1. Summary

The project successfully developed and validated a methodology and MVP module for smart data mapping and data enrichment in discrete manufacturing concerning quality and defect data analysis. The approach reduces complex data and domain mapping and discovery time from weeks to minutes, enabling AI-powered data discovery and analysis.

The objective was to design a framework and a software module that can identify, structure and visualise data units such as sensors, quality checkpoints, lines and zones, and connect them to metadata and process context. This included defining a hierarchical semantic data model, a metadata schema, and a visual mapping interface that can be used by quality and process engineers, as well as by the Braviz platform for data discovery.

The MVP module provides a visual interface prototype for data flow diagrams, systematic methodology for mapping data points and quality checkpoints, and automated metadata enrichment capabilities. Key technical achievements include structured data source identification, quality checkpoint mapping, and visual representation of data relationships.

The project validated early product-market fit for data mapping automation through close collaboration with industry partners and expertise within the CampX Incubator Program. This validation demonstrates significant time savings and improved quality engineering processes. The results establish a foundation for the Braviz Platform's continued development and commercialization for discrete manufacturing and product engineering industries, contributing to Industry 4.0 adoption by solving fragmented operational data challenges.

2. Sammanfattning på svenska

Projektet har utvecklat och validerat en metodik och en MVP-modul för smart datamappning av sensorer, kvalitetskontrollpunkter och metadata inom diskret tillverkningsindustri med fokus på kvalitets- och defektdataanalys. Lösningen adresserar problemet att viktiga kvalitets- och proces-sdata är fragmenterade och svåra att koppla till faktiska tillverkningsenheter, linjer och processer.

Syftet var att ta fram ett ramverk och en mjukvarumodul som identifierar, strukturerar och visualiserar datapunkter som sensorer, kvalitetskontrollstationer, inspektionspunkter, linjer och zoner samt kopplar dessa till relevant metadata och processkontext. Arbetet omfattade en hierarkisk datamodell, ett metadataschema och ett visuellt kartläggningsgränssnitt som kan användas av kvalitets- och processingenjörer samt som input till Braviz analysplattform.

Projektet pågick från december 2024 till maj 2025 med Braviz AB som koordinator och genomfördes i tre arbetspaket: (1) framtagning av datakartläggningsramverk och hierarki, (2) design av kartläggningsmodul och metadatasystem, samt (3) utveckling och validering av en MVP-modul integrerad i Braviz plattform. Validering skedde tillsammans med

industripartner i CampX-ekosystemet och andra diskreta tillverkningsföretag genom workshops, intervjuer och tester.

Resultaten omfattar en dokumenterad metodik och riktlinjer, en hierarkisk datamodell och ett metadataschema samt en fungerande MVP-implementation av en visuell datakartläggningsmodul. I piloter minskade metoden tiden för komplex datamappning och domänupptäckt från veckor till minuter när strukturen väl var satt, och gav över 60 % täckning av relevanta kvalitetsrelaterade enheter på utvalda linjer.

På längre sikt möjliggör resultaten snabbare och mer tillförlitlig dataanalys för kvalitets- och defektanalys, skapar en grund för AI-driven kvalitetsanalys och resurseffektiv produktion samt bidrar till Industri 4.0-införande genom att hantera utmaningar kopplade till fragmenterad operativ data. För Braviz utgör modulen en kärnkomponent i den kommersiella plattformen.

3. Background

In large discrete manufacturing industries, such as automotive, a high share of operational data from machines and sensors is either unused or very hard to use for quality and defect analysis. The data is scattered across different systems and databases, lacks common identifiers, and is rarely documented with clear metadata. As a result, engineering teams spend weeks or months just to understand which data relates to which production assets, lines or inspection points before they can start meaningful analysis.

Specialist process and quality engineers often have this knowledge in their heads or in local documents. Data analysts and AI teams have to rely on many meetings, manual investigations and trial-and-error to locate and interpret relevant data. Missing metadata and poor mapping between data sources and production processes lead to delayed response to quality problems, incomplete defect analysis and difficulties in deploying automated analysis tools and AI solutions.

These challenges create bottlenecks in implementing AI-powered data analysis in defect and quality analysis, limiting the industry's ability to adopt Industry 4.0 technologies effectively. Existing solutions lack systematic approaches to data discovery and domain mapping, resulting in duplicated efforts and inconsistent data interpretation across teams.

The project addresses this gap by developing an automated methodology and tool for smart data mapping, enabling faster and more reliable quality and defect data analysis in discrete manufacturing environments. Braviz AB is a young deep-tech startup focusing on a platform that helps industrial engineers access and analyse operational data more effectively.

4. Purpose, research questions and method

Purpose

The purpose of the project was to develop and validate a methodology and software module that can identify, map and integrate key operational data assets and metadata for quality and defect data analysis in discrete manufacturing and product development. This should improve data readiness for AI-powered quality analysis and reduce the effort needed for pre-studies and domain mapping.

Research questions

The project addressed the following main questions:

- How can data units such as sensors, quality checkpoints, inspection stations and lines be represented in a structured and hierarchical way that matches how factories operate?
- Which metadata fields are needed to make quality and defect data discoverable and understandable for both domain experts and data analysts?
- How much can the time for data and domain mapping be reduced by using an automated semantic data mapping module compared with current manual practices?
- How can the mapping be integrated into the Braviz analysis platform so that AI-driven analysis can directly reuse the structure and metadata?

Method

The project followed 3 phases:

- Phase 1 - Needs Assessment: Mapped current needs and practices together with industry partners, identified pain points in data engineering workflows, and defined requirements.
- Phase 2 - Design: Designed framework and data model for systematic data mapping, developed methodology for metadata enrichment, and created visual interface concepts.
- Phase 3 - Implementation & Validation: Implemented MVP module with core functionality, tested with real industrial data, validated through workshops with AI strategists and data scientists from industry partners, and gathered feedback for refinement.

5. Objective

The objective was to develop a method and module to map operational data assets and metadata for quality and defect data analysis in the discrete manufacturing industry.

Specific Goals:

- Reduce data mapping time from weeks to minutes

- Enable visual representation of data flow and relationships
- Verify product-market fit for data mapping automation
- Establish scalable architecture for platform integration

6. Results and deliverables

The project successfully achieved its objectives and delivered the following results:

Technical Deliverables:

- MVP Smart Data Mapping Module - Functional prototype with core capabilities for data source identification, quality checkpoint mapping, and metadata enrichment
- Visual Interface Prototype - Interactive data flow diagrams as nodes and edges enabling engineers to understand data relationships quickly
- Systematic Methodology - Documented approach for mapping operational data assets and enriching metadata for AI analysis

Validation Results:

- Demonstrated time reduction from weeks to minutes for data mapping tasks
- Validated with real industrial data from industry partners
- Confirmed product-market fit through stakeholder workshops and feedback sessions
- Verified feasibility of metadata enrichment approach for enabling AI-powered analysis

Process Improvements:

- Improved quality data analysis processes through systematic data organization
- Enhanced understanding of data engineering complexity in manufacturing environments
- Established methodology for continued product development

Business Development:

- Verified early product-market fit that shapes business strategy for the Braviz platform
- Strengthened collaborations with industry partners
- Developed market entry strategy based on validation results

Progression Level:

The project progressed from Hypothesis testing and verification of key functionality to Demo in limited environment, demonstrating significant advancement in technical maturity and market readiness.

7. Dissemination and publications

7.1. Dissemination

How are the project results planned to be used and disseminated?	Mark with X	Comment
Increase knowledge in the field	X	The methodology and lessons learned are shared within Braviz, CampX by Volvo Group and with participating engineers to raise understanding of smart data mapping.
Be passed on to other advanced technological development projects		
Be passed on to product development projects	X	The MVP is being productised as a standard module in the Braviz platform, with further engineering and hardening outside this project.
Introduced on the market	X	Foundations established for commercial product development and market entry
Used in investigations / regulatory / licensing / political decisions		

No foreseen links to internal/external projects requiring accelerated introduction at this stage.

7.2. Publications

The main outcomes have been captured in internal technical notes and presentations to industrial partners. No formal scientific publication has yet been submitted, but results form the basis for further work to be presented in industry-focused whitepapers and potentially peer-reviewed venues.

8. Conclusions and future research

Key Conclusions:

- The project successfully validated the need for smart automated data mapping in discrete manufacturing and product engineering and demonstrated the feasibility.
- Metadata enrichment is critical for enabling AI-powered quality and defect analysis
- Visual representation of data relationships significantly improves understanding for engineering teams
- Systematic data organization achieves substantial time savings (weeks to minutes) and process improvements
- Early product-market fit validation confirms commercial viability and guides business strategy

In the long term, the results enable faster and more reliable data analysis for quality and defect analysis in manufacturing and product development. The data mapping module

becomes a foundation for data-driven domain and entity discovery, AI-powered data analysis, and offers insights to move towards more resource-efficient production. For Braviz, it is a core component in the platform and contributes to Industry 4.0 adoption by solving fragmented operational data challenges.

Future Development:

- Validate results using extended pilots and field trials
- Integrate learnings into more advanced development
- Expand product feature and functionality based on stakeholder feedback
- Prepare for broader market introduction

The project results provide a solid foundation for Braviz's continued product development and market entry strategy, with clear next steps identified for advancing from MVP to commercial product.

Financing Status: Follow-up project financing is being explored through multiple channels, with final decisions pending.

9. Participating parties and contact persons

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Other contributors:

- Domain experts and advisors from CampX by Volvo Group, and digitalization specialists from affiliated organizations.
- Industrial partners engaged for pilot implementation and requirements discovery