this level is on co-innovation workshops, Proof of Concept (PoC) projects and the agile development of tech prototypes in the testing and innovation labs. The third level supports the measures and offerings of the first two levels. It lays the foundation for implementation by installing the provision and ongoing development of a test and data infrastructure (e.g., Research Computing Infrastructure), as well as the necessary expertise and the people who operate the test infrastructure and sandboxes. This includes support for the “data economy” facilitating access to public and private data sets for testing and development.

2.1 Test before Invest Services Catalogue

The condensed list of Test before Invest offerings are listed in Table 1. It should be noted that the offerings may be differentiated depending on the key technology, tech lab, and sector.

TBI-1:	Use and access to Tech Labs including sufficient support and consulting
TBI-2:	Future-Tech Check-up: AI, cybersecurity, ethics, privacy & digitisation: interactive survey and workshop with different stakeholders in a company/public admin.; identification of tech maturity and digital innovation potential in a company
TBI-3:	Use case development service: in-house workshops with different stakeholders to identify and develop tech use cases
TBI-4:	JPOC – Joint Proof of Concept/feasibility project: co-creation, prototyping & agile development project delivering a PoC (Proof of Concept) & PoV (Proof of Value)
TBI-5:	Experiments, intensive processing on the Research Computing Infrastructure (AI servers, HPC, security experiments) with expert support
TBI-6:	Agile Development Series (challenge-based ideation, rapid prototyping, minimal valuable product)

Table 1: Test before Invest Catalogue

2.2 Test before Invest Formats

In the following, the developed blueprints for the services within the Test before Invest pillar are presented. It is important to note that the offers can be tailored according to key technology and SME/PA, industry, sector or tech lab. However, the blueprint describes the common requirements, target groups, processes, procedures and intended participants. This is to be considered as a report from the current state of the project. Through iterative feedback processes, it can be assumed that these will be adapted.

2.2.1 Access to Tech Labs incl. support (TBI-1)

Tech Labs have proven their value in IT as platforms with which knowledge can be transferred in a vivid and lively environment. In addition, they offer a suitable space, or more precisely the appropriate infrastructure, for rapidly investigating new ideas and performing experiments, for example with the agile development of prototypes. Tech Labs are further characterized by a focus on practical applications, where the sharing of experiences is at the foreground.

Based on the basic ideas that also characterize the Ahoi Digital initiative², the Tech Lab service at EDIH Hamburg is intended to provide SMEs and PSOs with an understanding of the practical use of methods from the fields of AI, Digitization, Cybersecurity and HPC (ADCH), and to support them in the implementation of their own prototypical projects, as can be carried out in a Tech Lab. In the context of the Ahoi Digital initiative, the following key aspects can be identified with the four associated Tech Lab environments. These aspects are also relevant for the requirements and challenges in the EDIH Hamburg:

1. The base.camp at the University of Hamburg supports participants in the realization of projects and offers experimental spaces to try out ideas and frameworks. The main topics also include Big Data, Artificial Intelligence and Security.
2. The Creative Space for Technical Innovations (CSTI) at the HAW Hamburg is an interdisciplinary platform for applied research and knowledge transfer in the field of human-computer interaction and smart systems. The topics Machine Learning / Data Mining are treated as points of focus.

² Ahoi Digital – Network of Labs, <https://csti.haw-hamburg.de/network-of-labs/> website retrieved on 26/05/2023.

3. The Things@TUHHLab at the Hamburg University of Technology supports the goal of developing technology for people in terms of research, teaching and transfer. The main topics include communication networks and sensor networks.
4. The City Science Lab at the HafenCity University Hamburg has a strong focus on linking technical challenges with social and cultural developments. The topics Urban Platform and Urban Mobility Behaviour are among the main points of focus.

Below the service to access the Tech Labs, on the current state of planning, is shown.

Partner: HITeC, ARIC		Title: Access to Tech Labs incl. support
est. Duration: 1-2 days	Target Group: all (Start-ups, Craft, Public, Administration, Logistics, Industry)	
Format: consulting / demonstration / development		Focused on key technologies: AI, Cyber Security, Digitisation, HPC
Stakeholder from SME/PAs side: for those who have a technical background and have overview about IT processes, data engineering and technologies used		
Requirements for participation: affinity with technical systems		

Description of Access to Tech Labs process:

1. Contacting the potential participants
2. Clarifying the relevant SME/PSO topics to be addressed in a Tech Lab (2 hours)
3. A distinction can be made between general and specific topics:
 - a. For a more general topic, the participation in the most appropriate (regularly scheduled) event in a Tech Lab can be offered. The support of the participants is based on prepared demonstrations and learning content. The presentation character is in the foreground, but depending on the specific topic, there will also be room for additional hands-on elements. (2-4 hours).
 - b. For a specific topic, the EDIH experts clarify which Tech Lab seems best suited for the corresponding individual experiments. The experts then plan and coordinate access to the Tech Lab and, if necessary, prepare the environment, e.g. with the installation of additionally required frameworks. Next, they accompany and support the participants in their experiments in the sense of individual coaching. (4-12 hours).
4. Summarizing the results and planning the next steps (1-2 hours).
5. [Request to participate in the survey on the TBI service by e-mail.](#)

Considered aspects of SME/PAs internals:

- **Processes** Process mapping to Tech Lab infrastructure
- **Data** engineering type of collected data, integration aspects of data, how to use data in the Tech Lab infrastructure
- **Technologies** with focus on Tech Lab infrastructure

Partner: ARIC	Title: Access to Tech Labs incl. support
est. Duration: 1,5-2 h	Target Group: all (Start-ups, Craft, Public, Administration, Logistics, Industry)
Format: demonstration	Focused on key technologies: AI
Stakeholder from SME/PAs side: Stakeholder from different sectors can learn from example practical demonstrations the Application areas and their implications for business models, ethics, legal and for operations.	
Requirements for participation: none	

Located at the headquarters of ARIC in the Docklands/Nordakademie the ARIC Showroom is a physical space designed to make Artificial Intelligence visible and tangible. It is inspired by the e-Government Showrooms of ARIC's cooperation partner Estonia.

The AI showroom's motto is to inspire, learn, collaborate and create. It serves two main purposes: The first of them is Showcasing AI, presenting understandable exhibits like an AI-based virtual doorman or a delivery robot. The second half is dedicated to Developing AI offering equipment supporting collaborative development of AI applications. The showcases can be exchanged depending on the occasion and the respective participant's individual interests.

[An overview of the agenda, presentation materials and technical equipment for entire format is provided in Deliverable 2.2 – updated version.](#)

Partner: HWK	Title: Access to Tech Labs incl. support
est. Duration: 1-2 days	Target Group: all (Start-ups, Craft, Public, Administration, Logistics, Industry)
Format: demonstration	Focused on key technologies: Digitisation
Stakeholder from SME/PAs side: for those who have a technical background and have overview about IT processes, data engineering and technologies used	
Requirements for participation: none	

The HWK is set to launch a cutting-edge Digital Innovation Lab focusing on Artificial Intelligence (AI) and Virtual Reality (VR) applications tailored for SMEs in the crafts sector. This initiative aims to foster a deep understanding and practical application of digital technologies through a series of interactive stations and workshops designed to enhance operational efficiency and customer engagement.

Lab Features:

Interactive AI & VR Demonstrations: Hands-on sessions will illustrate how these technologies can be integrated into daily business processes, improving design, production, and training.

Specialized Workshops: Participants will have the opportunity to engage in workshops like “AI in Customer Service” and “VR for Product Design”, each aimed at addressing specific industry needs.

Custom Consultation Services: As an extension of the lab's offerings, personalized coaching sessions will be available to help integrate these digital solutions into existing business models effectively.

This lab is not just a learning environment but a hub for innovation, where SMEs can explore the potential of digital tools to transform their businesses. The focus on practical applications ensures that participants not only understand but are also able to implement these technologies to gain a competitive edge in their respective fields. The Lab is in the planning phase.

Partner: HWK	Title: Access to Tech Labs incl. support
est. Duration: 2-18 hrs	Target Group: all (Start-ups, Craft, Public, Administration, Logistics, Industry)
Format: demonstration	Focused on key technologies: Digitisation
Stakeholder from SME/PAs side: for those who have a technical background and have overview about IT processes, data engineering and technologies used	
Requirements for participation: none	

The HWK offers tailored digitalization consultations. These consultations aim to help craft businesses optimize and streamline their digital transformation. The digitalization consultations cover a broad spectrum of topics, including enhancing the digital basic skills of employees, the introduction of a paperless office, digital time recording, improved file management, IT security, data protection, resource management through ERP systems, CRM systems, file management DMS systems, and substitutive scanning.

The consultations are tailored to the individual needs of the businesses and follow a “help to self-help” approach. For example, when introducing new software, a list of criteria is created together with the business, and a functional specification document is generated, enabling the business to independently contact various software manufacturers. In addition to the consultations, accompanying workshops or trainings can be offered upon request. These support the businesses in further deepening their knowledge and skills in the discussed digital areas.

Overall, this service helps to strengthen the digital competencies of craft businesses and enables them to effectively master the challenges and opportunities of digitalization.

Partner: DigiHub	Title: Using EDIH-TBI - Research Computing Infrastructure
est. Duration: 2-3 hrs	Target Group: all (Start-ups, Craft, Public, Administration, Logistics, Industry)
Format: Workshop	Focused on key technologies: HPC, Digitisation, AI
Stakeholder from SME/PAs side: for those who have a technical background and have overview about IT processes, data engineering and technologies used	
Requirements for participation: none	

The goal of this workshop is to introduce the SMEs and other enterprises to the research computing infrastructure, which has been installed and made available within the Framework of the EDIH-Project at the premises of the Digital Hub Logistics GmbH. At this workshop,

examples for use of the computing infrastructure, usage specifications, processing infrastructures as well as contact persons within the consortium are introduced. This workshop format can be adapted to the customer needs.

2.2.2 Future-Tech Check-up (TBI-2)

The purpose of a Future-Tech Check-up is to assess and evaluate the current state but also the potential of new technologies and their impact on the SME/PA. This involves analyzing the latest technological advances to identify opportunities, challenges and implications for the SME/PA. This service helps to assess a company's/PA's own digital status in a comparable way. A Digital Maturity Assessment (DMA) is the yardstick for the maturity level.

Partner: HITeC, ARIC		Title: Future-Tech Check-up
est. Duration: 2 days	Target Group: all (Start-ups, Craft, Public, Administration, Logistics, Industry)	
Format: consulting/workshop		Focused on key technologies: AI, Cyber Security, Digitisation, HPC
Stakeholder from SME/PAs side: for those who have overview about IT processes, data engineering and technologies used		
Requirements for participation: none		

Description of Future-Tech Check-up process:

1. (Optional) Impulse presentation with trends in relevant sectors.
2. Screening: SME/PA experts provide first information about processes, technologies and data in an on-site workshop to EDIH experts (4 hours).
3. EDIH experts discuss technological situation of SME/PA (internally 2x4 hours).
4. Recap-workshop with SME and EDIH workshop for clarifying questions and first checkup overview and DMA (2 hours).
5. Presentation of final Future-Tech Check-up results provided by EDIH experts (2 hours).
6. [Request to participate in the survey on the TBI service by e-mail.](#)

Considered aspects of SME/PAs internals:

- **Processes** Process presentation (number of processes, administration, core business process, overview per process, used data per process)
- **Data** engineering type of collected data, integration aspects of data, how to connect data
- **Technologies** with focus on used algorithms, infrastructure and, frameworks

Partner: HITeC, ARIC, HWK		Title: Future-Tech Check-up
est. Duration: 1 hour	Target Group: all (Start-ups, Craft, Public, Administration, Logistics, Industry)	
Format: consulting/workshop		Focused on key technologies: AI, Cyber Security, Digitisation, HPC
Stakeholder from SME/PAs side: for those who have overview about IT processes, data engineering and technologies used		
Requirements for participation: none		

Description of Future-Tech Check-up Process:

1. Online survey on key technologies (ADCH), see Figure 11.
2. Presentation of final Future-Tech Check-up results and pointers to corresponding EDIH offers in which deficits and needs were identified provided by EDIH questionnaire.

Considered aspects of SME/PAs internals:

- **Processes** Process presentation (number of processes, administration, core business process, overview per process, used data per process)
- **Data** engineering type of collected data, integration aspects of data, how to connect data
- **Technologies** with focus on used algorithms, infrastructure and, frameworks

Developed materials for this service.

As part of this service, an online survey has been created, see Figure 11. It is currently available in German, but will be translated if required. The survey is divided into four parts. At the beginning, information on the organization is collected, such as size, range and communication with customers and suppliers, the digital solutions and business processes already used in the organization or the willingness to use them, as well as information on the degree of digitalization.

This is followed by questions on the topic of AI. In this part, the customer is asked about the AI strategy in the organization, the positioning of the company with regard to AI, obstacles and use of/experiences with AI, also with regard to training and acceptance, as well as possible risks.

The third section contains questions on the topic of cyber security, which cover awareness, risk, requirements and existing measures.

HPC is the topic of the last section of the survey. The first step is to clarify whether HPC is useful or needed for the business environment. If it is already being used, the goals for its use and the system architectures used to date are queried. Job scheduling, benchmarking and the potential effects of increasing computing performance are topics of the section.

Partner: HWK	Title: Future-Tech Check-up
est. Duration: 2-18 hrs	Target Group: all (Start-ups, Craft, Public, Administration, Logistics, Industry)
Format: consultation	Focused on key technologies: Digitisation
Stakeholder from SME/PAs side: all	
Requirements for participation: none	

The service is used to assess the current state of digitalization in a craft business and identify potential areas for improvement and further development. The approach for initial analyses is based on the use of proven tools such as the Digital Maturity Assessment (DMA) and the assessment of the Mittelstandszentrum Digital³. These tools allow to gain a comprehensive picture of a company's digital maturity and identify specific areas that could be considered for further digital projects. The initial analysis begins with a thorough examination of the company's current digital infrastructure, processes, and competencies. This is followed by a comprehensive evaluation that highlights the company's current state of digitalization and identifies potential areas for improvement.

This service aims to provide craft businesses with a clear understanding of their digital landscape and support them in effectively planning and implementing their digital strategy. In this way, SMEs can optimally seize the opportunities of digitalization and strengthen their competitiveness in an increasingly digitalized world.

2.2.3 Use Case Development Service (TBI-3)

The EDIH Use Case Development Service enables organizations to systematically analyze, define, and communicate how a product, service, or technology can be effectively used to address specific needs and achieve desired outcomes. Use cases enhance the clarity, feasibility, and success of development efforts, contributing to better-designed solutions and improved customer satisfaction of the SME and PA.

Partner: HITeC & ARIC	Title: Use Case Development Service
est. Duration: case specific up to 1PM	Target Group: all (Start-ups, Craft, Public, Administration, Logistics, Industry)
Format: consulting	Focused on key technologies: AI, Edge/Cloud, Cybersecurity, Digitisation, HPC
Stakeholder from SME/PAs side: for those who are responsible for development, sales, management, Cybersecurity, HPC, digitisation or AI and have an overview about IT process, data engineering and technologies used	
Requirements for participation: Development and business process skills	

Description of the Use Case Development Process:

1. Onboarding meeting: SME/PA experts giving an overview on structure, ideas and, if applicable, data of the SME/PA (2 hours)

³ <https://www.kompetenzzentrum-hamburg.digital>, retrieved May 2023

2. Joint workshop for use case detailing with several EDIH experts and the partner. Important: Here, the partner also describes the use case from his point of view.
3. Data analysis phase: EDIH experts make an in-depth analysis of the available data (public, the SME/PA if applicable) with the help of the SME/PA.
4. (EDIH internal) EDIH experts define a technical use case description (document) to be applied, consisting of input and output, and technical methods.
5. Use case finalization (joint meeting):
 - a. Presentation of the technical use case
 - b. EDIH experts and partners discuss final technical use case description.
6. Request to participate in the survey on the TBI service by e-mail.

Considered aspects of SME/PAs internals:

- **Data** engineering type of collected data, integration aspects of data, how to collect data.
- **Interfaces and processes:** Which will be affected by the use case.
- **Positions:** Which positions will be affected by the possible introduction and need to be specifically addressed.

Developed materials for this service.

As part of this work package, a number of templates have been created for the Use Case Development and Joint Proof of Concept services (see next service), which can, but do not have to be used.

Their use depends on the working methods of customers and employees, their product development strategies, preferences, but also on the degree of maturity of the use case / JPOC idea.

A support graphic was developed for the AI area in order to support the brainstorming and **ideation** process with the EDIH customer. This is used to discuss questions with the customer from three different perspectives (data, technology, and requirements) in order to obtain a better picture of the customer organization and its needs, see Figure 3.

A **use case canvas** was developed to further support use case development, see Figure 4. This includes a structured description of the use case, but also the need for improvement, previous solution approaches, target groups (future users and affected parties), interfaces, expected improvements, aspects of data (access and scope), but also the desired degree of maturity of a possible joint-proof of concept.

In order to capture the goals and needs for the use case, a template for a **fictional persona** description was designed as part of EDIH Hamburg. They enable a better tailoring of products or services to target groups. In addition to demographic information, needs, goals, frustrations, motivation and a specific scenario, as well as the technology used by the person can be described, see Figure 5.

The product vision expresses the common, overarching goal of product development or the use case. With the help of the **product vision board** template, this goal and the most important information for achieving the goal can be clearly recorded, see Figure 6.

The structured recording of statements about the **user's needs** helps to communicate the end user's problem that the use case aims to solve and the value it can provide. The user (assigned

to a persona) is captured with a real and representative need and insight. A template created in the project is available for this purpose, see Figure 7.

The recording of **functional and non-functional requirements** is also supported by a template see Figure 8.

2.2.4 JPOC – Joint Proof of Concept (TBI-4)

The purpose of a Joint Proof of Concept (JPOC) development under EDIH is to collaboratively explore and validate the feasibility, functionality, and potential value of a new technology, solution, or innovation in a real-world context of an SME or PA. It involves multiple stakeholders, such as the service providers, developers, and end users, working together to develop a prototype or demonstration that shows the capabilities and benefits of the concept.

This service can be seen as an extension of a use case development, but is also offered as a stand-alone service.

Partner: HITeC & ARIC		Title: Joint Proof of Concept Service
est. Duration: case specific up to 3PM	Target Group: all (Start-ups, Craft, Public, Administration, Logistics, Industry)	
Format: development & consulting		Focused on key technologies: AI, Edge/Cloud, Cyber Security, Digitisation, HPC
Stakeholder from SME/PAs side: for those who are responsible for development, sales, management, Cybersecurity, HPC, digitisation or AI and have an overview about IT process, data engineering and technologies used		
Requirements for participation: Development and business process skills		

Description of the Joint Proof of Concept Process (this may follow a use case concretization service). In principle, this is very similar to the Use Case Development service:

1. Onboarding meeting: SME/PA experts giving an overview on structure, ideas and, if applicable, data of the SME/PA (2 hours). Can also be based on the insights from the use case service.
2. Joint workshop for detailing the JPOC with several EDIH experts and the partner, [with the help of the developed materials, see Section 2.2.3 above.](#)
3. Data analysis phase: EDIH experts make an in-depth analysis of the available data ([also open or public](#), if applicable) with the help of the SME/PA. Can also be based on the results from the use case service.
4. (EDIH internal) EDIH experts define a technical JPOC description (document) to be applied, consisting of input and output, and technical methods.
5. JPOC finalization (joint meeting):
 - a. Presentation of the technical JPOC;
 - b. EDIH experts and partners discuss final technical JPOC description.
6. Development phase:
 - a. Internal development followed by presentation of interim results to partner (3 iterations);
 - b. Final presentation of the JPOC to the partner.
7. Delivery of results consisting of code, documentation and licensing information.
8. [Request to participate in the survey on the TBI service by e-mail.](#)

Considered aspects of SME/PAs internals:

- **Data** engineering type of collected data, integration aspects of data, how to collect data.
- **Interfaces and processes:** Which will be affected by the use case.
- **Positions:** Which positions will be affected by the possible introduction and need to be specifically addressed.

Developed materials for this service.

Please consult the materials described in the Use Case Development Service (TBI-3).

2.2.5 Experiments, intensive processing on Research Computing Infrastructure (TBI-5)

The purpose of developing and administer experiments or intensive processing on a research computing infrastructure is to provide SMEs and PAs with a powerful and scalable computing environment to perform computationally intensive tasks within EDIH. The goal is to accelerate the development of SME and PA digital innovations, enable large-scale simulations, support collaboration, and facilitate data-driven discovery. Customers are guided through their experiments by EDIH platform experts.

Partner: HITeC & ARIC		Title: Develop and administer experiments, intensive processing on the Research Computing Infrastructure Service
est. Duration: varies by case up to 14 days	Target Group: all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: consulting		Focused on key technologies: AI, HPC
Stakeholder from SME/PAs side: for those who are responsible / have an overview about development, data engineering / are data analysts, are HPC-, Digitisation-, AI-experts in SME/PA		
Requirements for participation: Development and business process skills		

Experiment process: this may follow a use case concretization service

1. Onboarding meeting: Platform experts of EDIH giving an overview on structure, handling, capabilities, permissions of the EDIH-platform and, SME/PA experts giving an overview of planned experiments, and the data to be processed. [The user has to agree to terms of use, see below. The onboarding topics for the successful use of RCI are listed in detail in the workflow document.](#) (3 hours)
2. Develop and test experiment: With the necessary resources and permissions in place, the development and testing of the experiment starts. This may involve uploading data, writing and optimizing code, testing the workflow, and validating test results.
3. Processing phase: SME/PA begins to conduct the experiment on the research computing infrastructure. This may involve scaling up the resources, running multiple iterations of the experiment, and monitoring the progress.
4. Experiment conclusion: Analyzing the results with the EDIH expert in AI, HPC.
5. [Request to participate in the survey on the TBI service by e-mail.](#)

Considered aspects of SME/PAs internals:

- **Data** analyzing collected data, integration aspects of data, how to collect data.

Developed materials:

Terms of use for accessing to the Research Computing Infrastructure (RCI) of the EDIH4UrbanSAVE project has been developed. Every user must read and accept these user regulations before being granted access to the RCI – a High-Performance Computing (HPC) Cluster. This regulates RCI requirements for registration and access, responsible use, the allocation of computing time, data protection and security, reporting obligations and the handling of violations. For details see Figure 9.

The **onboarding** aspects for the successful use of the RCI are itemized in the **workflow** document, see Appendix A.1.

2.2.6 Agile Development Series (TBI-6)

An Agile Development Series refers to the application of agile principles and practices of agile methodology, in a sequential and iterative manner to deliver software or products in a flexible, collaborative, and adaptive way. Agile development is an approach that emphasizes flexibility, collaboration, and adaptability in the software development lifecycle. It focuses on delivering incremental value to customers through short development cycles called sprints. In an Agile Development Series, multiple sprints are conducted sequentially to achieve the desired outcome. The key characteristics of an Agile Development Series include: the iterative development, close collaboration and frequent communication among service members, continuous improvement and empowered and self-organized teams.

Partner: DigiHub	Title: Boostcamp
est. Duration: varies by case	Target Group: all (Startups, Craft, Public Administration, Logistics, Industry)
Format: workshop	Focused on key technologies: AI, HPC
Stakeholder from SME/PAs side: for those who are responsible for development, sales, management, Cybersecurity, HPC, digitisation or AI in SME/PA	
Requirements for participation: Development and business process skills	

This format aims to 1) establish concrete problems/issues that businesses face, 2) bring relevant companies and other entities together in a group to address them, and, in the end via so-called “innosprint” methodologies, 3) establish whether the consortium can (in the long term) function as an effective vehicle to deliver on these problems as well as 4) ideate and test possible solutions.

Boostcamp offers a two-part workshop format:

I. In the initial “Development” phase of Boostcamp, via intensive coaching-sessions, partaking teams will attempt to sharpen their particular problem that they wish to solve.

II. During the “Solution and consortium building” phase, the teams work in parallel in a 4-day camp on the established problem. This phase includes understanding the problem, designing solutions and iterative development (test - adapt - test ...) up to MVP/pilot planning.


Currently, there is deliberation to continue the Boostcamp format as a project relevant service with a focus on scaleups as its main participants and beneficiaries.

Some slides representing this format are given in Figure 10.

3. Summary

In this document we updated the description of the developed blueprints for the pillar *Test before Invest*, which are ready for operation. This deliverable is an extended version of the blueprints after a project duration of 18 months. A survey on quality and implementation was created for all the formats listed here and will be sent to the participants by the implementing partner afterwards. This allows the services and accompanying material to be iteratively adapted to new requirements.


Appendix



Docket für Test before Invest-Services
Use Case Development und POC

1. **Onboarding in EDIH** (Meeting mit dem Partner*)
 - a. Onboarding-Dokument ausfüllen (siehe Vorlage)
 - b. Entscheidung vom Partner:
 - i. Sollen mehrere Use Cases grob beschrieben, oder
 - ii. ein Use Case in Detail entwickelt werden
 - c. Information an Partner über die Minimis-Grenze von 200.000€ über 3 Jahre
 - d. Information an Partner über DMA s.u. (dreimal mit uns durchzuführen)
2. (EDIH intern) **DMA**: Info an Zuständigen mit Kontaktdaten des Partners, um das Digital Maturity Assessment (zwingend) durchzuführen. Einstündige Befragung des Partners zur digitalen Reife seiner Institution (bei Beginn, nach einem und nach zwei Jahren).
3. (EDIH intern) **Stundenerfassung** über Laufzeit des Service erfassen, Stundenzettel ggf. erfragen
4. Gemeinsamer Workshop zur **Use Case-Detailierung** mit mehreren EDIH-Experten und dem Partner. Wichtig: Hier beschreibt auch der Partner den Use Case aus seiner Sicht.
5. **Datenanalyse-Phase**: EDIH-Experten machen eine eingehende Analyse der verfügbaren Daten (öffentliche, ggf. die der Institution) mit der Hilfe des Partners.
6. (EDIH intern) EDIH-Experten definieren eine **technische Use Case-Beschreibung** (Dokument), die angewendet werden soll, bestehend aus
 - a. Input und Output,
 - b. sowie technischen Methoden.
7. **Use Case-Finalisierung** (gemeinsames Meeting)
 - a. Vorstellung des technischen Use Cases
 - b. EDIH-Experten und Partner diskutieren abschließend über die technische Use Case-Beschreibung und vereinbaren dessen Durchführung.
 - c. Paper Work:
 - i. Ist eine Verschwiegenheitsvereinbarung gewünscht?
 - ii. Kooperationsvertrag (inkl. Haftungsausschluss)
8. **Entwicklungsphase**
 - a. Interne Entwicklung gefolgt von einer Vorstellung der Zwischenergebnisse beim Partner (3 Iterationen)
 - b. Abschließende Vorstellung des POC beim Partner

* KMU oder Public Sector



9. **Auslieferung** Übergabe der Ergebnisse:
 - a. des Codes,
 - b. einer Dokumentation und
 - c. Informationen zu den verwendeten Bibliotheken, Daten und Netzen mit entsprechenden Angaben zu Lizenzmodellen
10. Mögliche **nächste Schritte** in EDIH besprechen:
 - a. Planung für nächste EDIH-Säulen Support to Find Invest (Investitionsmöglichkeiten) / Proposal writing
 - b. Umsetzung weiterer POC

Figure 2: Docket for Use Case Development or Joint Proof of Concept Service for EDIH experts.

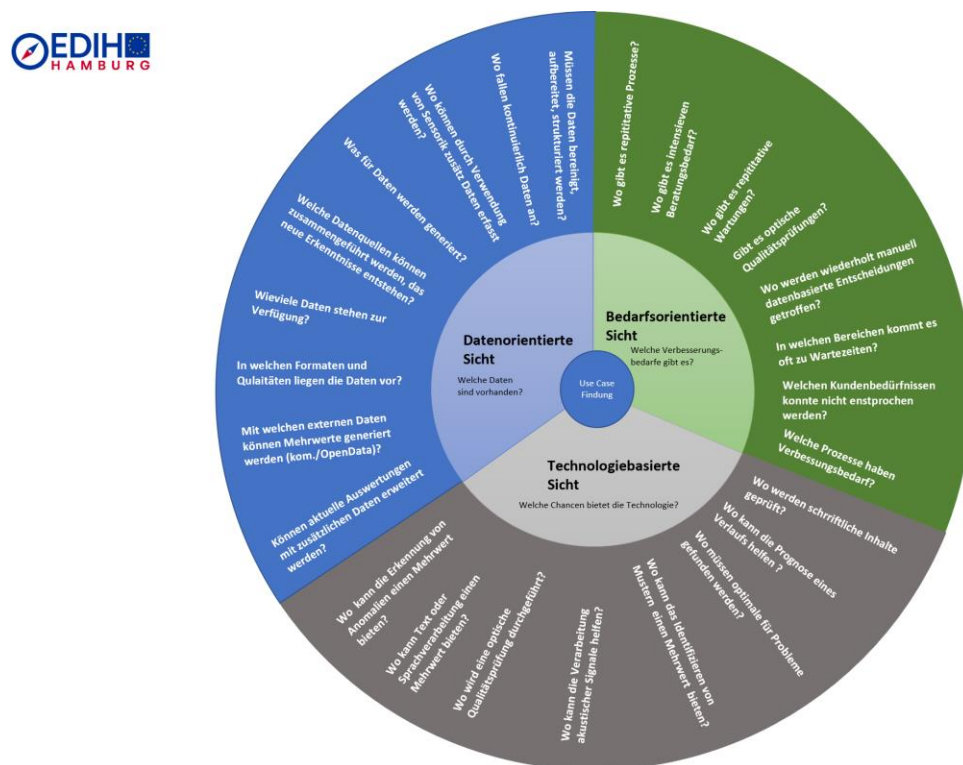



Figure 3: AI ideation support.

Use Case Canvas

Name: _____


Kunde: _____



Welchen Verbesserungsbedarf gibt es? (Beschreibung der Aufgabe)	Derzeitiger Ansatz (Wie wurde die Aufgabe bisher gelöst?)
Ziel (Was soll erreicht werden?)	Zielgruppe (Wer ist von dem Task betroffen? Wer soll das System benutzen?)
Impact (Welche Abteilungen, Services, Prozesse und Systeme sind betroffen?)	Performance (Erwartete Verbesserungen: Effizienz, Kundenerlebnis etc. Woran werden sie gemessen?)
Verfügbarkeit von Daten (Welche Datensätze gibt es? Wie schnell sind sie verfügbar?) Zugang zu benötigten Daten: Benötigter Umfang an Daten: Benötigte Datenqualität:	Ethik& Recht (Inklusivität, Urheberrecht, DSGVO, Barrierefreiheit)
Use Case-Kurzbeschreibung (Value Proposition)	angestrebter Detaillierungs- / Reifegrad des JPOC

Figure 4: Use case canvas.

Personas



Für mögliche Persona-Beschreibungen, ggf. vervielfältigen


	Wants/Bedarfe	Needs/Goals	Frustrations
	Name		
	Gender		
	Position		
	Motivation	Szenario	Technologie
	Ausbildung		
	Alter		
	Bio (Charakter, Habits, Hobby)		

Figure 5: Personas (fictitious) template.

Product Vision Board




Vision 			
Zielgruppen 	Bedarfe 	Produkt/ Ansatz 	Business Goals 

Figure 6: Product vision board.

User Need Statements



Benutzer (Adjektive, die den Benutzer beschreiben)	Braucht einen Weg um... (Verben zur Beschreibung des Bedürfnisses)	Denn... (Erkenntnisse aus Beobachtungen)
Ein Mitarbeiter der mit wenig Arbeitserfahrung als Schweißer tätig ist...	braucht vor dem Zusammenschweißen von Bauteilen für ein Treppengestell, die Vorgaben aus der Bauverordnung	damit der Mitarbeiter nicht jedesmal den Meister fragen muss, um die Vorgaben für das jeweilige Einsatzgebiet zu erfahren.

Figure 7: User needs statement template.

Anforderungen



Funktionale Anforderungen beschreiben ein "Soll"-Verhalten, ein Merkmal, eine Funktion oder ein erwartetes Ergebnis eines JPOC.
Beispiel funktionale Anforderung: Das System berechnet die Umsatzsteuer auf 2 Nachkommastellen genau.

Anforderung:	<Titel>	<No>
Beschreibung:	<Das Produkt soll ...>	
Problembeschreibung:	<Text>	
Begründung der Notwendigkeit:	<Text>	
Abnahmekriterium:	<Text>	
Priorität	<Text>	

Nichtfunktionale Anforderungen beschreiben ein Kriterium für den Betrieb eines JPOC.
Beispiel funktionale Anforderung: Das System erlaubt einen unautorisierten Zugriff auf Daten nicht.

Anforderung:	<Titel>	<No>
Beschreibung:	<Text>	
Problembeschreibung:	<Text>	
Begründung der Notwendigkeit:	<Text>	
Abnahmekriterium:	<Text>	
Priorität	<Text>	

Figure 8: Functional and non-functional requirements recording template.



Hamburg, as of April 2024

User regulations for access to the Research Computing Infrastructure (RCI) of the EDIH4UrbanSAVE (European Digital Innovation Hub for urban interconnected supply and value Ecosystems) project

Introduction

These user regulations govern the use of the Research Computing Infrastructure (RCI), hereinafter also referred to as the High-Performance Computing (HPC) Cluster, of the EDIH4UrbanSAVE (European Digital Innovation Hub for urban interconnected supply and value Ecosystems) project.

Every user must read and accept these user regulations before being granted access to the HPC cluster.

Registration and access

Each user must first submit an informal application for access to the HPC cluster, briefly stating the need to use the resources. The application is reviewed and approved by the HPC team of the Hamburger Informatik Technologie Center e.V. (HITeC), hereinafter also referred to as the HPC team.

Once the application has been approved, an appropriate user account for access to the HPC cluster will be set up and a short introductory course on how to use the system will be given as part of the "RCI Onboarding", in which the user is involved in a video conference.

The user is responsible for the security of their account and must not disclose their login details to third parties.

The unprotected storage of sensitive information (passwords in plain text, password-less SSH keys, etc.), which would prevent direct access to services, is not permitted.

Access to the HPC cluster is granted for an interval of 6 months, which can be extended as often as required by 6 months.

Responsible use

The HPC cluster may only be used for authorized and lawful purposes.

The user may not perform any <avoidable(?)> actions that could impair the performance of the HPC cluster or disrupt other users.

The user should use the resources of the HPC cluster responsibly and must not perform any actions that could lead to excessive utilization of system resources. In particular, the login node (rci-head) should not be blocked unnecessarily due to high load or over a longer period of time (e.g. in the range of several minutes).

The user must follow all instructions from the HPC team for safe and appropriate use of the HPC cluster.

Allocation of computing times

The workload manager of the HPC cluster's batch system determines the order in which the jobs of the various users are processed. This automatically ensures the fairest possible treatment of all users who compete to a certain extent for the resources of the HPC cluster. In exceptional cases, it may be

necessary for the HPC team to intervene in this automated control in order to optimize operations with regard to current priorities.

Data protection and security

The user may not store any confidential data on the HPC cluster unless this has been expressly authorized and the data is adequately protected.

The user must comply with all applicable data protection laws and regulations.

The HPC team may inspect user files (home directories, work directories, ...) that are neither personal nor specially protected as telecommunication content, in compliance with data protection regulations, insofar as this is necessary to rectify current faults or as part of user support. The users concerned will be notified of the inspection.

To ensure proper operation and to improve the system, various operating parameters can be stored and analyzed internally (such as performance indicators and batch job runtimes). The HPC team can provide anonymized data to the sponsors if they request it.

After registering for access to the HPC cluster, the email address stored with the user account is added to a mailing list in order to send messages to the user regarding the operation of the HPC cluster (for example, regarding planned maintenance work or malfunctions).

The data in the users' home directories is regularly backed up overnight. However, no guarantee can be given for these backups or for the availability of the data stored and generated on the HPC cluster.

Reporting

In publications for which the resources of the HPC cluster have been used, the use should be mentioned accordingly, for example in the acknowledgements section of a paper.

Violations

The HPC team can withdraw access to the HPC Cluster if the user culpably violates the user regulations.

Consent

I have read and understood these Terms of Use and agree to abide by their terms.

Name of the user

Date

Figure 9: Terms of use for the Research Computing Infrastructure (RCI).

The figure displays a series of slides for the Boostcamp presentation. The first slide, titled 'MOIN INNOVATORS Digital Hub Logistics Hamburg', features a stylized graphic of a city skyline. The second slide, 'Was ist das Boostcamp?', describes it as a 3.5-day innovation camp for startups and companies, offering a structured process from idea to prototype. The third slide, 'Was erwartet mich?', outlines the expectations for participants, including intensive preparation, coaching, and networking. The fourth slide, 'Überblick', provides a timeline of the camp's activities, from registration to the final pitch. The fifth slide, 'BENEFITS', lists the advantages of participating, such as access to a network of experts, a dedicated workspace, and a supportive environment. The final slide shows the Boostcamp logo and the Digital Hub Logistics Hamburg logo.

Figure 10: Boostcamp presentation.

Section A: General Information about the company/organization

A1. How many employees does your company/your organisation have?

1-9 ☐

10-49 ☐

50-249 ☐

250-499 ☐

500-2999 ☐

3000 oder mehr ☐

A2. What is the proportion of private (B2C) and institutional (B2B) customers does your company/organisation count?

Please indicate percentages.

Private Customers

Commercial customers

Public customers

A3. Please rate the following statements regarding the use of digital solutions for communication with customers and suppliers in your company/organisation.

Does not apply at all Does not apply Rather not apply Neither/true Rather applies Applies Fully applies No answer

We inform our customers about our products and services through targeted digital media. ☐

We collect and analyze customer data. ☐

Suppliers are integrated into our service provision through IT systems. ☐

A4. Please rate the following statements regarding the business processes in your company/organization.

Abbreviations: QM: Quality Management ERP: Enterprise Resource Planning

Does not apply at all Does not apply Rather not apply Neither/true Rather applies Applies Fully applies No answer

The processes (management, core, and support processes) are documented. ☐

The facilities, machinery, and equipment in our company are interconnected. ☐

Does not apply at all Does not apply Rather not apply Neither/true Rather applies Applies Fully applies No answer

Internal information flows, such as time tracking, tool management, and construction diary, are supported via smartphone or tablet. ☐

Our company uses digital media for employee recruitment. ☐

We have a QM system in place for standardizing and improving our processes. ☐

Our processes from quotation acceptance through order processing to invoicing are fully mapped out using an ERP system. ☐

A5. How many days per week can be worked in home office / remotely?

Not at all ☐

1-2 days ☐

3-4 days ☐

Fully ☐

Section B: Application of Artificial Intelligence (AI)

B1. Please answer the following questions regarding the AI strategy of your company/organization.

Does not apply at all Does not apply Rather not apply Neither/true Rather applies Applies Fully applies

The use of AI is an integral part of the company/organization's strategy. ☐

The AI implementation is a long-term corporate vision. ☐

Executives are actively involved in the AI initiatives. ☐

B2. Please answer the following questions regarding the positioning of your company/organization regarding AI topics.

Very well positioned Well positioned Rather well positioned Neither/true Rather poorly positioned Poorly positioned Very poorly positioned

How do you assess the positioning of the company/organization regarding AI? ☐

How does your company/organization stand in comparison to others in the industry regarding the implementation of AI? ☐

B3. Have you identified potential for AI-based automation in one or more areas of your company/organization?

Yes ☐

No ☐

B4. Is AI used in your company/organization?

Yes ☐

No ☐

B5. What are the obstacles to the use of AI in your company/organization (e.g., economic, organizational, or technical obstacles)?

B6. Which of the following AI applications have already been implemented in your company/organization?

Please select one or more response options.

Robotic Process Automation (RPA) ☐

Automated quality assurance ☐

Predictive maintenance ☐

Intelligent control processes ☐

Automated goods inspection ☐

Warehouse optimization ☐

Automated Guided Vehicles (AGVs) ☐

Sales forecasting in procurement ☐

Pricing indications for new orders ☐

Text generation and processing ☐

Customer support through chatbots ☐

Production and routing planning ☐

Automated documentation ☐

Image generation and processing ☐

Knowledge management through chatbots ☐

Others ☐

B7. Please rate your experience with the use of AI in your company/organization.

Yes No

Do you have a dedicated AI team or employees with AI expertise, or do you work with AI experts? ☐

Has special hardware been procured for the implementation of AI solutions? ☐

Do you collect data for AI applications and assess their quality? ☐

Do you actively monitor your AI systems and regularly make optimizations? ☐

Are your AI systems scalable and powerful enough to meet growing demands? ☐

Do you invest in research and development in the field of Artificial Intelligence? ☐

Can your AI systems adapt to changing requirements and environments? ☐

Do you use AI to generate new knowledge or gain insights from existing data? ☐

B8. Please answer the following questions regarding the acceptance and training of employees in the AI field.

Yes No Partially

Are there internal training sessions or programs for employees on the use of AI? ☐

Are there measures in place to promote employees' acceptance of AI solutions? ☐

Are there best practices that can be learned from? ☐

B9. Please rate the following questions regarding legal aspects in the development and use of AI solutions.


Yes No

Do legal aspects influence the selection and use of AI systems in your company/organization? ☐

Do you consider data protection aspects in the development and use of AI systems? ☐

Are your AI applications compliant with applicable laws and regulations? ☐

Do you ensure the explainability of the results of your AI models? ☐




B10. Are there already measurable successes from the use of AI in your company/organization? If yes, what are they?

B11. What risks do you see from the use of AI in your company/organization (e.g., impact of AI on existing jobs, legal aspects, etc.)?



Section C: Cybersecurity in the company/organization

C1. Does your company/organization have specific guidelines for IT security?

Yes ☐ No ☐

C2. Which of the following measures are currently implemented in your company/organization?


	Yes	No	No answer
Minimum requirements for passwords	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Up-to-date antivirus software	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Regular backups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2-Factor-Authentication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A dedicated IT security specialist or department	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Individual assignment of access and user rights according to the task	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Physically separated storage of backups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Yes	No	No answer
Use of cryptography (encryption, digital signatures (emails, invoices))	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Encryption of backups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Regular and timely installation of available security updates and patches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Protection of IT systems with a firewall	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Written policies for information and/or IT security	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Protection against phishing through policies or training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
No detailed responsibilities and/or contact information of employees are publicly accessible on the internet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Written policies for emergency/incident management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Regular risk and vulnerability analyses (also: penetration testing)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Encryption of storage media (hard drives, USB sticks, solid state drives (SSDs)) of laptops/PCs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Redundantly configured IT systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use of an uninterruptible power supply	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Exercises or simulations for the failure of important IT systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Isolation of externally accessible server systems from the intranet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Guidelines for data and document protection when working from home	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Access restrictions to company premises	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Assessment of potential threats to IT systems through monitoring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Certification of IT security (e.g. according to ISO 27001 or VDS 3473)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C3. How high do you estimate the risk for your company/organization to be harmed by a cyber attack in the next twelve months?

Very low	<input type="checkbox"/>
Low	<input type="checkbox"/>
Neutral	<input type="checkbox"/>
High	<input type="checkbox"/>
Very High	<input type="checkbox"/>
No answer	<input type="checkbox"/>

Section D: High Performance Computing (HPC)

"High Performance Computing (HPC)" refers to the utilization of powerful computer systems and parallel processing techniques to solve complex and computationally intensive tasks. HPC systems are designed to process vast amounts of data in a short amount of time and perform complex calculations that would be impractical or time-consuming for conventional computers.

In this section of the survey, we would like to inquire about the potential of HPC within your company/organization.

D1. Is High Performance Computing (HPC) (own hardware, cloud computing) feasible for use in your business field?

Yes ☐ No ☐ Cannot give an estimation ☐

D2. Do you use HPC within your company/organisation?



Yes ☐ No ☐

D3. Please estimate how often your company/organization requires High Performance Computing (HPC).

Once ☐ Sporadically ☐ Continually ☐

D4. What are the obstacles to the implementation of HPC in your company/organization (e.g., economic, organizational, or technical barriers)?

D5. What goal do you aim to achieve with the implementation of HPC (e.g., reducing runtime of application programs, processing large data sets)?

D6. Please answer the following questions regarding knowledge of IT system architectures within your company/organization.

	Yes	No
Does your company utilize computers with a Linux-based operating system?	<input type="checkbox"/>	<input type="checkbox"/>
Do you utilize an HPC system where cluster nodes are interconnected via a high-performance communication network?	<input type="checkbox"/>	<input type="checkbox"/>
Do you utilize a parallel program with multiple threads on a single computer (Shared Memory)?	<input type="checkbox"/>	<input type="checkbox"/>
Do you utilize a parallel program with multiple processes on multiple computers (Distributed Memory)?	<input type="checkbox"/>	<input type="checkbox"/>
Do you utilize parallel programs to leverage a GPU (Graphical Processing Unit)?	<input type="checkbox"/>	<input type="checkbox"/>
Do you utilize a parallel program to leverage multiple GPUs?	<input type="checkbox"/>	<input type="checkbox"/>
Do you utilize a parallel program to leverage multiple GPUs across multiple computers?	<input type="checkbox"/>	<input type="checkbox"/>

D7. HPC systems typically consist of cluster systems where multiple compute nodes are interconnected via a high-performance communication network. Parallel programs are necessary to fully utilize their performance potential.

What criteria do you use to procure hardware?

Access speed to the main memory	<input type="checkbox"/>
Size of the main memory	<input type="checkbox"/>
Number of CPU sockets	<input type="checkbox"/>
Number of cores	<input type="checkbox"/>
Clock frequency rates	<input type="checkbox"/>
Network speed, Interconnect (Ethernet, InfiniBand, ...)	<input type="checkbox"/>
Other criteria	<input type="checkbox"/>

D8. Please answer the following questions regarding Performance Engineering in your company/organization.

	Yes	No
Do you calculate speedups as the ratio of sequential to parallel runtime of a program and efficiencies as the ratio of speedup to the number of compute cores used?	<input type="checkbox"/>	<input type="checkbox"/>
Do you conduct benchmarking to determine the runtime behavior (especially efficiency) of parallel programs?	<input type="checkbox"/>	<input type="checkbox"/>
Do you engage in program tuning (binding/tuning of processes/threads, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>
Have you experienced that the maximum achievable speedup is limited by the parallelization of programs (due to overheads for data communication and synchronization of processes and threads)?	<input type="checkbox"/>	<input type="checkbox"/>

D9. When it comes to job scheduling, a Work Load Manager handles the unattended execution of programs or jobs in the background using queues.

Please answer the following questions regarding job scheduling in your company/organization's IT system.

Do you have experience with workload managers like SLURM (Simple Linux Utility for Resource Management) or TORQUE (Teracore Open-Source Resource and Queue Manager)? ☐ Yes ☐ No

Is a specific scheduling configuration used in your systems (e.g., maximizing job throughput or minimizing wait times)? ☐ Yes ☐ No

D10. What systems do you use?

Workstation with a single CPU with multiple cores ☐ Not in use ☐ Considered for use ☐ In use

Workstation with more than one CPU with multiple cores ☐ Not in use ☐ Considered for use ☐ In use

Workstation with a single GPU ☐ Not in use ☐ Considered for use ☐ In use

Workstation with multiple GPUs ☐ Not in use ☐ Considered for use ☐ In use

Multiple standalone workstations ☐ Not in use ☐ Considered for use ☐ In use

Cluster system with multiple compute nodes (physical or in the cloud) ☐ Not in use ☐ Considered for use ☐ In use

D11. What environments/tools are used in software development?

Development of a multi-threaded application utilizing shared memory accesses, for example, based on OpenMP (Open Multi-Processing) ☐ Not in use ☐ Considered for use ☐ In use

Development of a parallel application for utilizing multiple compute nodes (Distributed Memory), for example, based on the Message Passing Interface (MPI) ☐ Not in use ☐ Considered for use ☐ In use

Development of an application for leveraging a GPU, for example, based on CUDA (Compute Unified Device Architecture) or OpenACC ☐ Not in use ☐ Considered for use ☐ In use

Development of a hybrid parallel application (for example, OpenMP or OpenACC combined with MPI) ☐ Not in use ☐ Considered for use ☐ In use

D12. Please answer the following questions regarding the HPC needs of your company/organization.

We would not benefit from an increase in the computing power of our systems to accelerate our application programs. ☐ Does not apply at all ☐ Does not apply ☐ Rather not apply ☐ Somewhat ☐ Rather applies ☐ Applies ☐ Fully applies ☐ Quite Applies

We would benefit from a twofold (2x) increase in the computing power of our systems within the next 2 years. ☐ Does not apply at all ☐ Does not apply ☐ Rather not apply ☐ Somewhat ☐ Rather applies ☐ Applies ☐ Fully applies ☐ Quite Applies

Section E: Feedback

E1. Do you have feedback on the survey or would you like to withdraw your participation?

Thank you for your participation!

Figure 11: Online survey on key technologies (Future Tech Checkup).

A.1 Workflow of onboarding RCI users

Onboarding of a new user accessing the Research Computing Infrastructure (RCI) of EDIH4UrbanSAVE (European Digital Innovation Hub for urban interconnected supply and value Ecosystems)

Workflow

- 1) Entry options for using the RCI:
 - a) The recommendation to use the RCI was made by us.
 - b) The user approached us proactively and would like to use the RCI.
- 2) Handing over the RCI user regulations:
 - a) The user receives the user regulations (e.g. by email) with a request to sign and return them. In addition, the user will be asked (as stated in the user regulations) to submit an informal application in which they briefly explain their need to use the RCI.
 - b) The user sends us back the signed user regulations and his informal application.
- 3) Application review and invitation to the video conference:

- a) Once the documents have been positively reviewed, an appointment will be made for a video conference with the user to finalize the setup of their user account with two-factor authentication (2FA) and for a short introductory course on using the RCI. (Duration approx. 1 to 2 hours, depending on the user's previous knowledge).
- b) Preparation of the user access:
 - a) The user is asked to create an SSH (secure shell) key pair as part of the invitation to the video conference and to send us the public part of the SSH key by email before the video conference. The additional 2FA is based on the Google Authenticator plugin for Ubuntu, for which the user must have a suitable (smartphone) app ready during the video conference.
- c) Creation of the LDAP user account:
 - a) The user account is created via web browser using the LDAP (Lightweight Directory Access Protocol) Account Manager (LAM) server.
 - b) We install the public part of the SSH key for the new user as `~/.ssh/authorized_keys` in their home directory.
- d) Setting up SLURM usage:
 - a) The user is added by us to an existing SLURM account (e.g. "edih") – or, if necessary, to a new SLURM account that has yet to be created.
- 4) Video conference with the user:
 - a) The RCI is additionally secured via 2FA using the Google Authenticator plugin. As part of the video conference, we generate an initial token for the user as a QR (Quick Response) code, which the user must transfer from the shared screen, e.g. via smartphone, into their Google Authenticator app (this has proven itself in practice and avoids the need for an alternative secure channel for transmitting this sensitive information).
 - b) The use of the RCI is covered in a short introductory course:
 - a) Overview of the RCI architecture
 - (1) Login (rci-head) and compute nodes with GPUs (Graphical Processing Units) (n21, nxx, ...)
 - (a) CPU Cores, GPUs, main memory expansion, RAIDs (Redundant Array of Inexpensive Disks), ...
 - (b) Hyper-Threading: Off
 - (2) Network
 - (a) Connection to the Internet via DigiHub
 - (b) Interconnect of the cluster nodes
 - (3) File systems
 - (a) NFS (Network File System)
 - (i) Home directories (home/...), accessible on all nodes ("shared")
 - (b) BeeGFS (Bee Grid File System)
 - (i) Work directories (/work/...) accessible on all nodes ("shared")
 - (c) Standard Linux file systems

- (i) System directories
 - (ii) Local directories (/local/...) only accessible on the respective node
- b) Login procedure:
 - (1) External access via ssh (on port 10022 with ssh-keys and 2FA)
 - (a) An ssh login via classic passwords is not possible to protect against cyber attacks and to improve security.
 - (2) Moving between the directories on the login node (rci-head)
 - (3) Moving between the nodes without re-entering a passphrase or a 2FA token via SSH agent forwarding
- c) Options for data exchange with the computer in the office or home office:
 - (1) SCP (Secure Copy)
 - (2) SFTP (Secure File Transfer Protocol)
 - (a) GUIs (Graphical User Interface) are freely available (Filezilla, ...)
 - (3) SSHFS (Secure Shell File System)
 - (a) Particularly convenient, for example to be able to edit files directly on the RCI with a local editor or a local IDE (Integrated Development Environment).
 - (4) Built-in functionality of terminal clients such as MobaXterm under Windows
- d) Presentation of the batch system:
 - (1) Workload-Manager SLURM
 - (2) Queues (correspond to partitions in SLURM terminology)
 - (3) Fair scheduling when selecting the next job for execution
 - (4) Elementary SLURM commands:
 - (a) Display of an overview of the current status of the cluster nodes and the queues (sinfo and squeue)
 - (b) Submitting jobs (sbatch) and interactive use of nodes (salloc)
 - (c) Cancel jobs (scancel).

Glossary

Notions defined in this glossary are specific for this document only.

Notion	Meaning
ADCH	AI, Digitisation, Cybersecurity, and HPC
AI	Artificial Intelligence
ARIC	Artificial Intelligence Center Hamburg
CPU	Central processing unit
CRM	Customer Relationship Management
CSTI	Creative Space for Technical Innovations
DigiHub	Digital Hub Logistics GmbH
DMA	Document Management System
DMS	Digital Maturity Assessment
EDIH	European Digital Innovation Hub
EDIH4UrbanSAVE	European Digital Innovation Hub for urban interconnected supply and value Ecosystems
ERP	Enterprise Resource Planning
EU	European Union
GA	Grant Agreement
GPU	Graphics processing unit
HAW	Hochschule fuer Angewandte Wissenschaften Hamburg / University of Applied Science Hamburg
HiTeC	Hamburger Informatik Technologie-Center
HPC	High-Performance Computing
HWK	Handwerkskammer Hamburg
IDE	Integrated development environment
JPOC	Joint Proof of Concept
MVP	Minimal Viable Product
NFS	Networking file system
PA / PSO	Public Authority / Public Sector Organisation
PM	Person month
PoC	Proof of Concept
PoV	Proof of Value
PPP	Public Private Partnership
PSO / PA	Public Sector Organisation / Public Authority
RCI	Research Computing Infrastructure
SLURM	Slurm Workload Manager,
SME	Small and Medium Enterprises
SSH	Secure shell
TBI	Test before Invest
TUHH	Technische Universitaet Hamburg / Hamburg University of Technology
VR	Virtual Reality