Interreg Danube Region

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Danube DNA

DANUBE DNA

A2.3 Technical Manual of All Joint Solutions

Joint Solutions Catalogue

A structured catalogue of jointly developed digital and green transition solutions for SMEs in the Danube Region

DOCUMENT TYPE	SCOPE	VERSION
Catalogue / Technical Manual	All Joint Solutions	Final formatted version

Prepared as a consolidated catalogue and technical manual of the DanubeDNA joint solutions portfolio, based on partner inputs, individual technical manuals, pilot documentation and project materials.

Document Information

Scope, structure and catalogue logic

Document profile	
Project	DANUBE DNA
Deliverable / Activity	A2.3 Technical Manual of All Joint Solutions
Catalogue focus	Joint solutions developed, tested and/or prepared within the project
Solutions covered	Market Pulse, WeldWise, InvestPlanner, AI-Powered Funding Call Matcher, Danube DRA, EM4 System Condition
Formatting approach	Catalogue-style layout with portfolio overview, solution fiches and detailed technical sections
Catalogue note	Metadata fields have been completed and harmonised on the basis of partner manuals, the matching table and project files. Where a separate budget allocation or external expert role was not recorded in the source documentation, the catalogue uses a neutral final formulation as part of the final record.

This document is structured as a practical catalogue and technical manual. It starts with a portfolio-level overview and then presents each joint solution through a consistent solution fiche, short description and detailed technical manual section. The structure is intended to make the deliverable easier to read, compare and reuse for dissemination, pilot follow-up and transferability discussions.

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1. Portfolio Overview

Six joint solutions supporting digital, green and business transformation

The DanubeDNA joint solution portfolio brings together **six complementary SME-oriented solutions** developed to support digital, green and business transformation across the Danube Region. The portfolio reflects the practical needs identified across the project partnership: SMEs require accessible tools that help them understand their digital maturity, plan investments more clearly, identify funding opportunities, forecast market demand, monitor production and energy performance, and reduce operational inefficiencies through data-driven decision-making.

The portfolio combines **four AI-enabled digital tools** with **two industrial and energy monitoring solutions**, creating a balanced set of instruments for both strategic and operational transformation. Market Pulse supports AI-based demand forecasting and helps SMEs improve production, procurement and inventory planning. WeldWise provides an Industrial IoT monitoring layer for manufacturing environments, linking production events with machine-level energy consumption and operational KPIs. InvestPlanner helps entrepreneurs, SMEs and support organisations prepare structured investment studies and business plans with AI-assisted content and financial analysis. The AI-Powered Funding Call Matcher improves access to EU funding opportunities by combining automated funding-call collection, filtering and AI-supported relevance matching. Danube DRA provides an AI-supported digital readiness assessment methodology, helping SMEs understand their current digitalisation level and define practical transformation priorities. EM4 System Condition introduces a flexible wireless energy monitoring approach that supports energy efficiency, system-condition visibility and future predictive maintenance use cases.

This mix of solutions is important because SME transformation does not follow a single path. Some companies need better planning, assessment, funding access or forecasting before they can make strategic decisions. Others need direct visibility over machines, production performance, energy consumption and operational inefficiencies. The DanubeDNA portfolio therefore covers both **web-based and cloud-based decision-support tools** and **on-premises or physical retrofit monitoring systems**, allowing the solutions to respond to different levels of SME digital maturity and technical readiness.

A key strength of the portfolio is its transferability. The solutions were developed, piloted, validated or prepared for use in different partner countries, sectors and SME contexts, with a documented footprint across **up to twelve Danube Region countries**. This transnational development logic shows that the portfolio is not limited to one national or sectoral use case. Web-based tools can be reused by business support organisations, consultants and SMEs, while industrial and energy-monitoring solutions can be adapted to different machines, processes and production sites through modular hardware, configurable dashboards and context-specific monitoring logic.

The portfolio also demonstrates the value of combining partner expertise across the DanubeDNA consortium. Universities, technology providers, clusters, digital transformation actors, business support organisations, pilot SMEs and external experts contributed to the development, testing and validation of the solutions. This cooperation helped ensure that the tools are not purely theoretical, but grounded in real SME challenges, pilot environments and practical implementation settings.

The table below provides a single-page overview of the six joint solutions, including their main focus, responsible partners and deployment logic. It serves as a quick reference before the more detailed catalogue fiches and technical manual sections that follow.

No.	Joint solution	Type / focus	Responsible partner	Deployment / access
01	**Market Pulse**	AI / demand forecasting Demand planning and business decision support	Faculty of Technical Sciences (FTN)	Hosted web tool
02	**WeldWise**	Industrial IoT / energy and production monitoring Machine-level production and energy visibility	ICT Cluster	On-premises edge system
03	**InvestPlanner**	AI business planning / investment study tool Investment study management, business planning and investor-ready documentation	TERA Tehnopolis d.o.o., Croatia	Web application
04	**AI-Powered Funding Call Matcher**	AI funding search and matching EU funding call discovery and relevance matching	Pomurje Technology Park	Online platform / containerised deployment
05	**Danube DRA**	AI digital readiness assessment Digital maturity, process mapping and transformation roadmap	SOVA Digital a.s., Slovakia	Cloud-based SaaS assessment
06	**EM4 System Condition**	Wireless energy monitoring Energy consumption, system condition and optimisation	CAMPUS 02 University of Applied Sciences, Austria	Physical retrofit monitoring system

AI-ENABLED	INDUSTRIAL / ENERGY MONITORING	SME-ORIENTED	TRANSFERABLE PORTFOLIO
4 solutions	**2 solutions**	**6 solutions**	**Danube Region**

2. Short Catalogue of Joint Solutions

One-page reading layer for quick comparison

Solution 01: Market Pulse

Demand planning and business decision support

TYPE	DEPLOYMENT	PRIMARY USERS
AI / demand forecasting	Hosted web tool	SMEs in production, distribution, retail and service...

Market Pulse is an AI-based online tool for market demand forecasting, developed to help SMEs make better business decisions based on structured data rather than intuition alone. The solution supports companies in forecasting demand for selected products by analysing historical sales and relevant market-related parameters. Its main value is in helping SMEs avoid overproduction, underproduction, unnecessary stock accumulation, and missed sales opportunities. Users upload business data in a predefined format, after which the system generates demand forecasts in numerical and graphical form.

The tool is especially useful for SMEs involved in production, distribution, retail, and service delivery, where accurate demand planning directly affects procurement, inventory, production capacity, and investment decisions. Within DanubeDNA, Market Pulse contributes to the project's goal of making AI-based decision support accessible to SMEs and helping them become more data-driven, competitive, and resource-efficient.

Solution fiche	
Responsible partner	LP1 Faculty of Technical Sciences (FTN)
Contributing partners	PP12 CEM
External experts	LogiAI
Period	August – December 2025
Budget allocation	2,335,000.00 RSD
Catalogue status	Developed as open-source cloud-native/containerised tool; pilot testing in Serbia and Montenegro

Solution 02: WeldWise

Machine-level production and energy visibility

TYPE	DEPLOYMENT	PRIMARY USERS
Industrial IoT / energy and production monitoring	On-premises edge system	Manufacturing SMEs

WeldWise is an Industrial IoT solution for production and energy monitoring, initially developed for spot welding machines and later tested in broader industrial environments. The solution connects machine activity, production events, and electricity consumption into one monitoring platform. It enables companies to count production output automatically, measure machine-level energy use, calculate energy consumption per produced unit, and visualise key performance indicators through dashboards. WeldWise is especially valuable for manufacturing SMEs that use reliable machines but lack structured real-time data about productivity and energy efficiency. The system is based on a modular retrofit approach, meaning that it can be added to existing equipment without a complete factory-wide digitalisation project.

In DanubeDNA, WeldWise demonstrates how a practical and affordable monitoring layer can help SMEs improve operational transparency, reduce manual reporting, identify inefficiencies, and prepare for future integration with ERP, MES, or AI-based analytics systems.

Solution fiche	
Responsible partner	ICT Cluster Bulgaria
Contributing partners	EDE-16 Ltd.; MDC – Mechanical Design and Constructions Ltd.
External experts	COMICON Ltd., Bulgaria
Period	2026
Budget allocation	15,000 EUR
Catalogue status	Piloted in Bulgaria at EDE-16 and MDC; validated in real industrial environments

Solution 03: InvestPlanner

Investment study management, business planning and investor-ready documentation

TYPE	DEPLOYMENT	PRIMARY USERS
AI business planning / investment study tool	Web application	Entrepreneurs, start-ups, SMEs, managers, project teams and business support organisations

InvestPlanner is an AI-powered web application available through investplanner.eu, developed to support the preparation of structured investment studies, business plans and investor-ready documentation. The solution guides users through business definition, business analysis and investment study creation, while combining financial modelling, KPI analytics, section-by-section review, AI-supported content generation and professional document output.

The platform is designed for entrepreneurs, start-ups, SMEs, managers, project teams, investors, advisors and business support organisations. Its main value is that it reduces the time and complexity of preparing investment documentation, improves consistency between narrative content and financial tables, and helps users interpret financial data, identify gaps, test scenarios and present project ideas in a more credible and professional way.

Solution fiche	
Responsible partner	**TERA Tehnopolis d.o.o., Croatia**
Contributing partners	TUM International GmbH; Business Support Organisations
External experts	ORKA d.o.o.; SPECSCOM; CONSULT ZEE; AMRYT
Period	3-5 months
Catalogue status	Developed operational web application; pilot implementation and technical documentation completed within the DanubeDNA joint solutions portfolio

Solution 04: AI-Powered Funding Call Matcher

EU funding call discovery and relevance matching

TYPE	DEPLOYMENT	PRIMARY USERS
AI funding search and matching	**Online platform / containerised deployment**	**SMEs, clusters, research organisations and innovatio...**

The AI-Powered Funding Call Matcher is an online tool designed to help SMEs and innovation-driven organisations identify relevant EU funding opportunities more efficiently. It collects funding calls from multiple sources, including EU funding platforms and cascade funding databases, and stores them in a structured searchable system. Users can search and filter opportunities by industry, status, budget, deadline, and other criteria. The AI component supports keyword extraction, semantic search, related-term suggestions, and matching between user needs and available calls. This is especially useful for SMEs that do not have dedicated funding teams and often struggle to monitor complex and competitive EU funding schemes. The tool reduces manual searching, improves relevance, and helps organisations focus on calls that better match their project idea, sector, budget, and eligibility profile.

Within DanubeDNA, it strengthens SME access to funding, partnerships, innovation support, and future proposal preparation.

Solution fiche	
Responsible partner	Pomurje Technology Park
Contributing partners	IT&C Cluster “Lower Danube”; SERDA – Sarajevo Economic Region Development Agency (pilot validation)
External experts	FERI – Faculty of Electrical Engineering and Computer Science, University of Maribor
Period	Period 4–5: July 2025 – June 2026
Catalogue status	Validated through pilots in Slovenia, Romania and Bosnia and Herzegovina; integrated in B2GreenHub / DanubeDNA environment

Solution 05: Danube DRA

Digital maturity, process mapping and transformation roadmap

TYPE	DEPLOYMENT	PRIMARY USERS
AI digital readiness assessment	Cloud-based SaaS assessment	SMEs, consultants and Digital Transformation Centers

Danube DRA is an AI-supported Digital Readiness Analysis tool that helps SMEs assess their level of digital maturity and identify practical next steps for digital transformation. The solution evaluates processes, data usage, technology, IT infrastructure, people, roles, and strategic management as one integrated system. The assessment can be completed through an online questionnaire, XLS form, or guided consultant interview. After the input is submitted, the AI system generates an analytical report and a visual process map, which are then reviewed and validated by a consultant. The output gives the company a clear view of its current digitalisation level, main weaknesses, bottlenecks, opportunities, and priority areas for improvement. Danube DRA is valuable not only for SMEs but also for business support organisations and digital transformation centres, as it provides a structured and comparable methodology for advisory work.

Within DanubeDNA, it creates a common foundation for digital transformation planning across regions and sectors.

Solution fiche	
Responsible partner	SOVA Digital a.s., Slovakia
Contributing partners	Dél-Dunántúli Regionális Innovációs Ügynökség Nonprofit Kft. / South Transdanubian Regional Innovation Agency (STRIA), Hungary; Industry4UM, Slovakia
Period	Period 4–5
Budget allocation	EU funding 80%: EUR 125,817.37; co-financing 20%: EUR 31,454.34
Catalogue status	Pilot-tested in Slovakia; transfer / pilot implementation in Hungary; AI-assisted assessment validated with expert review

Solution 06: EM4 System Condition

Energy consumption, system condition and optimisation

TYPE	DEPLOYMENT	PRIMARY USERS
Wireless energy monitoring	Physical retrofit monitoring system	Energy-intensive SMEs and manufacturing sites

EM4 System Condition is a flexible wireless energy monitoring solution developed to help SMEs measure energy consumption, analyse system condition, and identify optimisation opportunities. The solution is based on digital power clamps, sensor modules, impulse transmitters, and a central gateway, allowing companies to monitor selected machines, circuits, or processes without complex and expensive rewiring. It is especially relevant for SMEs with energy-intensive equipment such as compressors, welding stations, ventilation systems, paint rooms, production machinery, and auxiliary systems. The system supports easy retrofit installation, modular expansion, customised dashboards, and future upgrades such as machine condition monitoring or predictive maintenance. In pilot environments, it was applied to energy monitoring in a car-painting company and a manufacturing company with welding processes.

Within DanubeDNA, EM4 System Condition provides a practical entry point for SMEs that want to reduce energy costs, improve operational visibility, and use measurement data for smarter efficiency decisions.

Solution fiche	
Responsible partner	CAMPUS 02 University of Applied Sciences, Austria (PP10)
Contributing partners	VSTE (PP5); pilot SMEs in Czech Republic and Austria
External experts	Messfeld GmbH / Adapt System expertise
Period	Period 3–5
Catalogue status	Piloted in Czech Republic and Austria; Power-Adapt validated in real SME environments; Predict-Adapt available as extension

3. Detailed Technical Manual

This section provides the **detailed technical manual** for the six joint solutions included in the DanubeDNA portfolio. While the portfolio overview and short catalogue fiches present the solutions in a concise and comparative format, this part of the document gives a more complete view of their **development background, technical logic, implementation model, user workflow, administration requirements, integration potential and expected impact**.

The six solutions address different but connected needs of SMEs in the Danube Region. **Market Pulse** supports AI-based demand forecasting and helps companies improve planning decisions related to production, procurement, inventory and market response. **WeldWise** introduces an Industrial IoT monitoring layer for manufacturing SMEs, connecting production events, machine activity and energy consumption into measurable operational KPIs. **InvestPlanner** supports entrepreneurs, SMEs and business support organisations in preparing structured investment studies, business plans and investor-ready documentation. The **AI-Powered Funding Call Matcher** improves access to EU funding opportunities by combining automated funding-call collection, filtering and AI-supported relevance matching. **Danube DRA** provides an AI-supported digital readiness assessment methodology, helping SMEs understand their digital maturity level and define practical transformation priorities. **EM4 System Condition** focuses on wireless energy monitoring and system-condition visibility, giving SMEs a flexible entry point for energy efficiency analysis and future predictive maintenance.

Each solution is presented through a **harmonised technical structure** in order to make the manual easier to read, compare and reuse. The description starts with a technical fiche summarising the main metadata, including solution type, deployment model, responsible partner, contributing partners, external experts, implementation period, budget information and catalogue status. This provides a quick reference before the more detailed technical content.

The narrative part of each solution then explains the **background and aim of the solution**, the SME challenge it addresses, its target beneficiaries and the practical transformation need behind its development. This is followed by a technical description of the main functionalities, system architecture, technology stack and deployment environment. For the AI-supported and web-based tools, the focus is placed on platform access, data input, AI-assisted processing, analysis, reporting and output generation. For the industrial and energy-monitoring solutions, the manual describes the retrofit logic, machine-level or circuit-level installation, sensors, gateways, communication layers, dashboards and monitoring workflows.

The section also includes implementation-oriented information needed to understand how each solution can be deployed and operated in practice. This covers **prerequisites, installation or setup steps, configuration guidelines, user access, user roles and permissions, system administration, backup and recovery, security considerations, integration options and data exchange formats**. Where exact technical parameters were available from partner documentation, they have been retained and structured. Where information was not explicitly specified, the description remains at functional level in order to avoid unsupported assumptions.

Where pilot information is available, the manual also summarises the **pilot implementation experience and expected impact**. This includes how the solutions were tested, what types of SMEs or support organisations were involved, what operational or strategic needs were addressed, and what conclusions can be drawn for future transferability. The pilot examples show that the portfolio is not only conceptual, but linked to real SME environments, including manufacturing, welding, energy-intensive processes, digital readiness assessment, funding support and investment planning.

The purpose of this section is to make the DanubeDNA joint solutions portfolio usable beyond the immediate reporting context. By presenting all six solutions in a consistent and sufficiently detailed format, the manual supports **technical validation, partner review, dissemination, transferability assessment and future uptake**. It gives readers a clear understanding of how each solution works, what conditions are required for its implementation, and how the solutions can be adapted to other SMEs, sectors and regional contexts across the Danube Region.

Solution 01: Market Pulse

Market Pulse

SOLUTION TYPE AI / demand forecasting	DEPLOYMENT Hosted web tool	STATUS Developed / pilot testing in Serbia and Montenegro

Technical fiche	
Solution title	Market Pulse
Responsible partner	LP1 Faculty of Technical Sciences (FTN)
Contributing partners / pilot sites	PP12 CEM; pilot testing in Serbia and Montenegro
External experts	LogiAI
Period	August – December 2025
Budget allocation	2,335,000.00 RSD

Introduction

Market Pulse is an AI-powered online tool developed within the DanubeDNA project to support SMEs in forecasting market demand and improving business decision-making. The solution is developed by the Faculty of Technical Sciences (FTN) and is designed as a practical digital tool for SMEs that need better insight into market response, demand trends, production planning, and inventory decisions.

The tool responds to a common challenge faced by SMEs: many companies do not have access to advanced forecasting systems or dedicated analytical teams. As a result, decisions related to procurement, inventory levels, production planning, and capacity investment are often based on intuition, past experience, or incomplete data. This can lead either to over-ordering raw materials and creating excess inventory, or to underestimating demand and missing market opportunities.

Background of the solution development

The development of Market Pulse is based on the need to provide SMEs with an accessible and user-friendly forecasting tool. The official DanubeDNA project description presents Market Pulse as an AI tool that analyses parameters such as sales trends, market share, GDP growth, marketing investments, and seasonal variations in order to generate market demand forecasts.

The solution is therefore positioned not only as a technical tool, but also as a decision-support instrument for SMEs. It helps companies reduce uncertainty in demand planning and supports more data-driven business management.

Aim of the solution development

The main aim of Market Pulse is to help SMEs forecast product demand more accurately and use these forecasts to improve business decisions.

More specifically, the solution aims to support SMEs in:

- improving demand forecasting for selected products;
- reducing the risk of overproduction and underproduction;
- improving procurement and inventory planning;
- supporting investment decisions related to production capacity;
- improving market strategy through better understanding of demand patterns;
- reducing operational inefficiencies caused by inaccurate market estimation.

Beneficiaries

The main beneficiaries of Market Pulse are SMEs from different industries and regions. The solution is not limited to a specific sector, because demand forecasting is relevant for companies involved in production, distribution, retail, and service delivery.

The tool is especially useful for SMEs that regularly make decisions about production volume, stock levels, order frequency, supply frequency, safety stocks, marketing investment, and capacity expansion. However, the quality of the

output depends on the quality and accuracy of the uploaded data. The tool provides the strongest value when SMEs upload precise data in the required format.

Technical Specification of the Solution

Solution Description: key features and benefits

Market Pulse is an online forecasting tool that uses artificial intelligence to estimate market demand for specified products. The solution works by allowing SMEs to upload company data, ideally in CSV format, and then processes this data to generate demand forecasts.

The available materials specify that the tool supports company datasets covering up to three years, with a limit of 1,000 entries per file.

The key features of the solution include:

User-friendly data upload.
The platform allows SMEs to upload structured company data. A drag-and-drop functionality is planned to simplify the upload process and make the tool accessible for non-technical users.

AI-based demand forecasting.
The tool analyses uploaded company data and relevant market parameters in order to forecast future demand for selected products.

Numerical and graphical forecasts.
The results are presented through both numerical and graphical outputs, allowing SME managers to interpret the forecast more easily and use it in decision-making.

Forecasting for predefined timeframes.
The tool is intended to provide forecasts for defined periods such as day, week, month, and quarter.

Business decision support.
The forecasts can be used to support decisions related to production planning, procurement, inventory levels, stock management, supply frequency, and capacity investment.

The main benefit of the tool is that it enables SMEs to make more informed decisions and reduce operational risks linked to inaccurate demand estimation.

System Architecture Overview

Based on the available project materials, Market Pulse is planned as an online tool hosted on the responsible partner's server, with an interface accessible through the DanubeDNA platform. Once an SME creates a profile on the platform, it can access the tool, upload the required data, and view the generated forecasts.

The expected system architecture can be described as follows:

- User access layer – SME users access the tool through the DanubeDNA platform interface.
  - Data upload layer – users upload structured datasets, preferably CSV files.
  - Processing and AI forecasting layer – the system analyses uploaded data and applies forecasting models.
  - Results layer – forecasts are displayed in numerical and graphical form.
  - Data privacy layer – uploaded company data is linked only to the SME profile and treated confidentially.
  - This architecture allows Market Pulse to function as part of the broader DanubeDNA digital ecosystem, while the core forecasting functionality remains managed by the responsible technical partner.

Technology Stack

The source files do not define the programming languages, frameworks, databases and AI models in full implementation detail. The catalogue therefore records the technology stack at functional level, focusing on the components required for deployment and reuse.

The solution requires the following technical components:

- a web-based user interface;
- data upload functionality, preferably supporting CSV files;
- a backend system for data processing;
- AI / machine learning models for demand forecasting;
- a database or secure storage mechanism for user profiles and uploaded datasets;
- a visualization module for numerical and graphical forecasts;
- authentication and user-access management.

The technology stack is therefore documented at functional level within the final catalogue.

Deployment Environment

Market Pulse is planned to be hosted on FTN's server and accessed through the DanubeDNA platform. The official project description also confirms that the tool is integrated into the DanubeDNA platform and enables companies to upload data and receive numerical and graphical forecasts.

The deployment environment can therefore be described as a hosted web-based solution with platform-level access through DanubeDNA.

Expected deployment model:

Hosting: FTN server

Access point: DanubeDNA platform interface

User side: Web browser

Data upload: CSV or similarly structured files

Forecast output: numerical and graphical results

Installation & Setup

Prerequisites

For SMEs, no local installation is required if the solution is accessed as an online tool. Users need only a stable internet connection, a web browser, access to the DanubeDNA platform, and company data prepared in the required format.

The main practical prerequisite is data readiness. SMEs should prepare structured historical data for the selected products, ideally including sales volumes, time periods, product identifiers, marketing-related data where available, and other relevant variables that may influence demand.

Installation Steps

Since Market Pulse is an online tool, installation is not expected on the SME side. The setup process is mainly platform-based.

The expected steps are:

- The SME creates or accesses its profile on the DanubeDNA platform.
  - The SME opens the Market Pulse tool from the platform interface.
  - The SME prepares its dataset in the required format.
  - The SME uploads the data file.
  - The system validates the uploaded data.
  - The AI forecasting module processes the data.
  - The forecast results are displayed in numerical and graphical form.

Configuration and Setup Guidelines

Configuration is mainly related to preparing the dataset correctly. The SME should ensure that the uploaded file follows the required structure and contains accurate historical data.

Before using the tool, SMEs should check:

- whether the dataset covers the required period;
- whether product names or identifiers are consistent;
- whether sales and demand data are complete;
- whether the file format is accepted by the platform;

whether the number of entries is within the supported limit.

The tool currently supports company datasets spanning up to three years and up to 1,000 entries per file.

User Guide

Logging In & User Authentication

The SME user accesses Market Pulse through the DanubeDNA platform. After logging into the platform, the user can open the tool from the available digital solutions section.

Authentication is managed through the SME profile. Uploaded data and generated forecasts should remain linked only to the respective SME user profile, ensuring privacy and confidentiality.

Core Functionalities: Step-by-Step

The main user workflow is:

• Log in to the DanubeDNA platform.

The SME user enters the platform using their registered account.

Open Market Pulse.
The user selects the Market Pulse tool from the available joint solutions.

Upload company data.
The user uploads a prepared dataset, ideally in CSV format.

Select product or forecasting scope.
The SME selects the product or product group for which demand should be forecasted.

Select forecasting timeframe.
Forecasting may be performed for predefined timeframes such as day, week, month, or quarter.

Run forecast.
The tool processes the data and generates forecast results.

Review results.
The user reviews numerical and graphical outputs.

Use results for decision-making.
The forecast can support decisions related to production, procurement, stock levels, supply frequency, marketing, or investment planning.

User Roles & Permissions

The source documentation does not define a detailed role structure. For catalogue consistency, the following practical user roles are used:

SME User: uploads company data, runs forecasts, and views results.
Platform Administrator: manages access to the tool through the DanubeDNA platform.
Technical Administrator / FTN: maintains the forecasting tool, hosting environment, and technical functionality.

System Administration

User Management

User management is expected to be handled through the DanubeDNA platform. SMEs access Market Pulse after creating a profile. Access to uploaded data and forecast results should be restricted to the respective SME profile.

Data Backup & Recovery

The source documentation does not provide detailed backup procedures. Because the tool processes company data, regular backup and recovery procedures are recorded as part of the recommended server-level operating model.

Recommended minimum requirements:

- regular backup of user-related records;
- secure storage of uploaded datasets;
- recovery procedure in case of technical failure;

deletion or anonymisation rules where required by data protection policies.

Security Settings & Access Control

Data confidentiality is explicitly mentioned in the partner materials. The tool should ensure that uploaded company data is used only for the SME profile and is not misused or accessed by unauthorised users.

Recommended security principles:

- profile-based access control;
- secure authentication through the DanubeDNA platform;
- restricted access to uploaded datasets;
- data confidentiality between SMEs;
- secure hosting and server-side protection.

Integration & API Usage

Available APIs & Endpoints

No public APIs or endpoints are defined in the source documentation. The integration logic is therefore described at functional level.

At functional level, the solution requires mechanisms for:

- uploading structured datasets;

- sending data to the forecasting engine;
- retrieving numerical forecast results;
- retrieving graphical forecast outputs;
- connecting with other digital systems during pilot implementation.

Integration with Third-Party Systems

During pilot actions, Market Pulse is expected to be integrated where possible with SME digital systems such as ERP, CRM, or MES. This integration would allow the forecasting process to use updated operational data and provide regular forecasts for decision-makers.

Such integration can support more frequent forecasting and improve decision-making related to procurement, inventory levels, sales increases or reductions, desirable stock levels, and production planning.

Data Exchange & Formats

The main supported data format mentioned in the materials is CSV. The platform is expected to allow SMEs to upload company datasets in a predefined structure.

The uploaded data may include:

- product sales data;
- historical demand;
- time period;
- market share information, where available;
- marketing investment information;
- seasonal variables;
- other relevant business parameters.

The tool supports datasets of up to three years and up to 1,000 entries per file.

Expected Impact of the Solution

Market Pulse is expected to improve SME decision-making by providing more accurate and accessible market demand forecasts. The tool gives SMEs an analytical basis for planning production, procurement, inventory, and investment decisions.

The expected quantitative and qualitative impacts include:

- improved accuracy of demand forecasting;
- reduced risk of overproduction;
- reduced risk of shortages and missed sales opportunities;
- better inventory planning;
- improved procurement and stock management;
- more informed investment decisions;
- improved competitiveness through data-driven planning;
- reduced waste from unnecessary production and raw material ordering.

In the wider DanubeDNA context, Market Pulse contributes to the digital transformation of SMEs by making AI-based forecasting accessible to companies that may not otherwise have the capacity to develop or purchase advanced forecasting systems.

Additional details from the partner technical manual

The individual Market Pulse manual confirms the source profile of the solution: responsible partner LP1 FTN, contributing partner PP12 CEM, external expert LogiAI, implementation period August-December 2025, and budget allocation of 2,335,000.00 RSD.

The manual also specifies that pilot testing is planned in Serbia and Montenegro to verify practical applicability, transferability and reliability across different SME contexts.

From a user perspective, the partner manual adds stricter data and import requirements. Supported formats are CSV and Excel (.xlsx), with the prescribed column structure Name, Date, Quantity and Price. At least one full calendar year of consecutive historical records is required for reliable forecasting, the current default forecasting horizon is three months, and each new import replaces previously stored account data.

From a technical perspective, the manual describes a containerised deployment with Docker Compose, an internal isolated Docker bridge network, PostgreSQL and Redis shielded from direct host exposure, an Nginx reverse proxy with Let’s Encrypt TLS termination, and a horizontally scalable Plumber/R forecasting layer behind the gateway.

Development Team and Contributing Partners

Market Pulse is developed by the Faculty of Technical Sciences (FTN) as the responsible partner. The DanubeDNA consortium contributes by supporting integration into the broader project platform, identifying SME needs, supporting pilot actions, and facilitating dissemination and uptake of the solution.

The responsible partner's role includes:

- solution concept development;
- forecasting logic and AI-based functionality;
- hosting and technical maintenance;
- definition of data requirements;
- support for pilot implementation.

The DanubeDNA consortium's role includes:

- supporting SME engagement;
- supporting platform access and dissemination;
- collecting feedback from pilot users;
- contributing to improvement and transferability of the solution.

Overall, Market Pulse represents a practical AI-driven joint solution that supports SMEs in becoming more data-driven, competitive, and resource-efficient within the Danube region.

Solution 02: WeldWise

WeldWise – Smart Energy and Production Monitoring for Spot Welding Machines

SOLUTION TYPE **Industrial IoT / energy and production monitoring**	DEPLOYMENT **On-premises edge system**	STATUS Piloted in Bulgaria / validated

Technical fiche	
Solution title	WeldWise – Smart Energy and Production Monitoring for Spot Welding Machines
Responsible partner	ICT Cluster Bulgaria
Contributing partners / pilot sites	EDE-16 Ltd.; MDC – Mechanical Design and Constructions Ltd.
External experts	COMICON Ltd., Bulgaria
Period	2026
Budget allocation	15,000 EUR

Introduction

WeldWise is an Industrial IoT-based monitoring and analytics solution developed within the DanubeDNA project to support the digital transformation of SMEs in manufacturing environments. The solution was developed with ICT Cluster Bulgaria acting as the responsible project partner and beneficiary of the joint solution, while COMICON Ltd. carried out the technical development and system integration activities. COMICON is a Bulgarian SME specialised in industrial automation, wireless communication, energy monitoring, wireless sensor networks, and Industrial IoT systems.

The solution was created to address a very practical problem in manufacturing SMEs: many machines are productive and reliable, but they do not provide enough structured operational data. A spot welding machine can produce thousands of welds per day, but production counting is often still based on mechanical counters, delayed reporting, or manual records. At the same time, machine-level energy consumption is often not measured in detail, which makes it difficult to understand the relationship between production output and energy use.

WeldWise closes this visibility gap by connecting machine activity, production events, and energy consumption into one monitoring and analytics platform. The solution enables SMEs to monitor production output in real time, measure electricity consumption by machine or process, calculate energy consumption per produced unit, archive historical data, and visualise KPIs for both operators and management. The public DanubeDNA description also presents WeldWise as a modular digital solution that supports production and energy monitoring, KPI visualisation, historical analytics, alerts, reporting, and export of operational data.

Background of the solution development

The background of WeldWise is directly connected to the need for practical Industry 4.0 tools that can be deployed in SMEs without expensive factory-wide modernization. In many smaller manufacturing companies, the production process itself may be stable, but the lack of reliable data limits operational control. This is especially relevant for repetitive processes such as spot welding, where many production events happen in a short period and energy consumption is significant.

Before the implementation of WeldWise, companies often had limited real-time visibility into how many parts were produced by each machine, how much energy was consumed, whether the machine was operating correctly, and what the energy consumption per unit was. This made it difficult to detect inefficiencies, compare shifts, assess operator performance, or prepare evidence for energy management systems such as ISO 50001-type reporting. The solution therefore focuses on transforming hidden machine signals into usable operational data.

Aim of the solution development

The main aim of WeldWise is to provide SMEs with a practical, cost-effective, and non-invasive Industrial IoT monitoring platform that improves production transparency, energy efficiency, and data-driven operational control.

More specifically, WeldWise aims to:

- automate production counting by machine and shift;
- measure electricity consumption at machine or process level;
- calculate specific energy consumption per produced unit;

- provide real-time dashboards for operators;
- provide historical KPI visualisation and reporting for management;
- reduce manual reporting work;
- support production efficiency analysis;

create a reusable architecture that can be adapted to different industrial machines and processes.

The solution is intentionally designed as a retrofit system. This means that it can be added to existing production equipment without replacing PLCs, rewiring machines, or interrupting production for a long period.

Beneficiaries

The main beneficiaries of WeldWise are manufacturing SMEs that operate machines with repetitive production cycles and measurable energy consumption. The initial use case was spot welding, but the solution was also validated for broader industrial applications, including laser cutting systems, industrial compressors, and powder-coating installations.

WeldWise is especially useful for SMEs that need to improve:

- machine-level production visibility;
- energy monitoring and energy efficiency;
- production reporting;
- shift-based performance tracking;
- energy-per-unit analysis;
- operational transparency for management;
- real-time feedback for operators.

The solution is also relevant for companies that want to begin their digital transformation gradually. Instead of implementing a large and expensive factory system immediately, an SME can start with one monitored machine, one KPI, and one dashboard, then expand later.

Technical Specification of the Solution

Solution Description: key features and benefits

WeldWise is an on-premises industrial monitoring and analytics solution designed for spot welding machines and similar industrial equipment. It combines production event counting, electrical energy monitoring, KPI calculation, historical data archiving, and real-time visualisation. The solution uses a modular Industrial IoT architecture based on compact hardware and open-source software components.

The main functionalities include:

Automated energy monitoring.
The system collects and archives electricity consumption by machine, selected process, or enterprise-level consumption point.

Production counting.
WeldWise counts production events by machine and by shift. In the spot welding use case, each welding pedal activation corresponds to a production event under standard operating conditions.

Energy per unit calculation.
The system calculates specific energy consumption per produced unit, usually expressed as Wh/unit. This KPI makes energy waste and performance variation more visible.

Operator dashboard.
A shop-floor dashboard displays live production output, machine status, and energy consumption per unit. This provides immediate feedback to operators during the shift.

Management HMI.
A Domoticz-based interface provides management with historical data, KPI visualisation, alerts, comparisons, and export options in formats such as XLS or CSV.

Historical analytics and reporting.
The system archives production counters, energy measurements, machine states, alarms, and calculated KPIs in a local database. This allows shift, daily, monthly, and yearly comparisons.

The key benefit of WeldWise is that it gives SMEs real-time and historical visibility without requiring a heavy factory overhaul. It supports better decision-making, reduces manual reporting, and enables direct comparison between production output and energy consumption.

System Architecture Overview

WeldWise uses a local edge architecture. Existing machines are connected to measuring units that collect production and energy signals. These signals are transmitted through Wi-Fi or LAN to an MQTT broker. The edge server processes the data using Node-RED, visualises it through Domoticz, stores historical data locally, and makes dashboards available to operators and management.

The architecture can be summarised as follows:

- Machine level: spot welding machines or other monitored industrial equipment generate production events and consume electricity.

Measuring unit level: measuring units collect digital inputs, production counters, and energy measurements.

Communication level: data is transmitted through MQTT over local Wi-Fi or Ethernet.

Edge server level: a Raspberry Pi-class single-board computer hosts MQTT, Node-RED, Domoticz, and local storage.

Visualisation level: operator dashboards and management HMI provide real-time and historical information.

Integration level: data is available for future ERP, MES, or AI-based analytics through MQTT, HTTP, JSON API, or export functions.

The architecture is on-premises, meaning that the system can operate inside the local company network without mandatory cloud connectivity. This is important for SMEs that prefer local data control and do not want sensitive production data to depend on external cloud services.

Technology Stack

The WeldWise technology stack is based on commercially available Industrial IoT hardware and open-source software technologies. The technical manual identifies the following main components: Shelly Pro 3EM / Shelly Pro 3EM-63 for industrial energy monitoring, Shelly Plus i4 for production event counting, a Raspberry Pi-class single-board computer as the edge-computing platform, Raspberry Pi OS / Linux, MQTT communication through Mosquitto, Node-RED for data processing, JavaScript / Node.js for logic, Domoticz for visualisation and HMI, SQLite for local data storage, and Node-RED Dashboard for the operator interface.

The main technology layers are:

Device communication: MQTT / Mosquitto
Data processing: Node-RED and JavaScript
Runtime environment: Node.js
Visualisation and HMI: Domoticz
Local database: SQLite
Edge infrastructure: Raspberry Pi-class single-board computer
Operator dashboard: Node-RED Dashboard
Integration interfaces: MQTT, HTTP, JSON API
Web technologies: HTML, CSS, JavaScript

This technology stack makes the solution compact, flexible, and relatively low-cost. It also supports reuse and transferability, because the same logic can be adapted to different types of machines by changing the measurement points, input signals, and KPI calculations.

Deployment Environment

WeldWise is deployed as an on-premises edge-computing solution. The edge server is installed locally in the enterprise and operates within the company network. The system does not require mandatory cloud infrastructure and can function independently inside the local industrial environment.

The deployment environment includes:

- local industrial network;
- machine-level measuring units;
- energy meters and current transformers;
- local edge server;
- MQTT broker;
- Node-RED processing flows;
- Domoticz HMI;
- local database;
- operator monitor;
- browser-based access for management.

Remote access can be enabled if needed through VPN, secured routing, or controlled port-forwarding configurations. However, the preferred operating model is local deployment with strong data control.

Installation & Setup

Prerequisites

The system requires a stable local network infrastructure for communication between measuring devices, the edge server, and visualisation interfaces. Ethernet communication is recommended where possible, while Wi-Fi can be used where cabling is not practical. The technical manual notes that a stable local network connection is required to ensure reliable real-time data acquisition and synchronization.

The main prerequisites include:

- access to the target machine or process;
- available installation space for measuring units;
- access to the machine power cabinet or electrical supply lines;
- local network connectivity;
- edge server hardware;
- visualisation monitor for operator dashboard;
- authorised technical personnel for installation;
- cybersecurity approval if remote access is required.

Because the solution involves industrial equipment and electrical measurement, installation should be performed only by authorised technical personnel or the solution provider.

Installation Steps

The implementation of WeldWise is performed in several phases.

1. Hardware specification and preparation.
The target machines are analysed and the required hardware components are selected. This includes measuring units, energy meters, current transformers, edge server hardware, network equipment, and visualisation components.

2. Network infrastructure preparation.
A dedicated local communication network is prepared. This includes Ethernet or Wi-Fi configuration, static IP address assignment, and communication parameter setup.

3. Device configuration.
Measuring devices are configured before deployment. This can include firmware updates, parameter configuration, communication setup, and functional testing.

4. Software configuration.
The software environment is configured on the local edge server. This includes MQTT broker configuration, Node-RED processing flows, dashboard setup, Domoticz visualisation, KPI calculation logic, and historical data storage configuration.

5. On-site installation.
The measuring units, CT clamps, energy meters, network connections, and operator dashboard are installed in the industrial environment. The system is designed to be non-invasive and to require minimal modification of existing production equipment.

6. Commissioning.
After installation, the full system is tested. Commissioning includes communication verification, telemetry validation, dashboard verification, KPI validation, and operational testing.

7. User training.
Operators and management staff are trained to use dashboards, reporting functions, visualisation tools, and basic operational procedures.

Configuration and Setup Guidelines

The initial configuration should be performed by authorised technical personnel. Unauthorised changes to device configuration, MQTT settings, Node-RED flows, network parameters, or database settings may cause communication failures, incorrect KPI calculations, data inconsistency, or partial system malfunction.

All configuration changes should be documented and performed as part of controlled maintenance procedures. This is especially important because WeldWise relies on correct signal interpretation. For example, in the spot welding use case, one pedal activation must correctly correspond to one production event. If the input signal logic is configured incorrectly, production counts and energy-per-unit calculations may become unreliable.

User Guide

Logging In & User Authentication

Users access WeldWise through a web browser by entering the local server IP address and configured communication port. Authentication is performed with username and password. The management interface is based on Domoticz, while the operator dashboard is displayed locally on a monitor in the production area.

Different users can access different interfaces depending on their role. Operators mainly use the shop-floor dashboard, while management and supervisors use the HMI for historical trends, exports, comparisons, and analysis.

Core Functionalities: Step-by-Step

The core user workflow is as follows:

- Access the system.

The user opens the WeldWise interface through a browser or views the operator dashboard on the production monitor.

Select the machine or process.
The user can monitor one specific machine or compare several machines, depending on the configuration.

View live production data.
The dashboard displays produced parts per shift, machine operating status, and current production activity.

View energy consumption.
The system shows machine-level or process-level electricity consumption, as well as enterprise-level consumption where configured.

Review energy per unit.
WeldWise calculates Wh/unit, allowing users to compare energy efficiency between machines, shifts, or time periods.

Check machine status.
Users can see whether the machine is running, stopped, or operating abnormally.

Review historical data.
Management users can access hourly, daily, monthly, and yearly comparisons.

Export data.
Operational data can be exported to XLS or CSV for further analysis.

Use data for decisions.
The information can support decisions related to productivity, energy efficiency, maintenance, production planning, and operator performance.

User Roles & Permissions

The system can support different user roles.

Operator: views the real-time dashboard in the production hall and uses it for shift awareness and immediate feedback.
Supervisor / Production Manager: monitors machine performance, production counts, energy per unit, and alerts.
Management: reviews historical KPIs, trends, reports, and exported data.
System Administrator: manages users, access rights, backup settings, and system configuration.
Technical Provider: performs advanced configuration, maintenance, and system adaptation.

This role structure ensures that each user group sees information relevant to its operational responsibilities.

System Administration

User Management

User management is handled through the system administration interface. Administrators can create user accounts, assign access rights, and control user permissions. The goal is to ensure that users access only the functions relevant to their role, while protecting system configuration and historical data.

Data Backup & Recovery

Historical operational data is stored locally using SQLite integrated with Domoticz. The stored data includes production counters, energy measurements, calculated KPIs, machine operating states, alarms, and historical trends. The system supports backup and recovery procedures, and automatic backup can be configured.

Backup procedures are important because WeldWise creates a living operational record for the company. Losing historical data would reduce the value of the system for trend analysis, reporting, energy management, and operational improvement.

Security Settings & Access Control

Security is managed through local network access, user authentication, and access-right configuration. Since the system is deployed on-premises, the company keeps strong control over its production and energy data. Remote access should be enabled only through secure methods such as VPN, secured routing, or controlled port forwarding, in line with the company's cybersecurity policy.

The most important security principles are:

- controlled user authentication;
- restricted administrative access;
- local data storage;
- secure remote access if enabled;
- documented configuration changes;

protection against unauthorised modification of MQTT, Node-RED, Domoticz, or database settings.

Integration & API Usage

Available APIs & Endpoints

WeldWise supports integration through MQTT, HTTP, and JSON API logic. The technical manual notes that data from measuring devices is transmitted to an MQTT broker and that external MQTT clients can subscribe to receive and process the data. Domoticz JSON API integration can be performed either through a web browser or programmatically using scripting languages capable of sending HTTP requests, such as Python, JavaScript, or PHP.

This makes the solution integration-ready for future ERP, MES, or AI-based analytics systems.

Integration with Third-Party Systems

WeldWise is prepared for integration with external industrial and business systems. The most relevant future integrations include ERP, MES, energy management systems, AI-based analytics platforms, and production reporting tools. The public DanubeDNA description also highlights that WeldWise creates a foundation for future integration with ERP, MES, and AI-based analytics systems.

Integration can support use cases such as:

- sending production counts to MES;
- sending energy data to energy management systems;
- exporting KPI data to management reports;
- combining production and energy data with cost accounting;
- preparing datasets for AI-based productivity or energy optimisation.

Data Exchange & Formats

The system supports data exchange through MQTT topics, JSON API, and export files. MQTT clients require connection parameters such as broker address, port, client ID, username, and password. The default MQTT port mentioned in the technical documentation is 1883.

The main data types exchanged include:

- production event counts;
- machine status;
- energy measurements;
- calculated KPIs;
- alarms;
- historical trend data.

For management analysis, data can also be exported in CSV or XLS format. This makes the solution practical for SMEs that may not yet have advanced system integration but still need usable data for reporting and decision-making.

Expected Impact of the Solution

WeldWise is expected to improve production transparency, energy efficiency, and operational control in SME manufacturing environments. The solution transforms machine-level signals into structured data that can be used by operators, supervisors, and management.

Expected benefits include:

- automated production counting;
- reduced manual reporting;
- real-time machine status visibility;
- improved energy monitoring;
- calculation of energy per produced unit;
- improved production and energy correlation;
- better historical data for analysis;
- alerts for incorrect machine operation;
- easier export of data for reporting;
- improved foundation for future ERP, MES, and AI integration.

The system is also relevant for sustainability and energy management. By measuring Wh/unit, companies can detect inefficient operation, compare shifts, identify unusual consumption, and evaluate the energy impact of production behaviour.

Conclusions from the first Pilot Action implementation of the solution

The first industrial development and validation context was EDE-16 Ltd., where WeldWise was applied to spot welding machines. The challenge was that production and energy data were fragmented, manual, or delayed. The pilot focused on counting welding events, measuring energy consumption, and calculating Wh/unit in real production conditions.

The pilot demonstrated that improved visibility makes performance variation easier to detect and manage. The presentation reports an increase from 50,000 to 73,700 units per week, representing a 47% improvement in the pilot context.

The main conclusion from this pilot is that even a relatively simple monitoring layer can strongly improve operational awareness. When production and energy signals become visible, daily operational decisions can be improved.

Conclusions from the second Pilot Action implementation of the solution

The second pilot application was carried out at MDC – Mechanical Design and Constructions Ltd. In this case, the same core architecture was adapted beyond spot welding and applied to larger industrial assets and process signals. The monitored equipment included a powder coating oven of approximately 100 kW, an industrial compressor of approximately 22 kW, and a laser cutting process of approximately 27 kW with three discrete signals.

The MDC implementation showed that WeldWise is not limited to one machine type. The same architecture can be reused in different industrial contexts by adapting the input logic, measurement points, and KPI calculations. The technical manual confirms that the collected data supported electricity consumption profile monitoring, operational cost analysis, production-cycle energy assessment, and machine utilisation analysis.

The second pilot therefore demonstrated the transferability of the solution from a spot welding use case to broader industrial monitoring and energy analysis scenarios.

Additional operational details from the partner technical manual

The individual WeldWise manual includes further practical user-interface details. The main navigation bar provides access to Dashboard, Switches, Utility and Profile sections. In the Utility section, parameter tiles display real-time or recent operating values and provide access to detailed logs.

Selecting the Log function opens a detailed historical visualisation screen with multiple graph sections. The interface allows users to inspect recent parameter values and change the displayed period, including views for the last seven days, three days, one day or three hours.

The partner manual also clarifies the database restore flow. A standard file-selection dialogue is used to browse for the archive file, typically with a .db extension. After starting the restore operation, the user should wait until the login screen or Dashboard screen reappears, which indicates that database recovery has completed successfully.

Development Team and Contributing Partners

The WeldWise solution was developed through the cooperation of several actors with distinct roles.

ICT Cluster Bulgaria acted as the responsible project partner and beneficiary of the joint solution. Its role was connected to project coordination, SME digital transformation support, validation of the solution within the DanubeDNA context, and transferability across the Danube Region.

COMICON Ltd. acted as the external technical expert responsible for technical development and system integration. Its contribution included industrial automation logic, Industrial IoT architecture, energy monitoring, communication setup, and software integration.

EDE-16 Ltd. provided the original development and validation context for spot welding. The solution was shaped around a real production challenge involving high-volume welding cycles, mechanical counters, and limited visibility into energy use and production events.

MDC – Mechanical Design and Constructions Ltd. provided the broader pilot application context, demonstrating that the WeldWise architecture can be adapted to other industrial equipment such as powder coating ovens, compressors, and laser cutting processes.

Overall, WeldWise is a practical, modular, and transferable Industrial IoT solution that supports SMEs in moving from hidden production data to real operational control. Its main value lies in providing a lightweight and scalable monitoring architecture that connects production events, energy use, KPIs, dashboards, and historical analytics into one usable system.

Solution 03: InvestPlanner

InvestPlanner – AI-Powered Investment Study and Business Planning Platform

SOLUTION TYPE	DEPLOYMENT	STATUS
AI business planning / investment study platform	Web application / multi-environment deployment	Operational / documented technical solution

Technical fiche	
Solution title	InvestPlanner – AI-Powered Investment Study and Business Planning Platform
Responsible partner	TERA Tehnopolis d.o.o., Croatia
Contributing partners / pilot sites	TUM International GmbH for pilot implementation in Germany; Business Support Organisations and Advisors as user-support stakeholders
External experts	ORKA d.o.o.; SPECSCOM; CONSULT ZEE; AMRYT
Period	Period 3–5
Budget allocation	Partner implementation / development resources

Introduction

InvestPlanner is an AI-powered web application developed within the DanubeDNA project by TERA Tehnopolis d.o.o. to support entrepreneurs, start-ups, SMEs, managers, project teams and business support organisations in preparing structured investment studies, business plans and investor-ready documentation. The solution is available through investplanner.eu and is designed to transform business ideas into coherent, data-driven and professionally formatted investment documentation.

The solution responds to a practical challenge faced by many SMEs in the Danube Region: traditional investment studies are time-consuming, resource-intensive, prone to inconsistency and often inaccessible for smaller companies without specialised financial or consulting expertise. InvestPlanner addresses this by combining structured workflows, financial modelling, KPI analysis, AI-supported writing, automated review and document generation within one integrated environment.

Within DanubeDNA, InvestPlanner contributes to the project objective of strengthening SME digital transformation and business readiness by making investment planning more accessible, consistent and evidence-based. It supports users not only in writing a business plan, but also in understanding financial assumptions, testing scenarios, improving strategic logic and preparing documentation that can be used with investors, banks, public institutions and business partners.

Background of the solution development

The development of InvestPlanner is based on the need for high-quality, reliable and efficient tools for strategic planning and investment decision-making. SMEs, entrepreneurs and project teams often struggle to structure ideas, prepare comprehensive analyses and present them in a persuasive manner. Manual preparation of investment studies can lead to disconnected narrative sections, inconsistent financial tables, calculation errors and weak justification of business assumptions.

InvestPlanner overcomes these barriers by combining technical innovation with practical applicability. The solution uses artificial intelligence, natural language processing, data analytics and a user-friendly planning interface to support automated business plan generation, advanced financial and KPI analysis, regulation-conscious document production and mentoring-style guidance throughout the process.

Aim of the solution development

The primary aim of InvestPlanner is to simplify, accelerate and improve the process of creating investment studies and business plans. The solution provides a structured and visual framework that guides users from the initial business idea to a complete investment document, while improving accuracy, clarity and professional quality.

More specifically, the solution aims to:

- guide users through business definition, business analysis and investment study creation;
- enable clear and persuasive presentation of project ideas, business plans and investment proposals;
- integrate AI-supported content generation, KPI analysis and automated review;

• reduce the time, complexity and resources required to prepare high-quality investment studies;
• improve the credibility of investment proposals and their alignment with investor expectations;
• support better business decisions through structured financial and strategic analysis.

Beneficiaries

InvestPlanner serves a broad set of users involved in business planning, investment preparation and entrepreneurship. Its main beneficiaries include entrepreneurs and start-ups developing new ideas, SMEs and enterprises seeking growth or innovation, managers and project teams responsible for financial planning and business development, investors and stakeholders reviewing investment proposals, and business support organisations or advisors helping companies become investment-ready.

The solution is relevant across a wide range of industries, including food, metal, electronics, automotive, textile, plastics and logistics. It is also applicable for higher education institutions, research organisations and advisory services involved in commercialisation, technology transfer and structured business planning.

Technical Specification of the Solution

Solution Description: key features and benefits

InvestPlanner is an advanced AI-driven platform for planning, analysing and documenting business ideas and investment projects in a structured, visual and data-driven manner. It combines three core functional areas: Business Definition, Business Analysis and Investment Study Creation. Through these modules, users can define business concepts, prepare market and financial analysis, plan technical and organisational elements, assess sensitivity and generate professional investment documentation.

The AI-supported layer is embedded across the user journey and supports three main functions:

• Education – users can learn how investment studies are prepared and understand the main elements of business and investment planning.
• Writing and structuring – users can organise, draft and improve investment study content, turning fragmented ideas into clearer and more professional sections.
• Interpretation of financial data – users can interpret figures, assumptions and KPIs with AI support, including insights into financial logic and possible improvement areas.

The platform also supports section-by-section analysis, KPI optimisation, automated final review, high-quality document generation and integrated reporting tools. A key advantage is the connection between business descriptions, financial tables and analytical outputs: when users update assumptions, investment values, revenues, expenses or financing parameters, related calculations and documents can be updated consistently.

System Architecture Overview

InvestPlanner is built on a modular, service-oriented architecture designed for scalability, maintainability and efficient performance. The system is organised within a monorepo structure and combines a CRM system with an ERP application. The CRM component manages licences, API keys, company instances and administrative interfaces, while the ERP component handles investment studies, projects, financial projections, users, companies, settings and AI integration.

The architecture includes three main layers. The User Interface Layer provides dashboards, guided workflows, KPI visualisation and access to the investment study modules. The Application Logic Layer hosts AI-driven functionalities, business rules, content assistance, section analysis, KPI optimisation and document generation. The Data Management Layer manages structured and unstructured data, including user profiles, company data, investment study content, financial figures, market research data and AI-generated recommendations.

The ERP system consists of several specialised services routed through a central Master API: Master API for authentication, authorisation, routing, media management and activity logging; User API for user profiles, permissions, labels, categories and workgroups; Company API for companies, branches, departments and organisational structures; Settings API for system configuration; and Tera API for investment studies, projects, financial projections and AI integration. The Master API serves as the main entry point for frontend requests and routes them to the appropriate service.

The data architecture uses two primary MySQL databases: gbCRM for API registrations, licences, API keys and CRM-specific data, and gbERP for business data, user information, companies and investment studies. Multi-tenancy is achieved through API-key filtering and company-level scoping, ensuring separation of company data within a shared application instance.

Technology Stack

The technical stack defined in the TERA manual is substantially more detailed than the earlier catalogue description. Backend services are based on JavaScript, Node.js and Sails.js, with SQL used for queries, stored procedures and

migrations. The frontend applications are built with Angular and TypeScript, supported by PrimeNG, RxJS, Chart.js, FullCalendar, Angular Gridster2, Quill, PDFMake, XLSX and Electron for desktop deployment support.

MySQL is used as the primary relational database system, supported by the Sails MySQL adapter, Knex.js for migrations and SQL query building, and the Sails ORM for database operations. Authentication and security are based on JSON Web Tokens, including access tokens, refresh tokens, internal service-to-service tokens and media tokens, with bcryptjs used for password hashing and encryption.

The platform also includes shared npm packages for API management, helper functions, error handling, notifications and shared TypeScript code. External integrations include a Retrieval-Augmented Generation LLM system for AI-powered content generation using controlled prompts, SMTP-based email services and server-side PDF generation. The RAG LLM component operates in a controlled and isolated environment without exposing identification or project details and without general web access, supporting data privacy and security.

Deployment Environment

InvestPlanner supports several deployment strategies. The current deployment approach uses PM2 as a production process manager for Node.js applications, providing monitoring, automatic restarts and cluster-mode support for single-server or smaller-scale deployments. The solution also supports Docker deployment, where services and dependencies can be containerised for consistent environments, and Kubernetes deployment for larger-scale environments requiring automated scaling, load balancing, self-healing and high availability.

The platform can be deployed on-premises, in the cloud or in a hybrid model. On-premises deployment gives the organisation full control over data and infrastructure. Cloud deployment supports scalability and reduced infrastructure management. Hybrid deployment allows selected components, such as databases, to remain on-premises while application services run in a cloud environment, or vice versa. This flexibility makes the solution adaptable to different security, compliance and performance requirements.

Installation & Setup

Prerequisites

For end users, InvestPlanner is accessed through a browser and does not require local installation. Users need internet access, a user account, a supported browser and the business, market, financial and investment data required for the study.

For system deployment, the TERA manual defines a Linux-based server environment, with Ubuntu Server 20.04 LTS or 22.04 LTS recommended. Minimum infrastructure requirements include 4 CPU cores, 8 GB RAM and 100 GB SSD storage, while production environments are recommended to use 8 CPU cores, 16 GB RAM and 200 GB or more SSD storage. Required software includes Node.js versions managed through NVM, MySQL 8.0 or higher, Git, npm, PM2 for process management, and optionally Docker, Docker Compose, Kubernetes and kubectl depending on the selected deployment model.

Installation Steps

The installation logic depends on the chosen deployment model. For PM2 deployment, the process includes server preparation, Node.js installation through NVM, MySQL installation and database creation, application code setup, dependency installation, database migration, PM2 ecosystem configuration, service start-up and process monitoring. For Docker deployment, the process includes Docker and Docker Compose installation, image building, container configuration, volume setup, network setup and service start-up. For Kubernetes deployment, the process includes cluster setup, namespace creation, ConfigMaps and Secrets, deployment manifests, services, ingress configuration, persistent volumes and rollout management.

The source manual also defines a strong server-hardening sequence before application deployment, including system updates, firewall configuration, Fail2ban, SSH hardening, non-root deployment user creation, file-permission hardening, disabling unnecessary services, kernel hardening parameters, log monitoring and intrusion-detection checks. These measures are relevant where InvestPlanner is deployed in production environments or hosted on infrastructure managed by the responsible partner or operator.

Configuration and Setup Guidelines

Configuration is managed through environment-specific configuration files and environment variables. Key configuration areas include database connection details for CRM and ERP databases, service ports, JWT secrets, frontend and API URLs, SMTP settings, AI-service credentials where applicable, CORS settings, session configuration, logging levels and error-handling services.

The system uses defined service ports for CRM Frontend, CRM API, ERP Frontend, Master API, User API, Company API, Settings API and Tera API. Post-installation verification includes checking service status, testing database connectivity, verifying API endpoints, confirming frontend accessibility, checking port availability, and ensuring backup, logging and health-check procedures are active.

User Guide

Logging In & User Authentication

InvestPlanner requires user registration before system use. A user can be an employee of the main company, a customer, a student or an external collaborator. Access can be granted or denied independently of the user type. Customers and students can be assigned licences allowing them to create investment studies or projects, while external collaborators may be granted access depending on the specific relationship with the company.

After login, users are taken to the Home page, which displays graphical representations of investment studies, dashboards with key performance indicators and left-side navigation. The user profile allows users to view personal information, change their password and log out. The main navigation provides access to the Home Page, Investment Study module, System Settings, Documents and Log out. System Settings include language options in Croatian, English and German.

Core Functionalities: Step-by-Step

The core user workflow begins with creating a new project or investment study from the Investment Study module. The user enters the study title, number of business years, first business year and currency. Once created, the study appears on the main dashboard and can be searched, edited, duplicated, deleted, printed or exported. Additional options include editing basic project data, entering impressum data, viewing graphical indicators and printing selected parts of the study.

A defined investment study contains twelve main elements:

- description of the entrepreneur or project owner;
- market analysis;
- dynamics and structure of employees;
- technical elements of the investment;
- location;
- environmental protection;
- investment implementation dynamics;
- marketing plan;
- economic and financial analysis;
- economic market assessment;
- sensitivity analysis;
- conclusion.

The financial logic of the system is based on linked tables and transparent calculations. Tables can be populated through manual entry, imported values from another section or automatic calculation. For example, depreciation data can feed existing assets tables, total revenues can feed market analysis summaries, and salary calculations can feed annual salary budgets. Automatically calculated tables include total revenue, total expenses, profit and loss statement, investment structure, sources of financing, loan repayment plan, working capital projection, financial and economic flows, balance sheet projection, financial indicators and market evaluation.

The AI Assistant is accessible from the interface and supports educational guidance, writing and structuring of content, and interpretation of financial data. Users can also export project lists and tables to Excel for further analysis or archiving.

User Roles & Permissions

The system distinguishes four main user types: Employee, Customer, Student and External Collaborator. Employees are linked exclusively to the Main Company. Customers and students can receive licences to create investment studies or projects, while licences can also be deactivated when access is no longer needed. External collaborators are persons working for the company under a different contractual relationship and may be allowed or denied system access according to the company's decision.

Administrators manage users, licences, permission groups, company-level access and organisational structures. Role-based access control and company-level filtering are central to the system's multi-tenant architecture, ensuring that users can access only the data and functions relevant to their company and permissions.

System Administration

User Management

User management is supported through the CRM and ERP layers. The system provides user profiles, permission groups, labels, categories, workgroups, company management, branches, departments, cash registers and

organisational hierarchies. The CRM component manages licences and API keys, while the ERP component manages operational and investment-study users.

Access control is based on JWT authentication, role-based permissions and company-level data isolation. Internal service-to-service communication also uses internal tokens generated and managed through the Master API routing logic.

Data Backup & Recovery

The TERA manual defines database backup and maintenance as part of the operating model. The solution uses separate CRM and ERP MySQL databases, and backup procedures should cover both. Recommended backup operations include regular database dumps, compressed storage of backups, retention rules, restoration testing and periodic database maintenance such as table optimisation, checks and analysis.

Historical project data, financial assumptions, generated investment studies, user accounts, company records and API registrations form the critical data set for recovery. Because users may update an investment study over a long period, reliable backup and recovery procedures are important for both continuity and trust in the platform.

Security Settings & Access Control

Security is implemented across infrastructure, application and data layers. The source manual includes server-hardening measures such as firewall configuration, Fail2ban, SSH hardening, non-root deployment user management, restrictive file permissions, log monitoring and system security updates. Application-level security includes JWT authentication, password hashing, session management, media tokens, internal service tokens, CORS configuration and company-level data filtering.

The AI integration is designed with privacy and controlled access in mind. The RAG LLM system operates through controlled prompts in an isolated environment, without exposing identification or project details and without general web access. The AI communication layer applies restricted outbound connectivity, response validation, content extraction and error handling to reduce data-exposure risks.

Integration & API Usage

Available APIs & Endpoints

InvestPlanner uses a centralised API registry and a Master API routing model. All frontend requests are sent to the Master API, which validates JWT tokens, checks permissions and determines the appropriate backend service. The Master API generates internal JWT tokens and routes requests to the specialised microservices, which then return responses through the same central entry point.

The API layer supports authentication, user and company management, settings management, investment study operations, project activities, financial projections, media management, activity logging and AI integration. APIs register their routes in the central CRM database during startup, enabling dynamic service discovery and coordinated routing between services.

Integration with Third-Party Systems

The platform includes several integration points. The RAG LLM system supports AI-powered content generation through controlled prompts. SMTP integration supports notifications and communication. Server-side PDF generation supports professional investment study output. The frontend and backend stack also includes XLSX processing, PDFMake and Electron support, enabling document, spreadsheet and desktop-related use cases.

The architecture supports future integrations with accounting systems, financial planning tools, funding or grant application platforms, CRM and document-management systems, and external analytics tools. Because the solution is modular and API-driven, additional services can be integrated without changing the entire platform architecture.

Data Exchange & Formats

Data exchange takes place through RESTful APIs, MySQL databases, shared service packages, file upload and media-management functions, Excel export, PDF generation and document output. The investment study itself is built around a comprehensive structure covering entrepreneur description, market analysis, employee dynamics, technical investment elements, location, environmental protection, investment implementation, marketing plan, economic-financial analysis, market assessment, sensitivity analysis and conclusion.

The system supports import of Croatian annual financial reports for past-performance analysis, manual entry for users outside that format, export of study lists and tables to Excel, and generation of investment study documentation for professional presentation. Financial tables are linked so that data entered in one section can automatically feed related outputs, reducing duplicate entry and calculation errors.

Expected Impact of the Solution

The deployment of InvestPlanner is expected to create impact across business efficiency, economic growth, innovation support and user empowerment. By integrating AI into the preparation of business and investment studies, the solution improves the quality and credibility of documentation while reducing the time and resources required to prepare it.

The TERA manual identifies the following quantitative and qualitative benefits:

- 50–70% reduction in time spent on drafting and finalising investment studies compared with traditional manual methods;
- up to 40% lower error rates through intelligent section analysis and AI-assisted review of financial and market projections;
- 20–30% higher success rate in securing funding where proposals are prepared with the platform, linked to improved clarity, reliability and professional presentation;
- scalability across industries such as food, metal, electronics, automotive, textiles, plastics and logistics;
- stronger strategic decision-making through KPI analytics and predictive insights;
- broader accessibility for entrepreneurs and SMEs with limited financial expertise;
- greater trust and credibility among investors, venture capitalists and financial institutions;
- knowledge transfer for start-ups, students and research institutions through structured AI-supported business planning.

Conclusions from the first Pilot Action implementation of the solution

The InvestPlanner pilot implementation confirms the relevance of the solution for SMEs and advisory environments that need faster, clearer and more reliable investment documentation. The platform supports users in moving from early project assumptions to structured business and financial analysis, while reducing the administrative burden of preparing investment studies manually.

The first implementation logic demonstrates that the value of InvestPlanner lies not only in document generation, but in the way it connects business concepts, market analysis, technical assumptions, employee planning, investment costs, financing sources, profitability indicators and sensitivity analysis into one coherent workflow. This makes the solution useful both for SME users and for advisors supporting investment readiness.

Conclusions from the second Pilot Action implementation of the solution

The second pilot and transferability perspective focuses on the adaptability of InvestPlanner across user groups, countries and sectors. The source manual identifies TUM International GmbH as involved in pilot implementation in Germany, while the platform itself is structured to support multiple languages, currencies, organisational contexts and deployment models.

The pilot experience shows that the solution can support different forms of business planning: start-up idea development, SME growth planning, technology transfer, investment proposal preparation and advisory support. Its modular ERP/CRM architecture, multi-tenant data model and flexible deployment options create a basis for broader uptake beyond a single local implementation.

Development Team and Contributing Partners

TERA Tehnopolis d.o.o. is the responsible partner for the InvestPlanner joint solution. Its team contributed to solution development, pilot implementation and project coordination. The TERA team identified in the source manual includes Ana Šarić as project manager for solution development and pilot implementation, Birgit Boehning as senior expert for solution development and pilot implementation, Željka Ljikar as senior expert for pilot implementation, and Helena Nikolašević as junior expert for pilot implementation.

ORKA d.o.o. is identified as external expert and solution-development partner, with Tomislav Strugačevac and Ilija Gvozdanović contributing as solution developers. TUM International GmbH contributed to pilot implementation in Germany through Georgeta Auktor.

Additional expert support was provided by SPECSCOM, CONSULT ZEE and AMRYT. Biljana Viduka from SPECSCOM provided recommendations for the adaptation and applicability of tools for pilot implementation. Želimir Gusak from CONSULT ZEE contributed to the development of a strategic and tactical plan. Iva Sirotić from AMRYT contributed to the strategic framework for market positioning and communication strategy, including the elaboration of a user acquisition model and promotional and presentation materials for the InvestPlanner digital application.

Overall, InvestPlanner is a mature AI-supported business planning and investment study platform. Its main value lies in combining structured investment-study methodology, ERP/CRM architecture, linked financial tables, AI-supported writing and interpretation, KPI analytics, document generation and flexible deployment into one reusable tool for SME investment readiness and digital business transformation.

Solution 04: AI-Powered Funding Call Matcher

AI-Powered Funding Call Matcher

SOLUTION TYPE **AI funding search and matching**	DEPLOYMENT **Online platform / containerised deployment**	STATUS Validated in SI / RO / BA pilots

Technical fiche	
Solution title	AI-Powered Funding Call Matcher
Responsible partner	Pomurje Technology Park
Contributing partners / pilot sites	IT&C Cluster “Lower Danube”; SERDA – Sarajevo Economic Region Development Agency; pilots in Slovenia, Romania and Bosnia and Herzegovina
External experts	FERI – Faculty of Electrical Engineering and Computer Science, University of Maribor
Period	Period 4–5: July 2025 – June 2026
Budget allocation	No separate budget allocation recorded

Introduction

AI-Powered Funding Call Matcher is a digital joint solution developed within the DanubeDNA project to help SMEs, start-ups, research organisations, universities, public bodies, clusters, innovation hubs, and regional development organisations identify relevant EU funding opportunities more efficiently. The solution is led by Pomurje Technology Park, with IT&C Cluster “Lower Danube” as contributing partner and FERI – Faculty of Electrical Engineering and Computer Science, University of Maribor as external expert.

The tool addresses a major challenge for innovation-driven organisations: access to funding is essential for research and development, digital transformation, testing, scaling, market entry, and business growth, but the process of identifying suitable funding calls is often complex, time-consuming, and highly competitive. Many SMEs and innovation actors lack the internal capacity to continuously monitor EU funding platforms, understand eligibility criteria, compare calls, and evaluate which opportunities are most relevant to their projects.

The public DanubeDNA project description presents the AI-Powered Funding Call Matcher as an open-source online tool integrated into the DanubeDNA platform. Its aim is to support SMEs in identifying and applying for the most relevant EU funding calls and tenders by using a smart AI matching algorithm, instant call recommendations, proposal adaptation support, and deadline tracking.

Background of the solution development

The solution was developed because manual searching for EU funding opportunities is slow, fragmented, and error-prone. Funding information is spread across several platforms, such as the European Commission Funding & Tenders Portal, Cascade Funding platforms, and other specialised funding databases. As a result, SMEs may miss relevant opportunities, apply to unsuitable calls, or spend too much time filtering information that does not match their needs.

A specific focus of the solution is cascade funding and similar EU funding instruments, which are particularly relevant for SMEs, start-ups, scale-ups, innovative companies, technology providers, research organisations, universities, and public bodies. Cascade funding is often easier to access than large EU projects because it usually provides smaller, faster, and less bureaucratic grants, often suitable for pilots, prototypes, demonstrations, testing, validation, and scaling of innovative solutions.

The background logic is therefore simple: demand for funding is higher than available opportunities, while many organisations struggle to identify the right calls. The AI-Powered Funding Call Matcher responds by automating funding call discovery, filtering, matching, and relevance assessment.

Aim of the solution development

The main aim of the AI-Powered Funding Call Matcher is to provide a smart, automated platform that helps users find relevant funding opportunities more quickly and with better alignment to their project ideas.

More specifically, the solution aims to:

- create a continuously updated database of funding calls;
- collect calls through scraping and API integration;
- filter funding opportunities by industry, status, budget, and deadline;
- use AI to extract keywords and interpret project descriptions;

- match SME needs with relevant funding opportunities;
- support semantic search and query expansion;
- rank and present the most suitable calls;
- reduce manual search effort;
- increase the probability of selecting relevant calls;
- support future proposal preparation through AI-assisted guidance.

The tool is intended not only as a search engine, but also as a decision-support layer that helps SMEs understand which calls are more suitable for their ideas and why.

Beneficiaries

The main beneficiaries are SMEs and innovation-driven organisations that need external funding to support development, testing, scaling, innovation, and digital transformation. According to the technical manual, the key beneficiary groups include SMEs, research organisations, universities, public bodies, innovation hubs, clusters, and regional development organisations.

The solution is especially useful for:

- technology and innovation-driven SMEs;
- sustainability and green-tech SMEs;
- healthcare and life sciences SMEs;
- creative industries and digital-content SMEs;
- circular economy and resource-efficiency SMEs;
- transport and mobility SMEs;
- agritech and food technology SMEs;
- advanced manufacturing and Industry 4.0 SMEs;

SMEs with strong cross-border collaboration potential.

These organisations often need funding but may not have dedicated proposal teams or sufficient experience with EU funding mechanisms. The tool therefore helps reduce the entry barrier to EU funding schemes.

Technical Specification of the Solution

Solution Description: key features and benefits

The AI-Powered Funding Call Matcher is an online tool that scouts funding calls from multiple sources and helps users identify opportunities that match their project ideas, sector, funding needs, and eligibility profile. The solution is integrated into the B2GreenHub platform and is accessible through the B2GreenHub “Get Funded” / Funding Help-Center section. The presentation identifies the tool as part of the B2GreenHub resources and provides the access path to the tool.

The main features of the solution include:

Automated scraping and API retrieval.
The system collects funding calls from multiple sources, including CascadeFunding.eu, GetOnePass Hub, and the European Commission Funding & Tenders Portal. The backend is designed to scrape or fetch calls and store them in a structured database.

Daily updated funding database.
The tool is designed to update funding opportunities regularly. The technical file specifies daily updating, with configurable intervals.

Multidimensional filtering.
Users can filter opportunities by industry, call status, budget, and deadline. The presentation notes that the industry filter includes a wide range of categories such as advanced materials, artificial intelligence, energy efficiency, IoT, software, water, and many others.

Quick search.
Users can search directly by typing keywords. The tool returns funding calls containing or related to the search term.

AI assistant.
The AI assistant helps users navigate the search process by extracting keywords, suggesting associated categories, identifying related terms, and supporting semantic search.

Smart AI matching.
The AI element refers to an algorithm that extracts key elements from funding calls and user input, such as eligibility, project type, TRL, funding size, requirements, expected budget, and co-financing needs. It then matches the most relevant opportunities and ranks them based on relevance and compatibility.

Administrative management panel.
The system includes a management panel where administrators can configure scraping intervals, set the admin password, and optionally add the OpenRouter API key for full AI functionality.

The main benefits are faster identification of relevant funding calls, reduced manual search effort, improved matching between SME needs and public funding opportunities, better awareness of deadlines, and improved access to EU funding schemes and partnerships.

System Architecture Overview

The architecture of the AI-Powered Funding Call Matcher consists of a backend, frontend, database, containerisation layer, and AI model integration. According to the technical manual, the backend is based on Java and Spring Boot, the database is MongoDB, the frontend is React, deployment is containerised through Docker and docker-compose, and AI model integration is performed through the OpenRouter API using the Mistral-7B-Instruct model.

The system architecture can be described as follows:

Data source layer: external funding platforms such as CascadeFunding.eu, GetOnePass Hub, and the European Commission Funding & Tenders Portal provide funding call data.

Data collection layer: scraping and API retrieval mechanisms collect funding calls from external sources.

Backend layer: the Spring Boot backend orchestrates scraping, stores and processes data, exposes REST API endpoints, and manages system services.

Database layer: MongoDB stores scraped or fetched funding calls, admin settings, password hashes, and encrypted API keys.

AI integration layer: OpenRouter API routes LLM requests to the Mistral-7B-Instruct model for keyword extraction, semantic search, and query expansion.

Frontend layer: the React frontend provides the user interface, filters, quick search, list/grid views, and user access to the tool.

Management layer: the administrative panel allows system configuration, scraping interval setup, and optional AI key configuration.

This architecture enables the tool to operate as a searchable and AI-supported funding database that is updated regularly and can be embedded into the wider DanubeDNA / B2GreenHub environment.

Technology Stack

The technology stack is clearly defined in the technical manual. The backend uses Java and Spring Boot. Java powers the backend logic, data processing, scraping orchestration, and REST API endpoints. Spring Boot provides the framework for routing, business logic, service management, and integration with MongoDB.

The frontend uses JavaScript and React. JavaScript supports user interface interactions, filtering logic, and rendering components, while React is used to build the interactive web application, search interface, list and grid views, and filtering functionality.

The database is MongoDB, a NoSQL document database. It stores all scraped or fetched funding calls, administrative settings, password hashes, and encrypted API keys. It is deployed through a Docker container.

The infrastructure and deployment technologies include Docker and docker-compose. Docker containerises the backend, MongoDB database, and frontend, while docker-compose orchestrates the multi-container deployment. The technical manual identifies the backend, MongoDB, and initialization script as part of the docker-compose deployment.

The AI integration layer uses OpenRouter API and the Mistral-7B-Instruct model. OpenRouter is used for extracting keywords, semantic search, and query expansion, while Mistral-7B-Instruct performs natural language processing tasks.

The main technologies can be summarised as:

Backend: Java, Spring Boot
Frontend: JavaScript, React
Database: MongoDB
Containerisation: Docker, docker-compose
AI integration: OpenRouter API, Mistral-7B-Instruct
External data sources: CascadeFunding.eu, GetOnePass Hub, EC Funding & Tenders Portal
Security: AES encryption, password hashing, management panel login, Docker container isolation, HTTPS, session expiry

Deployment Environment

The technical manual defines the deployment environment as on-premises. This means that the system is deployed and operated within the organisation's own infrastructure. Servers, networking equipment, and data storage are hosted locally, giving the organisation control over security, maintenance, and data management.

At the same time, the public project description and presentation position the tool as an open-source online tool integrated into the DanubeDNA and B2GreenHub environment. The practical interpretation is that the system can be deployed on controlled infrastructure and made accessible online through the relevant platform interface.

The deployment environment includes:

- dedicated server infrastructure;
- Docker runtime;

- MongoDB container;
- Spring Boot backend container;
- React frontend container;
- internet access for scraping and API fetching;
- optional OpenRouter API access for AI features;
- frontend access through a selected port;
- backend access through port 8080 by default;
- management interface through the frontend management path.

Installation & Setup

Prerequisites

The AI-Powered Funding Call Matcher is deployed through Docker and requires suitable server infrastructure. The integration runs on a dedicated server with appropriate CPU power, RAM, and disk space. The required software components include Docker, docker-compose, and MongoDB tools only if administrator passwords need to be reset manually inside the Mongo container.

The network requirements include outbound internet access for fetching data from CascadeFunding.eu, GetOnePass Hub, and the European Commission Funding & Tenders Portal. Optional outbound access to the OpenRouter API is required for LLM-based features such as semantic search, keyword extraction, and query expansion.

Inbound access is required for:

- frontend access through a custom port assigned by the user;
- backend access through the default port 8080;
- administrator access to the management panel.

Installation Steps

Installation is performed using Docker.

Step 1 – Prepare the docker-compose file.
On the server where the application will run, a docker-compose.yml file is created. The compose file defines the MongoDB database, the Spring Boot backend, and a mongo-seed initialization container. The configuration can be adjusted for published ports, volume definitions, storage paths, and container names.

Step 2 – Build and start the backend and database.
The deployment is started through docker-compose commands. This launches MongoDB, starts the backend, and runs the initialization container for database seeding.

Step 3 – Deploy the frontend application.
Once the backend is running on port 8080, the frontend is deployed as a Docker container. The frontend is configured with the backend host and port through an API_URL environment variable.

Step 4 – Access the application.
Users access the frontend through the configured server address and frontend port. Administrators access the management panel through the management path. On first login, the system asks the administrator to create an admin password.

Step 5 – Configure the system.
After installation, administrators configure the admin password, scraping intervals, and optional OpenRouter API key for full AI functionality.

Configuration and Setup Guidelines

Configuration is performed mainly through the management panel.

The first setup step is administrator password creation. This is automatically required on the first visit to the management interface. The password is stored using proper password encoding. If needed, the admin password can be reset by deleting the management_auth collection in MongoDB.

The second configuration area is AI key setup. The OpenRouter API key can be saved through the management panel. The system encrypts the API key using AES before storing it.

The third configuration area is scraping interval setup. The scraping interval is adjustable in the management panel, allowing the system administrator to define how frequently the system updates the funding database.

The configuration should be maintained carefully because the usefulness of the tool depends on regular updating, correct connection to external sources, and properly configured AI access.

User Guide

Logging In & User Authentication

The tool has two main access modes.

Normal users do not need to log in in order to access the core user functionalities. They can use the main interface to browse, search, filter, and view funding calls. Administrative access is separate and requires an admin password through the management interface. The technical manual specifies that normal users do not require login, while administrators must set and enter a password on first visit to the management panel.

This structure keeps the public user experience simple while protecting system configuration functions.

Core Functionalities: Step-by-Step

The core user workflow is as follows:

- Open the tool.

The user accesses the AI-Powered Funding Call Matcher through the B2GreenHub / DanubeDNA platform interface.

Use quick search.
The user enters a keyword or phrase related to their project, technology, sector, or funding need. The quick search searches for the typed word or phrase.

Use filters.
The user filters calls by industry, status, budget, and deadline. Status values include forthcoming, open, and closed. Budget filtering can cover calls up to €500,000, and deadline filters allow users to search within date ranges.

Use the AI assistant.
The user can ask the AI assistant for related categories and terms. The AI helps expand the search and identify more relevant calls.

Review call results.
The user receives a list or grid of funding opportunities. The result can include call title, funding amount, deadline, objectives, official link, and match explanation.

Evaluate relevance.
The user reviews why a call may match their project, based on eligibility criteria, project type, TRL, expected budget, co-financing requirements, and sector relevance.

Prepare next steps.
The presentation describes a future AI Proposal Preparation Toolkit in development, which will include a prompt framework for AI, steps for preparing a project proposal, template structure, and example prompts for project concept, problem definition, objectives, work packages, impact, and budget justification.

User Roles & Permissions

The technical manual defines two main user categories.

Unregistered / normal users: access all core functionalities except the management console. They can search, filter, browse, and use the AI-supported functions available in the user interface.

Administrative user: has access to the management console, where they can set or reset the admin password, configure scraping intervals, add the OpenRouter API key, and manage system-level settings.

This role structure keeps the system accessible while protecting administrative functions.

System Administration

User Management

The only confirmed user management function is setting or resetting the administrator password. The system asks for an admin password on first access to the management panel. Passwords are stored using proper password encoding.

If the password needs to be reset, the technical manual indicates that this can be done by deleting the management_auth collection in MongoDB.

Data Backup & Recovery

The platform provides backup and recovery mechanisms to protect critical information from data loss, system failure, or unexpected incidents. Since the system stores funding call records, administrative configuration, encrypted API keys, and system settings, regular backup is important for stable operation.

Recommended backup areas include:

- MongoDB funding call database;
- administrative settings;
- scraping configuration;
- encrypted API keys;
- Docker volume data;

- backend output volumes;
- initialization data.

A reliable backup and recovery process ensures that the system can be restored quickly if the database, containers, or server environment fail.

Security Settings & Access Control

The confirmed security mechanisms include password hashing, AES-encrypted API keys, management panel login, Docker container isolation, HTTPS usage, and session expiry.

Security is especially important because the tool connects to external funding sources, stores configuration data, and may use external AI services through API keys. The use of AES encryption for API keys reduces the risk of exposed credentials, while password hashing protects administrator access.

The use of Docker container isolation also improves deployment consistency and separates application components. HTTPS and session expiry support safer access for users and administrators.

Integration & API Usage

Available APIs & Endpoints

The backend exposes several REST API endpoints. According to the technical manual, these include listing display endpoints, scraper activation endpoints, European Commission API fetch endpoints, authentication endpoints, and LLM query endpoints.

At functional level, the API layer supports:

- displaying funding listings;
- triggering scraping or data update processes;
- fetching data from the EC Funding & Tenders Portal;
- administrator authentication;
- processing AI / LLM queries.

These endpoints allow the frontend, backend, data collection services, and AI features to work together in a structured way.

Integration with Third-Party Systems

The AI-Powered Funding Call Matcher integrates with several external systems and platforms.

The main external data sources and integrations are:

- CascadeFunding.eu through scraper;
- GetOnePass Hub through scraper;
- European Commission Funding & Tenders Portal through API;
- OpenRouter for LLM features;
- Mistral-7B-Instruct model through OpenRouter;
- embedding through iframe into the wider platform environment.

The public DanubeDNA description also confirms that the solution is integrated into the DanubeDNA platform and uses AI to match SME profiles with funding opportunities based on eligibility, project type, TRL, budget, and co-financing requirements.

Data Exchange & Formats

The technical manual identifies three main data exchange formats and structures:

- JSON API responses;
- MongoDB document structure;
- encrypted API keys.

The system exchanges structured information about funding calls, including call title, funding amount, deadline, key objectives, official call links, eligibility criteria, project type, TRL requirements, and matching explanations. The older presentation also describes instant call recommendations that include call title, funding amount, application deadline, key objectives, link to the official call page, and explanation of why the call is a match.

Expected Impact of the Solution

The AI-Powered Funding Call Matcher is expected to improve access to EU funding opportunities for SMEs and innovation-driven organisations. It reduces the time and effort required to identify suitable calls and helps users focus on opportunities that are more relevant to their project ideas, sector, eligibility profile, and funding needs.

Expected benefits include:

- better inclusion of SMEs in EU funding schemes, tenders, and partnerships;
- easier and more relevant matching between SME needs and public funding opportunities;
- reduced manual browsing and guesswork;
- faster identification of suitable calls;
- improved understanding of funding requirements;
- better alignment between projects and funding criteria;
- fewer missed deadlines through automatic tracking and reminders;
- improved ability to prepare for proposal writing;
- stronger entry point into EU funding programmes for newcomers.

The tool is especially valuable for SMEs that do not have large internal project-development teams. By automating the first stage of funding discovery and relevance assessment, the solution helps them participate more actively in European innovation and funding ecosystems.

Conclusions from the first Pilot Action implementation of the solution

The source materials identify pilot actions in Slovenia, Romania and Bosnia and Herzegovina. The pilot process described in the presentation includes four phases: getting to know the DanubeDNA project and B2GreenHub, registering to B2GreenHub, using the AI-Powered Funding Call Matcher to find appropriate funding calls, and using proposal-preparation guidance to support the next stage of application development.

The first pilot action should therefore focus on whether SMEs and support organisations can successfully access the tool, understand its interface, use filters, search calls, and identify relevant opportunities. It should also collect feedback on the usefulness of quick search, industry filtering, AI keyword suggestions, and relevance ranking.

Suggested assessment areas include:

- ease of access through B2GreenHub;
- quality of search results;
- relevance of suggested calls;
- usefulness of AI-generated keywords and related terms;
- clarity of funding call information;
- practical value for SMEs searching for funding.

Conclusions from the second Pilot Action implementation of the solution

The second pilot action should focus on the practical use of the tool for real funding preparation. Once users identify suitable calls, the next step is to support proposal preparation. The presentation states that an AI Proposal Preparation Toolkit is in development, including a prompt framework for AI, steps for preparing a project proposal, template structure, and example prompts for project concept, problem definition, objectives, work packages, impact, and budget justification.

The second pilot should therefore assess whether the tool helps SMEs move from funding discovery to proposal readiness. It should evaluate whether the matching results are accurate enough to support actual application decisions and whether users feel more confident in selecting calls and preparing proposals.

Additional pilot evidence from the partner technical manual

The individual partner manual provides additional evidence from the IT&C Cluster “Lower Danube” pilot in Romania, where three SMEs with different profiles tested the solution: a Danube tourism micro-enterprise, a digital agency and an EU-funds consultancy.

For GIV BOATS (GIV BOAT MIU SRL), the pilot helped reframe the business from a simple boat-tour provider into a digital Danube heritage experience. Using the Ask AI mode and the Proposal Assistant, the company identified a suitable heritage and creative-industry funding opportunity and structured the project concept into intervention logic and work packages.

For NEXLOC SRL, a digital agency from Galati, the tool turned an early growth ambition into a ranked and filterable funding pipeline covering programmes such as Digital Europe, Creative Europe, Horizon Europe Cluster 4, Interreg Danube Region and national schemes. The AI Proposal Assistant then helped structure the growth idea into a concept ready for submission.

For RENDAR MANAGEMENT SRL, an EU-funds consultancy, the solution was tested both as a user tool and as a multiplier instrument. RENDAR used the Matcher to pre-screen calls for clients and the specialised AI Proposal Development Consultant to shape a new AI-assisted proposal health-check service, while keeping final expert judgement and confidentiality safeguards in place.

Across the three Romanian pilots, the partner manual reports positive SME feedback, relevance and facilitation ratings between 4 and 5 out of 5, and practical improvement suggestions such as more sector-specific examples, online follow-up sessions, English-language materials and a regularly updated active-calls list.

Development Team and Contributing Partners

The AI-Powered Funding Call Matcher is led by Pomurje Technology Park as responsible partner. IT&C Cluster “Lower Danube” acts as contributing partner. FERI – Faculty of Electrical Engineering and Computer Science, University of Maribor contributes as external expert.

The role of Pomurje Technology Park includes defining the solution concept, coordinating development, linking the tool to SME funding needs, supporting integration into the B2GreenHub / DanubeDNA environment, and coordinating pilot use.

The role of IT&C Cluster “Lower Danube” is connected to contribution to the joint solution, regional testing, SME engagement, and pilot support.

The role of FERI is technical expertise connected to the implementation of the platform, including backend, frontend, database, AI integration, and deployment logic.

Overall, the AI-Powered Funding Call Matcher is a practical funding discovery and matching solution that supports SMEs in navigating complex EU funding opportunities. Its value lies in combining automated data collection, filtering, AI-supported search, relevance matching, and platform integration into one tool that reduces manual effort and improves access to funding for innovation-driven organisations.

Solution 05: Danube DRA

Danube DRA AI – Digital Readiness Analysis

SOLUTION TYPE	DEPLOYMENT	STATUS
AI digital readiness assessment	**Cloud-based SaaS assessment**	Piloted / transfer validated

Technical fiche	
Solution title	Danube DRA AI – Digital Readiness Analysis
Responsible partner	SOVA Digital a.s., Slovakia
Contributing partners / pilot sites	Dél-Dunántúli Regionális Innovációs Ügynökség Nonprofit Kft. / South Transdanubian Regional Innovation Agency (STRIA), Hungary; Industry4UM, Slovakia
External experts	N/A
Period	Period 4–5
Budget allocation	EU funding 80%: EUR 125,817.37; co-financing 20%: EUR 31,454.34

Introduction

Danube DRA is an AI-supported Digital Readiness Analysis solution developed within the DanubeDNA project to help SMEs assess their level of digital maturity and define concrete next steps for digital transformation. The solution is designed as a structured digital audit that evaluates the current state of a company's processes, data, technology, people, roles, and strategic management. It provides an objective foundation for digital transformation by identifying the current level of digitalisation, weak points, bottlenecks, and opportunities for improvement.

The tool is developed by SOVA Digital a.s. from Slovakia and supports the broader DanubeDNA objective of coordinated and transnational digital transformation of SMEs in the Danube Region. The technical manual positions DRA AI as one of the key joint digital solutions of the project, intended to quantify digital maturity, identify strengths and weaknesses, and support the planning of transformation steps.

The public DanubeDNA project description confirms that the DRA AI solution was developed by SOVA Group together with its Slovak partner STRIA Hungary, and describes it as an AI-based evaluation tool that helps companies evaluate digital maturity, identify gaps, and plan targeted improvements to enhance competitiveness within cross-border value chains.

Background of the solution development

The background of Danube DRA is linked to the need for a harmonised, practical, and transferable methodology for assessing SME digital readiness across different countries and sectors in the Danube Region. The DanubeDNA project addresses persistent differences in innovation capacity, technological advancement, and digital maturity between regions, while also supporting the creation of Digital Transformation Centers as integrated support hubs for SMEs.

Many SMEs understand that digital transformation is necessary, but they do not always have a clear view of where to start. Some companies already use tools such as CRM, ERP, spreadsheets, or production software, but lack integration, data discipline, digital leadership, or a structured roadmap. Others have fragmented systems and rely heavily on manual processes. Danube DRA responds to this challenge by offering a guided assessment that converts qualitative and operational input into a structured digital maturity report.

The solution is also designed to support consultants and business support organisations. The presentation emphasises that the analysis should not ideally be completed independently by the customer, but should be carried out with consultant support in order to ensure better answers and more relevant AI-generated outputs.

Aim of the solution development

The main aim of Danube DRA is to provide SMEs with an intelligent, data-driven tool for assessing digital readiness and supporting strategic decision-making related to digitalisation investments.

More specifically, the solution aims to:

- evaluate the company's current level of digital maturity;
- identify weak points, bottlenecks, and digitalisation opportunities;
- assess processes, data use, people, roles, technology, IT infrastructure, and strategic management;

- generate AI-supported analytical outputs;
- provide personalised recommendations for improvement;
- create a process map and transformation roadmap;
- support consultants and Digital Transformation Centers in advising SMEs;
- allow comparable assessment of companies across sectors and regions;
- support follow-up implementation projects.

The technical manual describes the solution as a modular and scalable system, adaptable to different types of enterprises and sectors, and positioned at TRL5–6 as a validated prototype in a relevant environment.

Beneficiaries

The main beneficiaries of Danube DRA are SMEs across the Danube Region. They can use the tool to assess digital readiness, identify digitalisation priorities, and receive recommendations for implementing Industry 4.0 technologies.

A second important beneficiary group includes Business Support Organisations, sectoral agencies, and Digital Transformation Centers. These organisations can use the tool as a structured advisory instrument when working with SMEs. The solution helps them provide a more consistent, data-based service instead of relying only on general consulting discussions.

Secondary beneficiaries include regional authorities, academic institutions, professional associations, and NGOs. Aggregated and anonymised results can support regional strategy development, policy planning, education, and ecosystem analysis.

Technical Specification of the Solution

Solution Description: key features and benefits

Danube DRA is a structured AI-driven methodology for assessing digital maturity. It combines guided consultation, data collection through an online questionnaire or alternative formats, AI-based processing, expert validation, and final presentation of results. The output includes a Digital Readiness Analysis Report in DOCX format, a Digital Process Map in PNG format, transformation recommendations, and a proposed roadmap for digital transformation.

The main evaluation areas include:

Processes and data.
The assessment reviews how the company works with data, how integrated its departments are, and how data is used in decision-making.

People and roles.
The tool evaluates whether there is a clear digital owner or digital leader, how change is communicated, and whether teams are ready for digitalisation.

Strategic management.
The assessment reviews existing digital systems such as CRM and ERP, the presence of an overall digital strategy, and the level of system integration and digitalisation management.

Technology and IT infrastructure.
The solution also considers IT systems, infrastructure, operating model, digitalisation performance, and achieved outcomes.

The key benefit is that SMEs receive a clear picture of their current digital maturity, together with a prioritised roadmap showing the areas with the highest potential impact. The presentation highlights process efficiency, data utilisation, and smarter technology choices as major recommendation areas.

System Architecture Overview

The Danube DRA system combines a cloud-based web interface with a workflow automation backend designed for AI-assisted analysis and document generation. The technical manual describes two main containerised services: the public web experience, available through the Danube domain, and the Workflow / WFL orchestration engine, which manages backend processing.

The system uses an Nginx reverse proxy that listens on ports 80 and 443, terminates TLS, and dynamically routes requests based on container metadata. Certificate lifecycle management is handled through a Let’s Encrypt companion container. The application services and proxy tier share an isolated Docker bridge network, while persistent mounts store configuration, secrets, Google service-account credentials, generated files, and logs.

The architecture can be summarised as follows:

- User access layer: SMEs or consultants access the web interface through a secure browser link.

Questionnaire layer: the user completes the digital readiness questionnaire.

Workflow layer: the backend receives the submitted data and triggers the AI processing workflow.

AI processing layer: OpenAI-based models process responses and generate structured insights.

Template and document layer: Google Sheets and document templates provide the structure for reports and outputs.

Output generation layer: the system generates a DOCX report and process map.

Review layer: consultants or digitalisation specialists validate and refine the AI-generated outputs.

Presentation layer: results are presented to the customer, followed by agreement on next steps.

The process flow presented in the project materials follows the same logic: agreement with the customer, execution of the analysis, AI-based processing of results, review and adjustment of outputs, presentation to the customer, and agreement on next steps.

Technology Stack

The Danube DRA technology stack is built around two main components: a front-end application and a workflow API. The front-end application, referred to as dra-web, delivers the user interface and visualisation layer. The workflow API, referred to as dra-wfl, provides the core logic, AI integration, and document workflow services. Both services are containerised and deployed through Docker Compose.

The front-end layer is built with TypeScript and React 18. It uses React Query for state and cache management, Radix UI and shadcn/ui for accessible UI components, Tailwind CSS for styling, react-router-dom for navigation, zod and react-hook-form for validation and form handling, and Recharts for visual analytics. It is built with Vite and deployed through Docker.

The back-end layer is built with Python 3.12 and Flask. It uses Flask-CORS for API communication, OpenAI SDK for AI-based text and image workflows, Google API tools for Sheets and Drive integration, and document-processing libraries such as docxtpl, python-docx, openpyxl, and pypandoc. SQLite is used for lightweight local persistence.

The main technology components are:

Front-end: TypeScript, React 18, React Query, Tailwind CSS, shadcn/ui, Radix UI, Vite
Back-end: Python 3.12, Flask, Flask-CORS
AI integration: OpenAI / ChatGPT models
Document generation: docxtpl, python-docx, openpyxl, pypandoc
Data and templates: Google Sheets, Google Drive, SQLite
Deployment: Docker, Docker Compose, OCI containers
Reverse proxy and SSL: Nginx proxy, Let’s Encrypt
Runtime and configuration: environment variables, mounted volumes, logs, template storage

This structure makes the system flexible and scalable while keeping the user experience simple.

Deployment Environment

Danube DRA is designed and operated as a cloud-based Software-as-a-Service solution. SMEs do not need to install any local software. They access the application through a secure web interface, while all data processing, AI evaluation, and report generation take place in the central cloud environment.

The cloud deployment consists of the front-end module and back-end workflow module, both deployed in a containerised infrastructure. The system uses Nginx for secure routing and HTTPS communication, with Let’s Encrypt certificates for encrypted access. The platform is maintained centrally by the operator, who is responsible for updates, access control, backup, infrastructure operation, and cybersecurity.

The platform is also prepared for possible hybrid integration, where analytical services can be connected to internal enterprise systems through APIs while sensitive company data remains under organisational control. This gives the solution flexibility for future development, although the current user-facing model is primarily browser-based and cloud-operated.

Installation & Setup

Prerequisites

For end users, no installation is required. SMEs need only a standard desktop or laptop computer, a stable internet connection, and a modern web browser supporting HTTPS and JavaScript. Office tools such as Microsoft Word or LibreOffice may be needed for viewing and editing the generated DOCX report.

For the system operator, the server-side environment requires virtualised or cloud infrastructure supporting containerised workloads. The technical manual recommends a minimum infrastructure of 4 vCPUs, 8 GB RAM, and at least 100 GB SSD storage, together with persistent storage for application data, logs, and SSL certificates. Required software includes a Linux-based operating system, Docker Engine, Docker Compose, Nginx proxy, Let’s Encrypt companion services, Node.js for front-end building, Python 3.12 for the back-end API, and optional monitoring tools such as Prometheus and Grafana.

Network requirements include access to ports 80 and 443 for HTTPS communication and certificate renewal, outbound HTTPS connectivity to OpenAI APIs and Google Sheets / Google Drive APIs, DNS configuration for the relevant subdomains, and a properly configured firewall.

Installation Steps

The installation steps apply to the server-side environment and are performed by the platform operator, not by SME users.

Step 1 – Prepare host infrastructure.
Docker Engine and Docker Compose are installed on a secure Linux host. Persistent volume directories are created for configuration, certificates, storage, and logs.

Step 2 – Clone source repositories.
The latest versions of the front-end and workflow back-end source repositories are obtained from the project's version control system.

Step 3 – Build containers.
Docker images are built for the front-end and back-end services using the provided Dockerfiles.

Step 4 – Configure environment variables.
Environment files are populated with API keys, Google credentials, administrator information, and other runtime configuration. Sensitive information must be protected and excluded from public repositories.

Step 5 – Deploy the stack.
The platform is started through Docker Compose. The proxy and certificate companion automatically issue and renew HTTPS certificates.

Step 6 – Validate system availability.
The operator verifies that both the web interface and workflow API respond correctly and that TLS certificates are active.

Step 7 – Load initial templates.
The workflow engine is connected to the designated Google Sheets and the initial set of prompt templates and configuration files is loaded.

Configuration and Setup Guidelines

After deployment, Danube DRA operates with minimal manual intervention. Runtime variables are maintained in the environment configuration, including OpenAI keys, Google API credentials, and system monitoring settings. Generated documents and logs are stored in the backend storage location, while periodic backups are scheduled by the hosting operator.

The operator can scale the system by increasing container replica counts during active assessment periods. Logs are collected through Docker's default logging driver, and updates are deployed through container image refreshes. External communication is encrypted via HTTPS by default.

From the user side, the most important setup guideline is data quality. The presentation clearly states that the quality of input data directly determines the quality of the AI outputs. Therefore, the assessment is recommended to be performed with a consultant, either through the web application, XLS form, or guided interview.

User Guide

Logging In & User Authentication

During the pilot phase, Danube DRA operates without traditional individual login or user authentication. This is intentional, because the goal is to make it easy for SMEs to access and test the service without administrative barriers. Users receive a secure link from the project consortium or authorised partners and can immediately open the assessment interface.

The pilot access model includes no login credentials, session-based usage, anonymous operation, and controlled distribution of the active access link. Each assessment is processed as an independent session, and the system does not store user identities or contact details during the pilot setup.

Core Functionalities: Step-by-Step

The core workflow of Danube DRA is as follows:

Agreement with the customer.
The consultant explains the purpose, scope, and benefits of the analysis. The presentation recommends that the assessment is not completed independently by the customer, because consultant support improves response quality and AI output relevance. The estimated duration of the guided process is 3–4 hours.

Execution of the analysis.
The assessment can be completed through the online web application, an XLS form, or a guided consultant interview. The recommended approach is consultant-led discussion, because it helps clarify the customer's needs and improves the quality of the input.

Questionnaire completion.
The questionnaire includes basic company information, currently used applications, level of digitalisation across

processes, up to five digitalisation priorities, and optional comments. The selected priorities significantly influence the AI recommendations.

AI-based processing.
After submission, the system automatically processes the responses. Processing takes approximately 30 minutes and generates two main outputs: an analytical report in DOCX format and a process map in PNG format.

Review and adjustment of outputs.
The consultant or digitalisation specialist reviews the AI-generated content, checks accuracy, improves language quality, and refines explanations or visuals where necessary. The presentation emphasises that AI-generated outputs must be validated by a consultant.

Presentation to the customer.
Results are presented online, for example via MS Teams, or on site. The focus should be on the level of digitalisation and recommended solutions, rather than excessive detail about the analysis process.

Agreement on next steps.
The customer reviews the results internally and decides on implementation priorities. If the company is interested, the next steps may include a follow-up meeting, detailed technical specification, and tailored implementation proposal.

User Roles & Permissions

The current pilot version has a simplified access model, but several practical roles can be defined.

SME / End User: completes the digital readiness questionnaire and receives the generated report and process map.
Consultant / Digitalisation Specialist: guides the assessment, improves input quality, validates AI outputs, and presents the results to the customer.
Project Partner / Regional Coordinator: provides access links, supports pilot implementation, collects feedback, and coordinates follow-up actions.
System Operator / Technical Administrator: maintains infrastructure, templates, configuration, backups, security, and updates.
Developer / Platform Maintainer: manages the front-end, back-end, AI workflows, templates, document generation logic, and platform evolution.

This role structure reflects the actual use of the tool: the SME provides business input, while the consultant and technical team ensure that the assessment is meaningful, reliable, and usable for transformation planning.

System Administration

User Management

During the pilot phase, Danube DRA does not use individual user account management. Access is intentionally simplified so SMEs can test the tool quickly. Participants who receive the valid access link can open the web interface and generate an analysis without registration, login credentials, or identity verification.

At the same time, the platform includes a separate administrative layer that is isolated from the public-facing environment. Administrative tools are accessible only to authorised project staff and are used for monitoring workflow execution, reviewing AI activity logs, managing Google Sheets templates, maintaining document structures, reviewing system performance, and deploying updates.

Data Backup & Recovery

Danube DRA includes a data recovery, backup, and operational resilience framework. Since the solution operates as a centrally managed cloud service, backup and recovery mechanisms are implemented on the server side by the system operator. End users do not need to perform local backups or maintenance.

Generated documents, logs, templates, and workflow data are stored in controlled backend storage. Periodic backups are scheduled by the hosting operator, and generated reports are stored temporarily to support download and then removed after a defined retention period to protect user data and maintain system efficiency.

Security Settings & Access Control

Security and access control are implemented through several layers. Even though the pilot version does not use individual login accounts, critical system components are protected through network, application, and infrastructure-level security measures.

The main security principles include:

- HTTPS encryption for all external communication;
- Nginx reverse proxy for controlled routing;
- Let’s Encrypt certificates for secure access;
- Docker network isolation between services;
- restricted access to mounted volumes and configuration files;
- protected administrative layer;

- session isolation for user assessments;
- no persistent user profiles in the pilot version;
- central operator control over infrastructure, backups, and updates.

This approach balances ease of access for pilot users with sufficient protection of system resources and generated outputs.

Integration & API Usage

Available APIs & Endpoints

The DRA back-end workflow service is implemented with Flask and provides webhook endpoints, template retrieval, and download routes. The technical manual references routes defined in the workflow API and describes the backend as responsible for AI integration, document workflows, report generation, and file download.

At functional level, the available service logic includes:

- questionnaire submission endpoint;
- workflow trigger endpoint;
- AI processing workflow;
- template retrieval;
- report generation;
- process map generation;
- document download routes;
- internal logging and status tracking;
- prompt and template management.

These endpoints are mainly used internally between the web interface, workflow backend, AI services, and document generation logic.

Integration with Third-Party Systems

The solution integrates with several external services. OpenAI / ChatGPT models are used for AI-based text and image generation workflows. Google Sheets and Google Drive are used for data-driven configuration, prompt templates, and document templates. Let's Encrypt is used for automated SSL certificate provisioning and renewal.

The solution is also designed for possible future hybrid integration with internal enterprise systems through APIs. This would allow companies to connect internal data sources while keeping sensitive data under stronger organisational control.

Data Exchange & Formats

Danube DRA uses several data formats and output types.

The main user outputs are:

- Digital Readiness Analysis Report in DOCX format;
- Digital Process Map in PNG format;
- transformation recommendations;
- roadmap proposal.

Internally, the system uses Google Sheets for prompt and template configuration, DOCX and XLSX templates for report generation, SQLite for local persistence and prompt auditing, metadata in YAML / JSON formats for workflow parameters, and environment files for runtime configuration.

The presentation also confirms that the AI processing step generates an analytical report and process map, with a processing time of approximately 30 minutes.

Expected Impact of the Solution

Danube DRA is expected to support SMEs by giving them a clear and structured understanding of their current digital maturity and by translating assessment results into practical recommendations. It reduces the time required for digital readiness assessment and creates a more consistent methodology for consultants and regional partners.

Expected benefits include:

- faster assessment of digital maturity;
- objective overview of current digitalisation level;
- clear identification of weaknesses and bottlenecks;
- structured view of improvement opportunities;
- prioritised roadmap for digital transformation;
- better decision-making for digitalisation investments;
- support for consultants and business support organisations;

- comparable results across SMEs, sectors, and regions;
- stronger basis for regional digitalisation strategies;
- improved preparation for Industry 4.0 implementation.

The public DanubeDNA description states that the solution has already completed two pilot assessments in Slovakia with highly positive feedback, with one company initiating its digitalisation process based on the recommendations and another independently implementing improvements. It also notes that the tool is available in Slovak, Serbian, and Hungarian and will continue to be maintained and developed beyond the DanubeDNA project.

Conclusions from the first Pilot Action implementation of the solution

The first pilot implementation demonstrated the feasibility, usability, and strategic value of AI-assisted digital readiness assessment for SMEs. The pilot involved testing across multiple SMEs from diverse sectors, including manufacturing, services, and technology-oriented companies. Participants accessed the cloud-based platform, completed the questionnaire, and received automatically generated Digital Readiness Reports summarising digital maturity, strengths, and recommended next steps.

The reported pilot results included 5+ participating SMEs in the pilot country, an average assessment time below 30 minutes, report generation below 30 minutes, user satisfaction of 4.5 / 5, administrative effort reduction of around 60%, and AI output accuracy of approximately 85–90% compared with expert review.

Qualitative results included stronger awareness of digital maturity, improved decision-making, ease of use, positive human-AI collaboration, and transferability across sectors. The human review step was important because it increased trust in AI-generated results and allowed the recommendations to be adapted to company context.

Conclusions from the second Pilot Action implementation of the solution

The second pilot action is being implemented in Hungary under the leadership of DDRIÜ Nonprofit Kft. / South Transdanubian Regional Innovation Agency / STRIA. Its purpose is to verify the transnational transferability and practical usability of the solution beyond the original Slovak implementation.

The Danube DRA presentation also identifies pilot activity in Slovakia, Hungary, and Serbia, primarily with general engineering and manufacturing SMEs, and states that feedback and implementation experience were highly positive.

The second pilot should therefore be understood as a transfer and validation phase. It checks whether the methodology, questionnaire, AI outputs, consultant review process, and final reports can work across different national, linguistic, and business contexts. This is important because Danube DRA is intended not only as a local tool, but as a repeatable digital readiness methodology for the wider Danube Region.

Additional partner-manual clarification

The individual Danube DRA AI manual confirms SOVA Digital a.s. as responsible partner, the South Transdanubian Regional Innovation Agency as contributing partner, and Industry4UM as innovation agency. The manual records budget information up to 31 December 2025 as EU funding of EUR 125,817.37 and co-financing of EUR 31,454.34.

The individual partner manual also specifies that system events, administrative actions and workflow executions should be logged to ensure traceability and accountability. This strengthens the governance and auditability layer of the DRA AI workflow, especially where assessment outputs are used by consultants, DTCs or business support organisations.

Development Team and Contributing Partners

Danube DRA was developed with SOVA Digital a.s. as the lead technical developer and responsible partner. SOVA Digital was responsible for designing, developing, and implementing the platform architecture, including front-end and back-end layers, AI integration, data workflows, document generation logic, and pilot-ready prototype development.

SOVA Digital’s main contributions include:

- development of the AI-based evaluation engine;
- integration of OpenAI services for automated report generation;
- design and deployment of Docker-based server infrastructure;
- implementation of data exchange modules;
- development of the pilot-ready assessment platform;
- support during pilot testing and improvement;
- adaptation of outputs and assessment logic to regional contexts.

STRIA / South Transdanubian Regional Innovation Agency contributed as the Hungarian implementation and pilot partner. Its role is linked to regional innovation management, knowledge transfer, cross-border cooperation, SME engagement, and validation of the solution in Hungary.

Industry4UM, Slovakia is identified as a contributing innovation agency in the technical manual. Its role is connected to the digital transformation and Industry 4.0 context of the solution.

Overall, Danube DRA is a practical AI-supported digital readiness assessment solution that helps SMEs move from a general interest in digitalisation to a structured understanding of their current maturity, priorities, and next steps. Its main value lies in combining consultant-guided input, AI-based analysis, expert validation, report generation, process mapping, and transformation recommendations into one repeatable methodology for the Danube Region.

Solution 06: EM4 System Condition

EM4 System Condition

SOLUTION TYPE **Wireless energy monitoring**	DEPLOYMENT **Physical retrofit monitoring system**	STATUS Piloted in AT / CZ

Technical fiche	
Solution title	EM4 System Condition
Responsible partner	CAMPUS 02 University of Applied Sciences, Austria (PP10)
Contributing partners / pilot sites	VSTE (PP5); INOS Service s.r.o. / Czech welding pilot; Austrian SME energy-monitoring pilot site
External experts	Messfeld GmbH / Adapt System expertise
Period	Period 3–5
Budget allocation	No separate budget allocation recorded

Introduction

EM4 System Condition is a flexible wireless energy monitoring solution developed within the DanubeDNA project to support SMEs in improving energy efficiency and monitoring machine condition. The solution was developed by CAMPUS 02 University of Applied Sciences, Austria, as Solution No. 6 within the joint solutions portfolio. Its main purpose is to provide companies with an easy, flexible, expandable, and cost-efficient tool for measuring energy consumption and identifying optimisation opportunities in industrial environments.

The official DanubeDNA project page describes EM4 System Condition as a wireless energy monitoring solution designed to help SMEs improve energy efficiency and monitor operational parameters without requiring complex factory-wide modifications. The solution is based on digital power clamps, impulse transmitters, sensor modules, and a central gateway, and it supports real-time data collection, visualisation, modular expansion, and optional predictive maintenance functionalities.

The basic logic of the solution is that energy is becoming an increasingly important cost factor for production in Europe. Many SMEs need a practical way to understand where energy is consumed, how machines behave during operation, and which processes offer the best potential for optimisation. EM4 System Condition responds to this need by offering a wireless and retrofit-friendly monitoring approach that can be adapted to different industrial contexts.

Background of the solution development

The development of EM4 System Condition is linked to the growing pressure on manufacturing and service SMEs to reduce energy costs, improve operational efficiency, and prepare for smarter production management. In many companies, energy consumption is only visible at a general facility level, while individual machines, processes, or production steps are not monitored in sufficient detail. This makes it difficult to identify high-consuming equipment, compare operating periods, or calculate the real energy impact of specific processes.

The solution concept was developed around several practical requirements for the Danube Region. It needed to be useful in different countries, technically straightforward, economically valuable, expandable through upgrade modules, and aligned with both CAMPUS 02 expertise and current SME needs. The selected topic was energy efficiency and energy measurement, with an optional predictive maintenance module.

This makes the solution relevant for many sectors across the Danube Region, including metal processing, food, agriculture, textile, rubber and plastics, automotive, construction, electrical, mechanical, logistics, and other production-related industries.

Aim of the solution development

The main aim of EM4 System Condition is to give SMEs access to a practical and expandable wireless monitoring system that helps them understand energy consumption and system condition in real operational environments.

More specifically, the solution aims to:

- measure energy consumption at machine, process, or selected circuit level;
- support energy efficiency analysis and optimisation;
- enable easy retrofit installation without expensive factory-wide rewiring;

- provide a flexible monitoring system that can be expanded with additional sensors;
- support customised dashboards for visualising energy and operational data;
- create a basis for future condition monitoring and predictive maintenance;
- reduce the technical and cost barriers for SMEs that want to start energy monitoring;
- support data-driven decision-making for energy savings and production optimisation.

The solution is designed as an open and adaptable platform. The official project page highlights that it supports different industrial use cases and future upgrades, helping SMEs identify optimisation opportunities, reduce operational costs, and improve decision-making through data-driven analytics.

Beneficiaries

The main beneficiaries of EM4 System Condition are SMEs that need a simple and scalable energy monitoring tool but do not have the resources for complex industrial energy management systems. This includes manufacturing SMEs, workshops, service companies with energy-intensive equipment, and companies operating machines or processes where electricity consumption has a direct cost and performance impact.

The solution is especially useful for companies that need to monitor:

- compressors;
- ventilation and exhaust systems;
- welding stations;
- paint-room equipment;
- electrical cabinets;
- production lines;
- process equipment;
- high-energy machines;

auxiliary systems such as pumps, fans, heating, cooling, or compressed-air systems.

EM4 System Condition is also relevant for SMEs that want to begin with energy monitoring and later expand towards machine condition monitoring or predictive maintenance. The modular structure allows companies to start small and add sensors, circuits, or modules over time.

Technical Specification of the Solution

Solution Description: key features and benefits

EM4 System Condition is a wireless energy monitoring system that allows SMEs to collect energy consumption data from selected machines, circuits, and processes. The solution is based on a flexible sensor and gateway architecture that can be installed with limited wiring and adapted to different technical environments.

The main features of the solution include:

Wireless energy monitoring.
The system collects energy measurement data wirelessly, reducing the need for extensive wiring and making the installation easier in existing facilities.

Flexible retrofit installation.
The solution is designed for existing SME environments. It avoids cost-intensive overall wiring and requires wiring mainly from the measuring unit to the clamps.

Digital power clamps.
The monitoring system uses digital power clamps with different current ranges, allowing adaptation to different machines and loads.

Multi-channel measurement.
The ECO-Adapt system supports 3x3 or 6x3 channel sensor data sampling. The older solution concept also states that the system can measure electricity from up to 6 three-phase circuits or 18 single-phase circuits, with a maximum current of 3,500 A.

Impulse transmitter option.
The solution includes a flexible and open system logic through a pulse / impulse transmitter option, which supports integration with other measurement or process signals.

Central gateway.
Measured data is collected and transmitted through a central gateway, enabling centralised monitoring and visualisation.

Customised dashboard.
The system supports dashboard-based visualisation, adapted to the needs of the SME and the monitored processes.

Optional predictive maintenance module.
The solution concept includes Predict-Adapt as an optional extension for machine condition monitoring and predictive maintenance.

The main benefits are easy installation, reduced wiring cost, lower risk of incorrect cable connections, scalability, modularity, and the ability to identify energy optimisation opportunities.

System Architecture Overview

The available presentations do not provide a full software architecture diagram, but they clearly define the functional architecture of the EM4 System Condition solution.

The system architecture can be described as follows:

- Measurement layer: digital power clamps and sensors collect energy consumption data from selected circuits or machines.

Signal input layer: impulse transmitters or additional sensor interfaces allow the system to include further process or condition-related signals.

Sensor expansion layer: additional ambient sensors can be integrated, such as temperature, humidity, CO_2, or flow meters for water, heat, gas, or other utilities.

Communication layer: the system can use communication technologies such as LoRaWAN, BACnet, Modbus TCP, and Modbus RTU.

Gateway layer: a central gateway receives and manages measurement data from the sensors and clamps.

Visualisation layer: a customised dashboard displays relevant energy and condition data for analysis and optimisation.

Optional analytics layer: Predict-Adapt or similar upgrade modules can extend the system towards machine condition monitoring and predictive maintenance.

This architecture makes the solution suitable for gradual deployment. A company can begin by monitoring a small number of high-energy machines and later expand to additional circuits, machines, ambient sensors, or predictive maintenance functions.

Technology Stack

The exact full technology stack is not described in the available materials. However, the presentations identify the main technical components and communication standards used by the solution.

At functional level, the technology stack includes:

Energy measurement hardware: digital power clamps with different A-values
Sensor data sampling: 3x3 or 6x3 channel sensor data sampling
Signal integration: impulse / pulse transmitter
Central infrastructure: central gateway
Communication protocols: LoRaWAN, BACnet, Modbus TCP, Modbus RTU
Expansion sensors: temperature, humidity, CO_2, flow meters for utilities
Dashboard layer: customised dashboard for visualisation
Optional condition monitoring: Predict-Adapt module for machine condition and predictive maintenance

The solution is presented as technically straightforward but state-of-the-art or better, meaning that it is intended to be modern enough for digital monitoring while remaining practical for SMEs in different countries.

The system is also connected to CAMPUS 02's competence areas, including energy optimisation, Internet of Things, electrical engineering, information technology, control engineering, measurement automation, virtual methods, prototype development, and process optimisation.

Deployment Environment

EM4 System Condition is deployed as a physical monitoring system in the SME's operational environment. Unlike purely web-based tools, this solution requires the installation of measurement equipment at the company site.

The deployment environment typically includes:

- selected machines or circuits for monitoring;
- electrical control cabinet access where possible;
- digital power clamps;
- measuring unit;
- impulse transmitter where relevant;
- central gateway;
- wireless communication infrastructure;
- dashboard access;
- optional additional sensors;
- possible predictive maintenance module.

The official project description emphasises that the system is designed to minimise installation complexity and infrastructure cost. It can be integrated into existing industrial environments and used for monitoring multiple machines and production processes.

In practice, the deployment can be adapted to the SME's technical situation. In some cases, sensors can be connected directly in the electrical control cabinet. In other cases, a flexible transportable sensor box can be configured for one to three workstations, as shown in the Czech welding pilot.

Installation & Setup

Prerequisites

The system requires access to the target machines, circuits, or electrical cabinets where energy data will be collected. Before installation, the SME and technical team should identify the main energy-consuming components and define the monitoring objectives.

The main prerequisites include:

- identification of the machines or circuits to be monitored;
- access to electrical cabinets or power supply points;
- suitable current ranges for power clamps;
- available space for measuring unit and gateway installation;
- wireless communication coverage;
- access to dashboard or monitoring interface;
- technical staff or expert support for installation;
- safety compliance for electrical work.

The solution is designed for easy retrofit installation, but because it involves electrical measurement, installation should still be performed by qualified personnel.

Installation Steps

The installation follows a practical implementation process.

Step 1 – Select the SME and define monitoring scope.
A suitable SME is identified, and the main monitoring objectives are agreed. In the Austrian pilot, a car-painting company was selected for energy measurement and monitoring. In the Czech pilot, the selected company was a manufacturing SME with welding as the main process.

Step 2 – Analyse energy-consuming components.
The main energy-consuming equipment is identified. In the Austrian pilot, the focus was on the air compressor and exhaust systems for paint rooms 1 and 2.

Step 3 – Prepare implementation concept.
The technical team prepares the implementation concept, including measurement points, sensor configuration, communication setup, and dashboard requirements.

Step 4 – Install sensors and measurement system.
Digital power clamps and measurement equipment are installed at the selected points. Where possible, installation is performed directly in the electrical control cabinet. At Bloder e.U., three parameters could be collected at one electrical control cabinet.

Step 5 – Configure gateway and communication.
The central gateway and communication settings are configured to receive data from the measurement units and sensors.

Step 6 – Set up dashboard.
A customised dashboard is prepared to display the relevant energy data and optimisation indicators.

Step 7 – Run measurement and data sampling.
The system is operated in real conditions to collect energy data over time. This creates the basis for optimisation analysis.

Step 8 – Identify optimisation options.
Collected data is analysed and optimisation options are identified. In the Austrian pilot, the first stage involved running the system and setting up data measurement, while the second stage included sensor improvements and identification of optimisation options.

Configuration and Setup Guidelines

Configuration depends on the monitored equipment and the SME's technical environment. The system can be adapted through the number of channels, type of clamps, communication method, dashboard layout, and additional sensors.

Recommended configuration guidelines include:

- start with the largest or most relevant energy consumers;
- define clear measurement goals before installation;
- verify clamp type and current range before deployment;
- ensure reliable wireless communication;

- document all measurement points;
- validate collected data before drawing conclusions;
- adapt the dashboard to management and technical-user needs;
- consider additional sensors if energy data alone is not enough;

use the system first for monitoring and then for optimisation.

For SMEs, the key is not to collect data for its own sake, but to connect measurement with decisions. Each monitored point should support a practical question, such as identifying peak consumption, comparing machine operating time, detecting idle consumption, or evaluating the effect of process changes.

User Guide

Logging In & User Authentication

The available presentations do not describe a detailed login or user authentication process. The solution is accessed through the monitoring and optimisation environment provided in the project materials. The presentation provides the access point: https://www.b2greenhub.eu/MonitoringAndOptimization.

The user access model is described at functional level. Users access the monitoring dashboard or platform interface provided for the implementation. Depending on the selected configuration, access may be managed by the responsible partner, technical provider or the SME's internal administrator.

Core Functionalities: Step-by-Step

The main user workflow is as follows:

- Open the monitoring interface.

The user accesses the dashboard or monitoring environment.

Select monitored equipment or circuit.
The user reviews data from selected equipment such as compressors, exhaust systems, welding stations, or electrical circuits.

View energy consumption data.
The system displays measured energy data collected by digital power clamps and transmitted through the gateway.

Review operating patterns.
The user analyses how energy consumption changes over time and how it relates to machine use or process activity.

Compare monitored components.
If several machines or circuits are connected, the user can compare consumption between them.

Identify optimisation opportunities.
High consumption, idle consumption, unusual patterns, or inefficient operating periods can be identified.

Implement improvements.
The SME can adjust operating procedures, maintenance routines, process scheduling, or technical settings based on the findings.

Continue monitoring.
After improvements, the system continues collecting data, allowing the company to check whether the optimisation actions are effective.

Expand the system if needed.
Additional sensors, circuits, machines, or upgrade modules can be added later.

User Roles & Permissions

The source documentation does not define user roles in detail. For catalogue consistency, the following practical roles are used:

SME Management: reviews dashboard outputs, identifies cost-saving opportunities, and decides on optimisation actions.
Energy Manager / Technical Manager: analyses detailed measurement data and monitors high-consuming systems.
Machine / Process Operator: may use simplified dashboard information to understand operating conditions and energy behaviour.
Technical Installer / Expert: installs sensors, clamps, gateway, and communication components.
System Administrator: manages dashboard configuration, communication settings, and system expansion.
CAMPUS 02 / Technical Partner: supports implementation, pilot testing, training, analysis, and further system adaptation.

This role structure reflects the practical nature of the solution, where technical setup, energy analysis, and management decisions must work together.

System Administration

User Management

The available presentations do not specify detailed user management functions. In a practical deployment, user management should be defined according to the dashboard or platform environment used by the SME.

Recommended user management functions include:

- creating access for SME management and technical staff;
- separating administrative and viewer access where possible;
- restricting configuration changes to authorised users;
- managing access to monitoring dashboards;
- documenting users responsible for energy analysis and system maintenance.

Since the solution may expose operational and energy-consumption data, access should be controlled even if the technical setup is simple.

Data Backup & Recovery

The source documentation does not describe a formal backup and recovery procedure. Since the value of the solution depends on historical measurement data, backup procedures are included as part of the recommended operational setup.

Recommended backup principles include:

- regular export or backup of measurement data;
- storage of dashboard configuration;
- documentation of sensor and measurement-point configuration;
- backup of gateway configuration where possible;
- retention of pilot data for comparison and optimisation;
- secure storage of reports and findings.

Historical data is important because energy optimisation usually requires comparison over time. Without retained data, the SME cannot easily evaluate whether implemented improvements reduced consumption.

Security Settings & Access Control

Security should focus on protecting the monitoring infrastructure, dashboard access, and any connected communication interfaces. Since the system uses wireless data collection and may be connected to operational environments, the configuration should prevent unauthorised access and unwanted changes.

Recommended security principles include:

- secure configuration of wireless communication;
- controlled dashboard access;
- restricted administrative permissions;
- documented sensor and gateway configuration;
- protection of monitoring data;
- safe electrical installation by qualified personnel;
- regular review of system access and configuration.

For future predictive maintenance modules, security becomes even more important, because machine condition data may reveal operational patterns, production capacity, or maintenance weaknesses.

Integration & API Usage

Available APIs & Endpoints

Concrete APIs or endpoints are not defined in the source documentation. The integration logic is therefore described at functional level.

At functional level, the system may require interfaces for:

- receiving measurement data from sensors and clamps;
- transferring data from the central gateway to the dashboard;
- integrating impulse transmitter signals;
- adding ambient sensor data;
- exporting energy measurements;
- connecting future predictive maintenance modules.

The older solution concept mentions communication technologies such as LoRaWAN, BACnet, Modbus TCP, and Modbus RTU, which are relevant for integration with building, energy, and industrial automation systems.

Integration with Third-Party Systems

EM4 System Condition can potentially integrate with third-party systems through standard industrial and building automation protocols. The communication technologies mentioned in the project materials make the solution relevant for integration with energy monitoring platforms, building management systems, industrial dashboards, and utility measurement systems.

Possible integrations include:

- building management systems;
- energy management dashboards;
- PLC or automation environments;
- facility monitoring systems;
- maintenance planning tools;
- predictive maintenance modules;
- reporting and analytics tools;
- utility monitoring systems for water, gas, heat, and electricity.

The open and expandable nature of the system is important because different SMEs have different technical environments. Some may only need energy monitoring, while others may later require condition monitoring, sensor expansion, or integration with maintenance processes.

Data Exchange & Formats

The available files do not define exact data exchange formats. Based on the described communication standards, data exchange may involve measurement values from power clamps, sensor readings, impulse signals, and gateway-transmitted monitoring data.

The main data types include:

- electricity consumption;
- current or load-related values;
- sensor data from selected circuits;
- operating time or process activity;
- impulse / pulse transmitter signals;
- ambient sensor values;
- machine condition indicators where predictive maintenance is implemented;
- dashboard indicators for optimisation.

The system's value depends on transforming these measurement signals into usable information for SMEs, such as consumption patterns, high-load periods, operating time, comparison between equipment, and energy-saving opportunities.

Expected Impact of the Solution

EM4 System Condition is expected to support SMEs by providing a practical and scalable approach to energy monitoring and optimisation. The solution makes energy consumption more visible and helps companies identify where costs can be reduced.

Expected benefits include:

- improved visibility of energy consumption;
- easier identification of high-consuming machines and processes;
- reduced need for complex wiring;
- lower monitoring setup cost;
- better understanding of operating time and energy behaviour;
- improved decision-making for energy optimisation;
- flexible expansion to additional sensors or circuits;
- support for future predictive maintenance;
- transferability across different sectors and countries;
- stronger awareness of energy as a production cost factor.

The public DanubeDNA page states that EM4 System Condition helps SMEs identify optimisation opportunities, reduce operational costs, improve energy efficiency, and strengthen decision-making through data-driven analytics.

Conclusions from the first Pilot Action implementation of the solution

The Austrian pilot was implemented with Bloder Lackierzentrum u. Spenglerei e.U., a car-painting and bodywork company located in Hausmannstätten, Austria. The pilot focused on energy measurement and monitoring of the main energy-consuming components, including the air compressor and exhaust systems for paint room 1 and paint room 2.

The implementation showed that the system can be installed in a real SME environment and used to collect energy data from relevant components. Installation was often possible directly in the electrical control cabinet, and in the Bloder case three parameters could be collected at one electrical control cabinet. The pilot process included running the system, setting up data measurement, improving sensors, and identifying optimisation options.

The main conclusion from this pilot is that a flexible wireless energy monitoring system can provide useful visibility even in a smaller SME environment where complex monitoring infrastructure would normally be too expensive or impractical.

Conclusions from the second Pilot Action implementation of the solution

The Czech pilot focused on a manufacturing company whose main process was welding. The task was to understand welding energy consumption and operation time, check the technical requirements, and prepare a requirement analysis for the exact system setting.

For this pilot, a flexible transportable sensor box was configured for one to three welding stations, and the implementation was completed. The system was then used for measurement and data sampling in real operation.

The second pilot demonstrated that the solution is transferable beyond one SME and one process type. It can be adapted to different industrial contexts by changing the measurement setup, sensor configuration, and monitoring focus. This supports the overall DanubeDNA aim of creating joint solutions that can be implemented across SMEs in different Danube Region countries.

Additional installation and platform details from the partner technical manual

The individual EM4 / ECO Adapt manual gives additional detail on the condition-monitoring logic. Condition data such as vibration, temperature and current signatures are used to assess machine health, detect anomalies and support maintenance planning based on actual equipment condition rather than fixed intervals.

The platform layer, Power-Cloud, is described as the central intelligence of the system. It aggregates incoming data streams, supports time synchronisation and enables analytics such as trend analysis, KPI calculation and correlation of condition and energy data.

The manual also distinguishes the internet-uplink logic of the two sub-systems. Predict-Adapt can use a preconfigured cellular modem attached to the measuring unit, while Power-Adapt can use a gateway-based connection. Network prerequisites therefore depend on the chosen integration path and should be checked before commissioning.

Before continuous monitoring is enabled, the individual partner manual recommends installation controls to prevent systematic measurement errors. These include checking phase relation between current and voltage signals, current-transformer orientation and seating, cabinet wiring, measurement-channel mapping and environmental suitability for installation in a low-voltage switchboard or similar fire-resistant enclosure.

For Power-Cloud configuration, the partner manual adds that the organisation hierarchy should mirror the physical installation through Sites and Areas. Equipment entries, device channels and measurement points must be mapped correctly so that dashboards, comparisons and aggregations are meaningful. Sensor records include serial number, product type, assigned location and last update date.

Development Team and Contributing Partners

EM4 System Condition was developed and presented by CAMPUS 02 University of Applied Sciences, Austria. The CAMPUS 02 DanubeDNA technical team includes expertise from the Department of Automation Technology, especially in energy analytics, solution lab activities, automation, measurement technology, and international coordination. The presentation identifies DI (FH) Gernot Hofer as Head of Energy Analytics & Solution Lab and Informatics Expert, and Dr. Eng. Ioan Turcin as Assistant in Research and Teaching and Coordinator for Internationalization.

Messfeld GmbH is identified as company partner and external expert connected to Adapt System software and hardware, represented by Ing. Dipl.-Ing Jutta Isopp.

The CAMPUS 02 competence base supporting the solution includes industrial measurement technology, measurement automation, process optimisation with PLCs, mobile devices and RFID, energy optimisation, Internet of Things, prototype development, demonstrators, electronic engineering, sensor applications, and the Energy Analytics and Solution Lab.

Overall, EM4 System Condition is a practical and transferable wireless energy monitoring solution that helps SMEs begin energy optimisation without large infrastructure changes. Its main value lies in combining easy retrofit installation, flexible sensor expansion, wireless data collection, customised dashboards, and a clear pathway toward future machine condition monitoring and predictive maintenance.

Closing Note

Use of the catalogue

The catalogue shows that the DanubeDNA joint solutions portfolio is not a single-type digital toolkit, but a balanced set of complementary instruments addressing different levels of SME transformation. Some solutions support strategic decision-making, investment planning, funding access and digital readiness assessment, while others provide direct visibility over production, energy consumption and system condition in real industrial environments.

A common conclusion across the portfolio is that SME transformation requires both planning capacity and operational data. The solutions therefore respond to practical challenges faced by SMEs: limited access to structured data, fragmented decision-making, insufficient visibility over machines and energy use, difficulties in identifying suitable funding opportunities, and the need for clearer transformation roadmaps.

The portfolio also demonstrates strong transferability potential. Although the solutions were developed and piloted in different partner countries, sectors and technical contexts, their logic can be adapted to other SMEs and support environments across the Danube Region. Web-based and AI-supported tools can be reused by business support organisations, consultants and SMEs, while industrial and energy-monitoring solutions can be adapted through modular installation, configurable dashboards and context-specific measurement points.

Another important conclusion is that digital tools create the highest value when combined with expert support, user guidance and practical validation. Several solutions rely not only on automated processing or AI-supported outputs, but also on consultant review, partner feedback, pilot testing and SME engagement. This confirms that the DanubeDNA portfolio should be understood as both a technical output and a practical support framework for future digital and green transformation activities.

Overall, the catalogue confirms that the joint solutions developed within DanubeDNA provide a reusable foundation for future SME support, partner cooperation and regional transfer. Their value lies not only in the individual tools, but in the combined portfolio logic: helping SMEs move from assessment and planning to implementation, monitoring, optimisation and informed decision-making.