Measurement 4 Management

Project end report

November 2024

Project Number RVO and/or ISPT(-TKI)	I40-20-07
Project Title + Acronym	Measurement 4 Management (M4M)
Secretary (penvoerder)	ISPT
Name Program support	Antonie de Haas
Name project leader	Jeroen Jansen
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Project start	1-9-2020
Project original end date	30-9-2024
Project final end date	30-9-2024

KPI	Omschrijving
1. **Organisatie/ Penvoerder**	ISPT
2. **Projectnummer- of dossiernummer**	I40-20-07
3. **Projecttitel evt. acronym**	Measurement 4 Management (M4M)
4. **TRL bij afsluiting, Hoofdcategorie**	Industrieel onderzoek
5. **TRL bij afsluiting, Detailcategorie**	4 (ondergrens, sommige cases zijn verder)
6. **Projectsucces**	1. Het project is afgerond conform de oorspronkelijk scope. Alle mijlpalen zijn behaald;
7. **Vervolg**	Vervolgonderzoek (EBI, F2F, Carefree Models)
8. **Aantal gerealiseerde peer-reviewed publicaties**	21
9. **Aantal verwachte peer-reviewed publicaties**	7
10. **Aantal gerealiseerde niet-peer-reviewed publicaties**	-
11. **Aantal aangevraagde patenten**	0
12. **Aantal verleende licenties**	0
13. **Aantal prototypes**	7, zie case study d, e, f, g, h, i and j.
14. **Aantal demonstrators**	Aantal ontwikkelde demonstrators + korte toelichting per demonstrator
15. **Aantal spin-offs/ spin-outs**	0

KPI	Omschrijving
16. Aantal nieuwe of verbeterde producten/ processen/ diensten geïntroduceerd	1
17. Impact	The M4M project has significantly advanced the TKI Energy and Industry mission goals by demonstrating that data-driven process control, when integrated with expert process knowledge, can optimize energy and raw material use across multiple value dimensions (SQDCME). Its findings underline the necessity of an integrated approach to digital innovation, creating a foundation for sustainable, CO_2-free industrial processes and informing future collaborative projects in the ISPT portfolio.

Public summary

The process industry faces increasing technological demands driven by global competition and a growing need for quality and environmental transparency across the value chain. Data, ranging from feedstock analyses to product quality control, plays a crucial role in this sector. The advent of Industry 4.0 has significantly enhanced data usage, evolving into Industry 5.0, which integrates AI with the expertise of operational and engineering professionals to improve decision-making.

Key developments in this landscape focus on quality improvement as a critical endpoint. Continuous Improvement highlights the necessity of six endpoints for achieving Process Excellence: Safety, Quality, Delivery, Cost, Morale/Maintenance, and Environment.

The M4M project has aimed to elevate Industry 4.0 to a mature concept for sustainable industrial practices through three main avenues:

1. **Enhancing data extraction:** Improving the extraction of chemical and engineering information from process data, transforming Artificial Intelligence into Real, Physical Intelligence.

2. **Broadening performance evaluation:** Expanding process performance evaluation beyond quality to include a comprehensive set of Key Performance Indicators, enabling informed decision-making for process value generation.

3. **Integrating process experts:** Co-creating informed digital solutions by incorporating process experts into the decision-making loop to leverage their knowledge.

The M4M consortium consisted of three academic research groups specializing in chemical data science, environmental sciences, and educational sciences, collaborating with nine key industrial stakeholders, each contributing valuable case studies.

Project outcomes include digital innovations that enhance process resilience and create value propositions aligned with SQDCME dimensions. This collaboration has fostered a systematic approach to AI in industry, ensuring that it meets the demands and strengths of process owners while addressing industrial challenges.

Notable results of the M4M project include:

- A method for predicting yarn properties through a strategic combination of process spectroscopy and parameter measurements, enhancing data interpretation.

- A model that provides transparency between Quality, Cost, and Environmental impact, facilitating effective Quality Control and Environmental Impact management.

- A qualitative interview tool to evaluate the onboarding challenges of Industry 4.0, supported by case studies that illustrate the interaction between process experts and model development.

Overall, the M4M project has delivered a social and digital toolbox that significantly enhances the sustainability potential of the Dutch process industry.