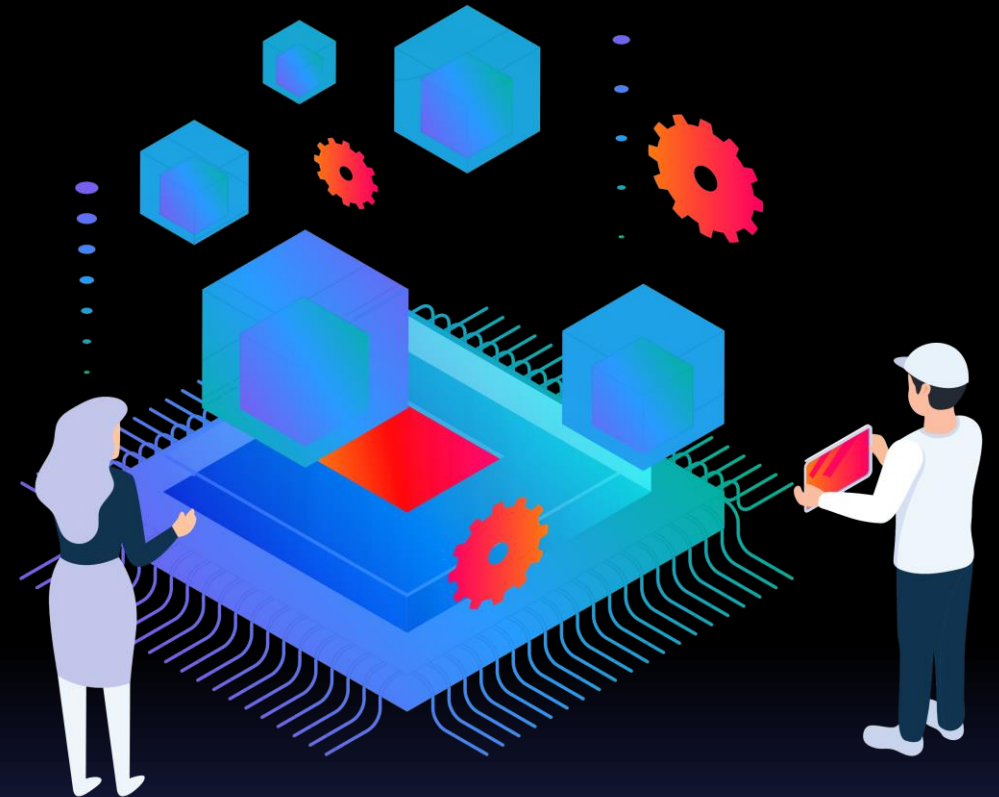


teaming.ai

This project receives funding in the European Commission's Horizon 2020 Research Programme under Grant Agreement Number 957402

Facts & Figures



15

partners



8

countries



5,7M €

EU Funding



36 Months

2021-2023

What's our vision?

**Human-AI Teaming
Platform for Maintaining
and Evolving AI Systems
in Manufacturing**

Limited possibilities

Overcome the lack of flexibility as a limiting factor of Industry 4.0

Societal dimension

Ensure the role of the human being in the future industrial scenario by means of a human-centered AI collaboration

Human-AI teaming to close the gap between



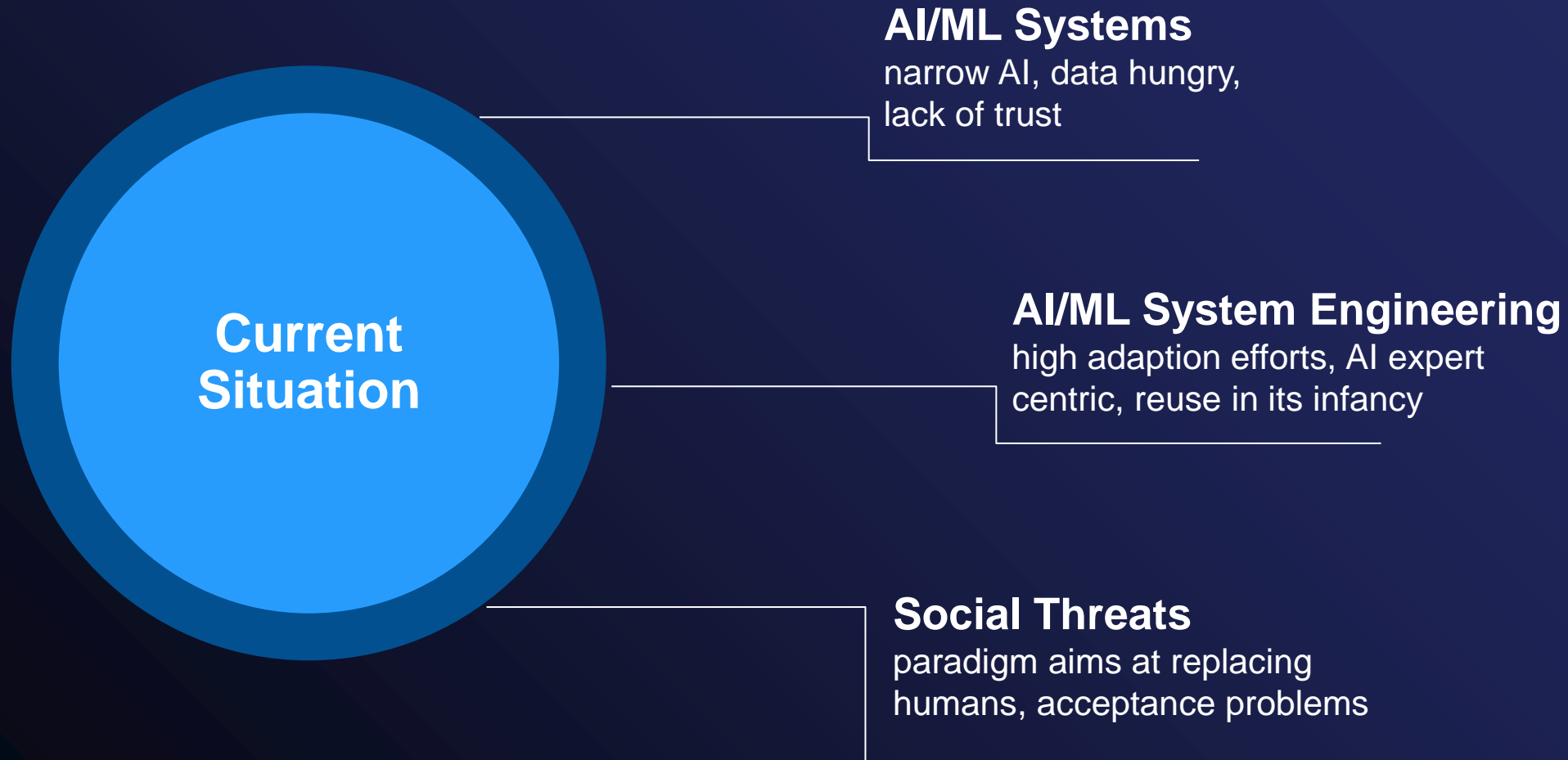
Current
Situation

The diagram consists of two large circles. The left circle is light blue with a darker blue border and contains the text 'Current Situation'. The right circle is light purple with a darker purple border and contains the text 'Future Challenges'. Between the two circles is the text '..and..'. A horizontal line is positioned above the circles.

..and..

Future
Challenges

Human-AI teaming to close the gap between



Human-AI teaming to close the gap between

Trend by Industry 4.0

Personalisation, small lot sizes, high quality

Engineering Challenge

compensate for the lack of reuse of workflows, General AI reuse of data & models

Human Centered AI

human in control, technological implantation of human-centered paradigm (Industry 5.0)

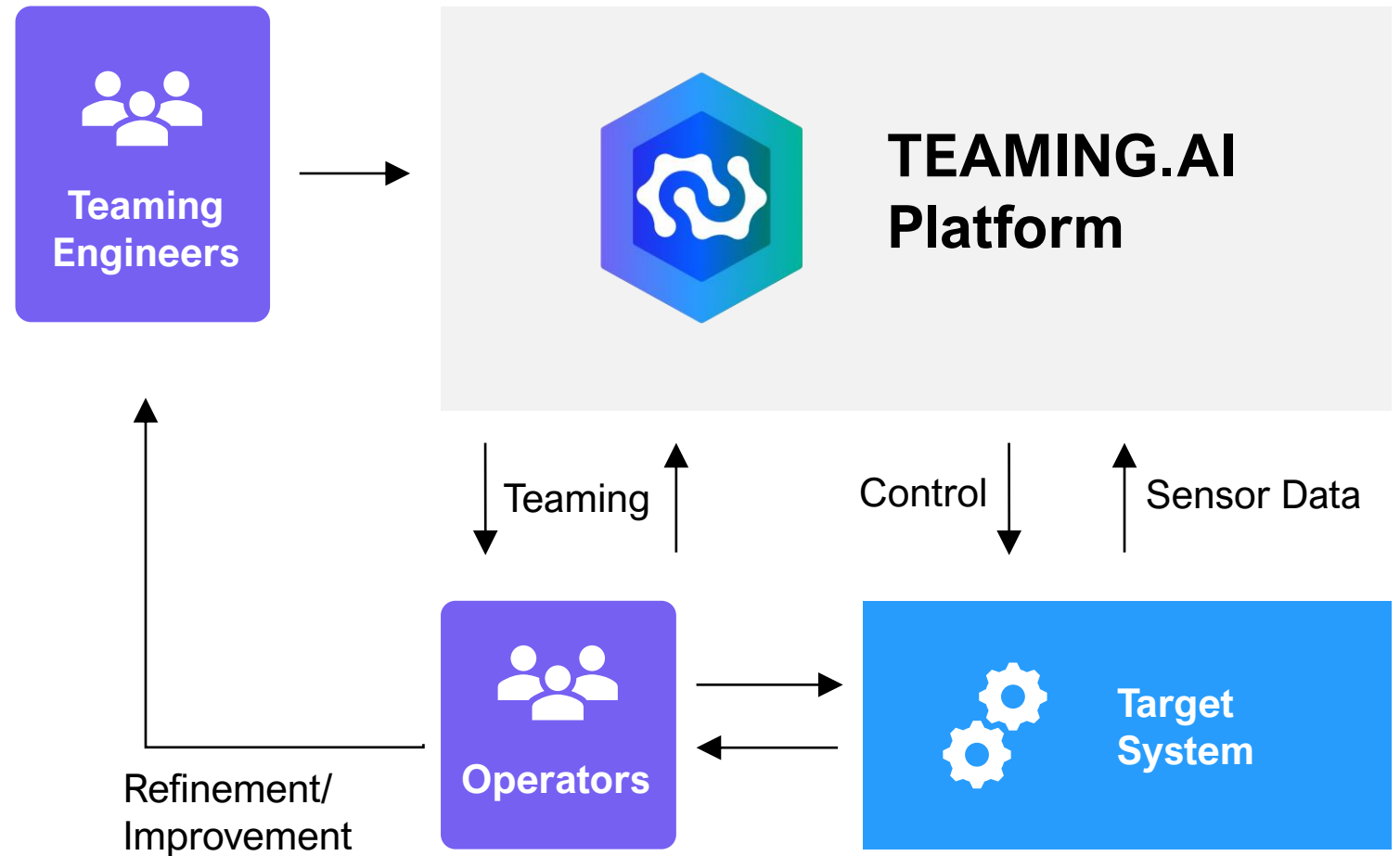


Future Challenges

First Results on the
**Modelling of
Teaming Intelligence**

TEAMING.AI Platform Overview

Designed as an add on to an existing production system in order to support knowledge-based reasoning and collaborative problem solving.



Collaborative Problem Solving

Static Knowledge



Dynamics



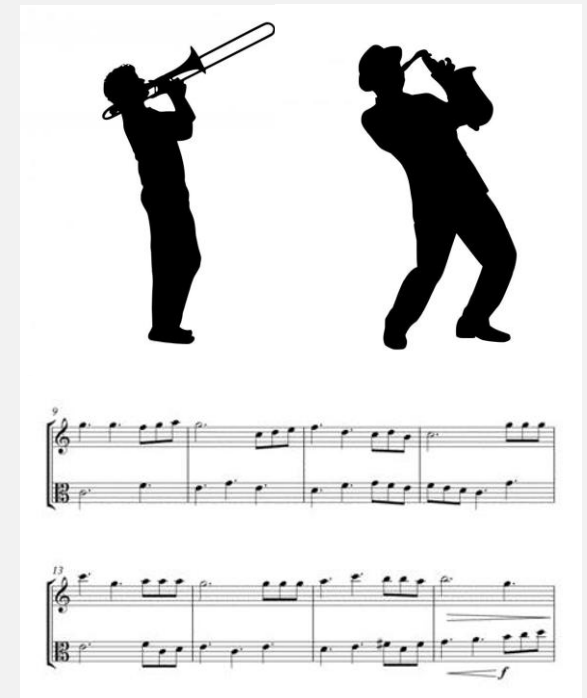
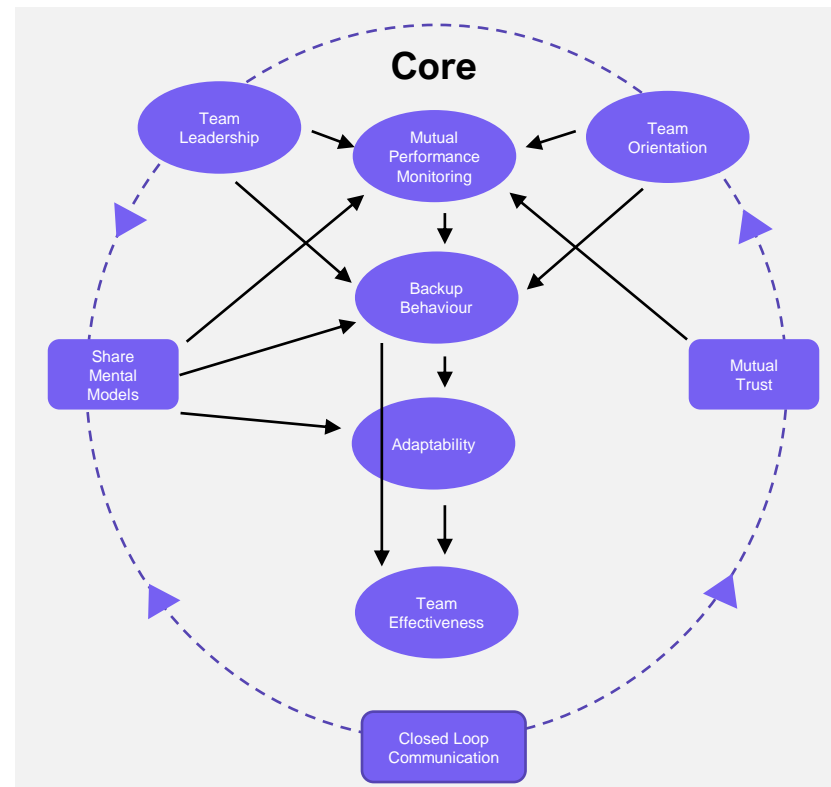
Action

Roles

Skills

Interdependences

Processes



Interdependency Analysis of Teamwork

Performer / Supporter
role assignment for
team activities



Activity		Human Team			Tools	Teaming.AI Platform		
		Operator Role 1	Operator Role 2	Operator Role 3	Machine	Decision Support	Runtime	Diagnostics
Activity 1				P				S
Activity 2					P			
Activity 3			P			S		
	Sub-Activity 3.1			P				S
	Sub-Activity 3.1			P				S
Activity 3							P	

Role P...Performer, S...Supporter

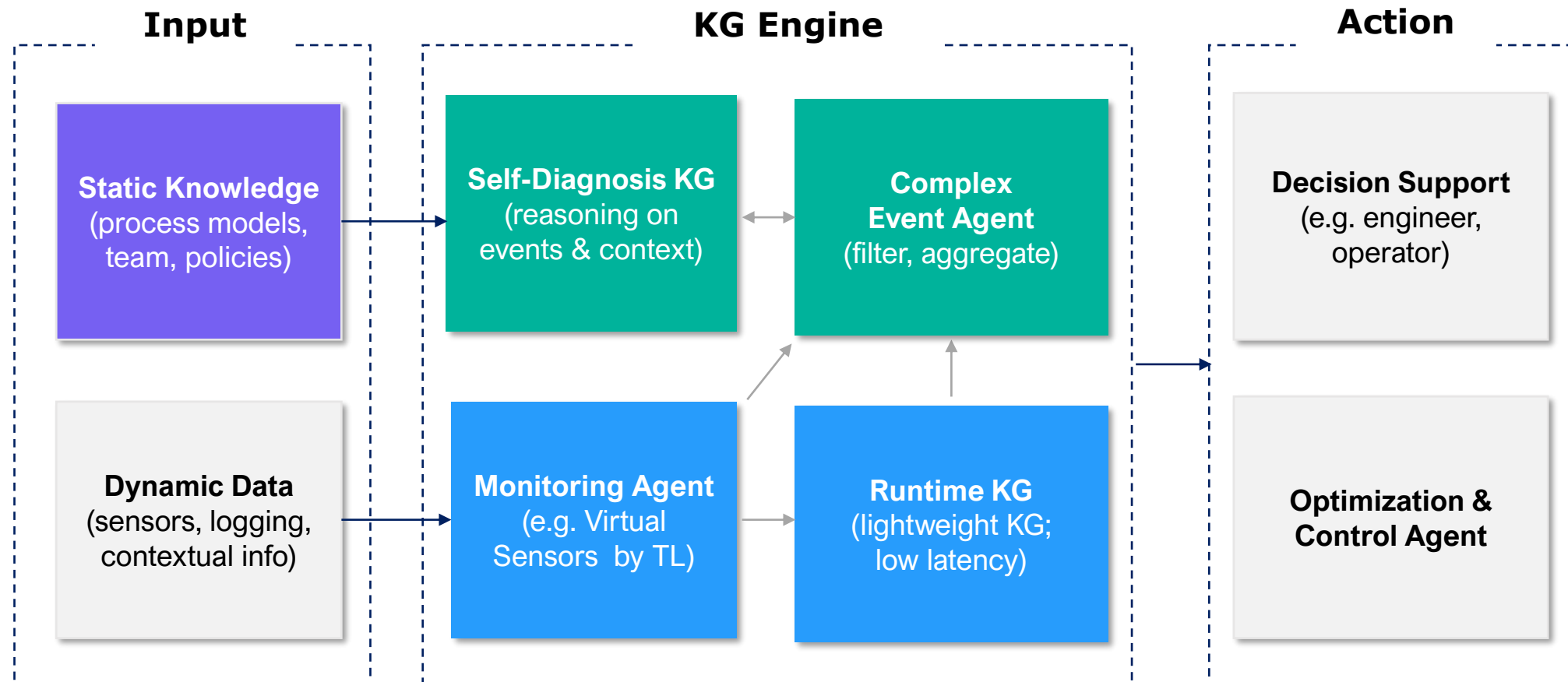
↔ Policy-dependent role assignment (P/S)

□ Policy-dependent activity execution

} Teaming Model

Knowledge Graph Dynamics

Low latency vs knowledge granularity



Knowledge-based Reasoning

Decision support and knowledge management system for repetitive manufacturing processes



Design process

Teaming Model

Activities
Policies
Events

Runtime process

Teaming Engine

dynamic KG

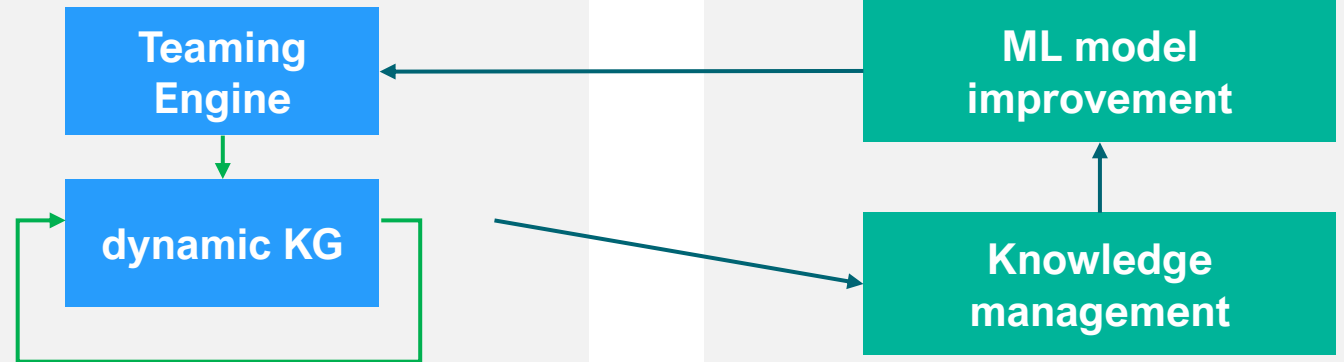
Traces,
Decisions,
Context

Teaming process

ML model improvement

Knowledge management

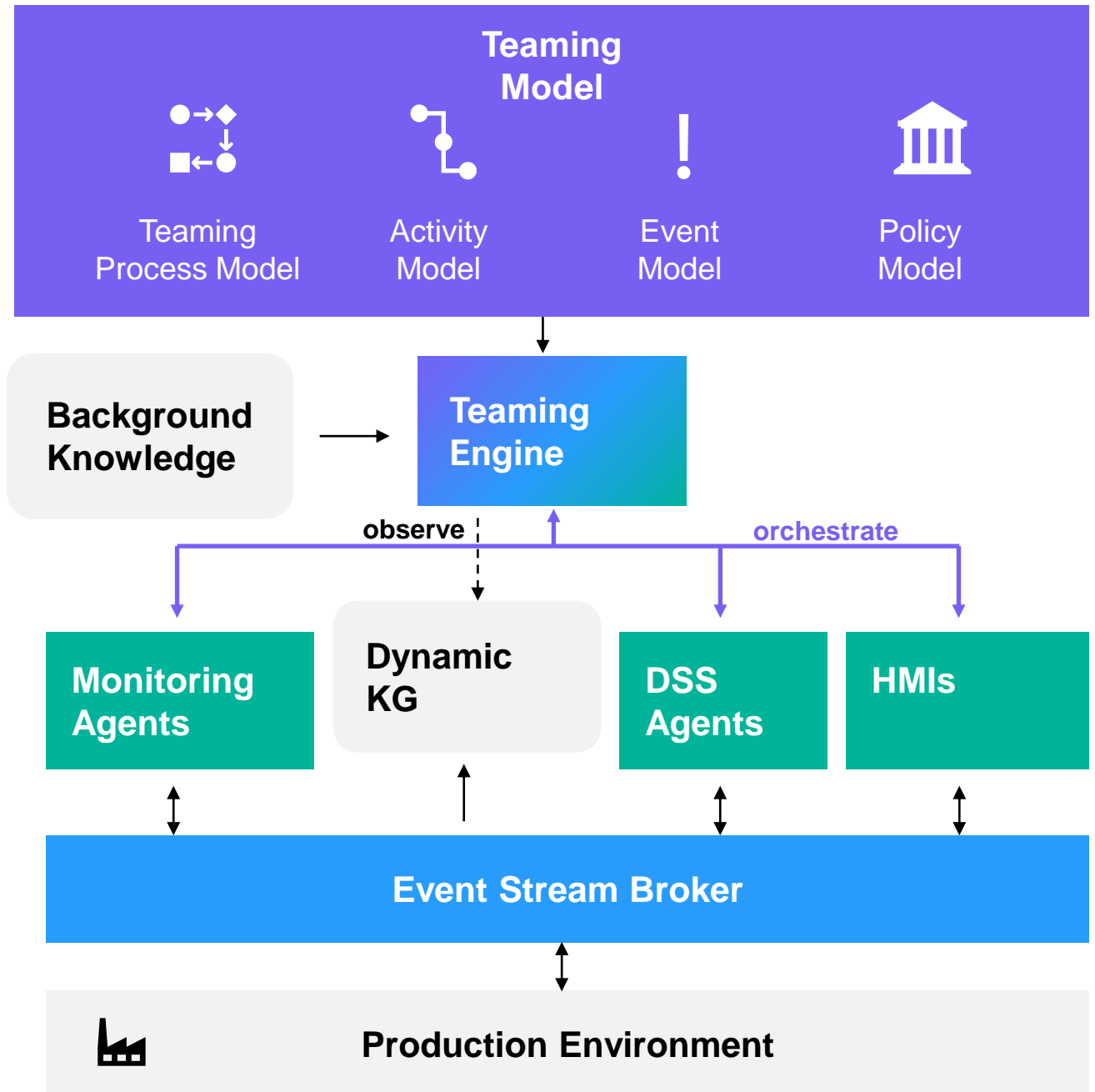
Models,
Workflows,
Audits



TEAMING.AI Architecture Details

- The **Dynamic KG** acts as a single integrated data store.
- It captures a **digital semantic shadow** of the production system for all software components.

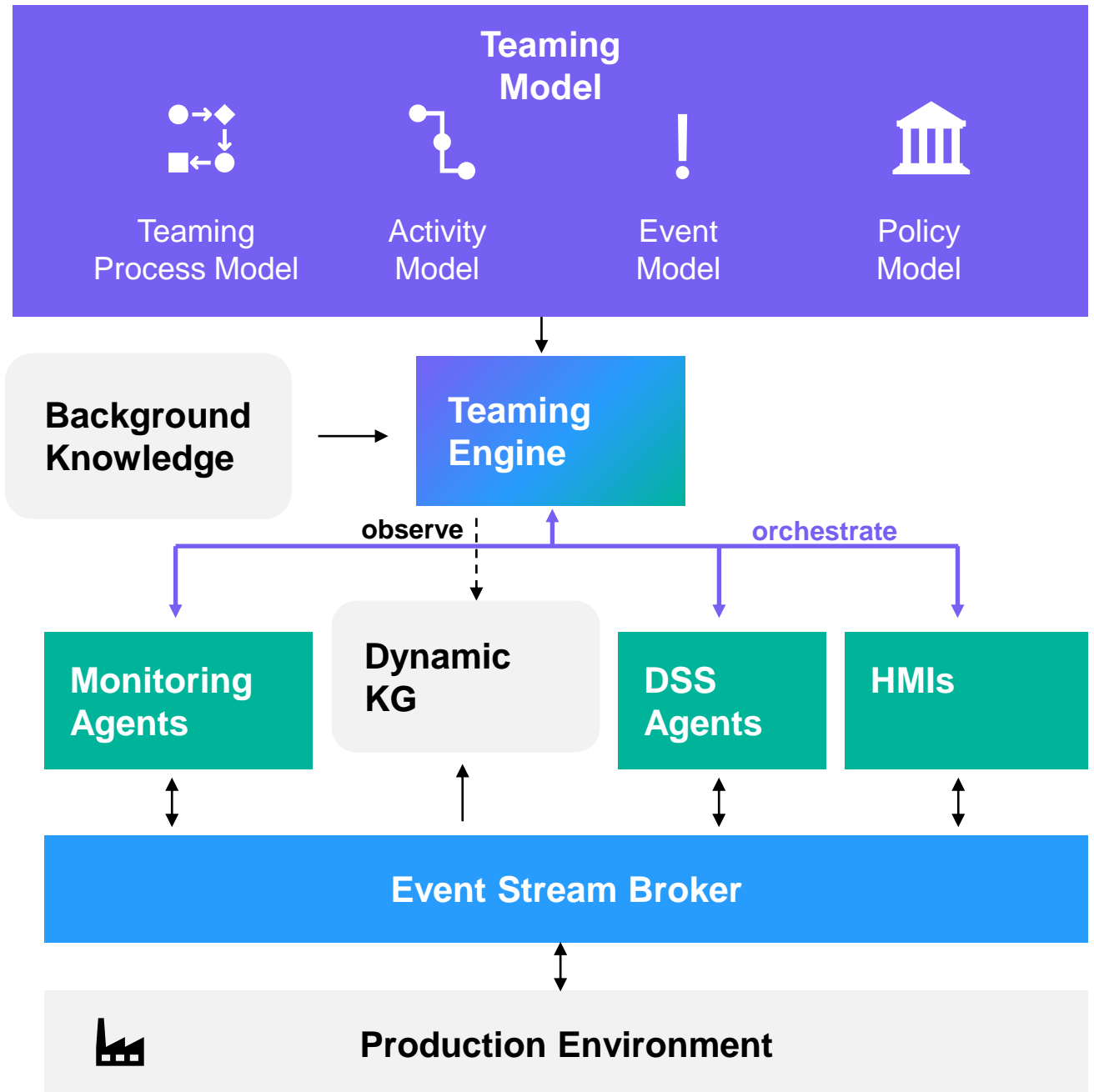
Haindl et al. "Towards a Reference Software Architecture for Human-AI Teaming in Smart Manufacturing, International Conference on Software Engineering (ICSE), 2022, accepted for publication



TEAMING.AI Architecture Details

- The **Teaming Engine** makes informed decisions at runtime about the behavior of the system.
- It is responsible for enacting the **Teaming Model** for activity automation.


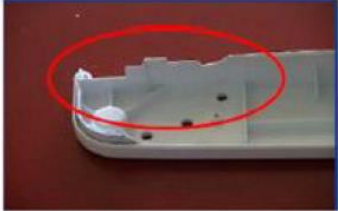


Haindl et al. "Towards a Reference Software Architecture for Human-AI Teaming in Smart Manufacturing." *arXiv preprint arXiv:2201.04876* (2022).





The three TEAMING.AI Use Cases

Use Cases

1

<p>Sinkmark</p> 	<p>Short shot</p> 
<p>Silver line</p> 	<p>Cold material mark</p> 

Quality Inspection
Transfer learning based robust **quality inspection** (for plastic injection sector)

  Turkey

2





Use Cases

2



Machine diagnostics

Machine diagnostics for plastic injection sector to improve quality and reduce waste

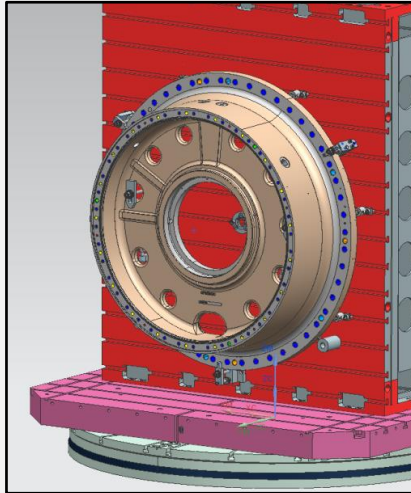


3



Use Cases

3



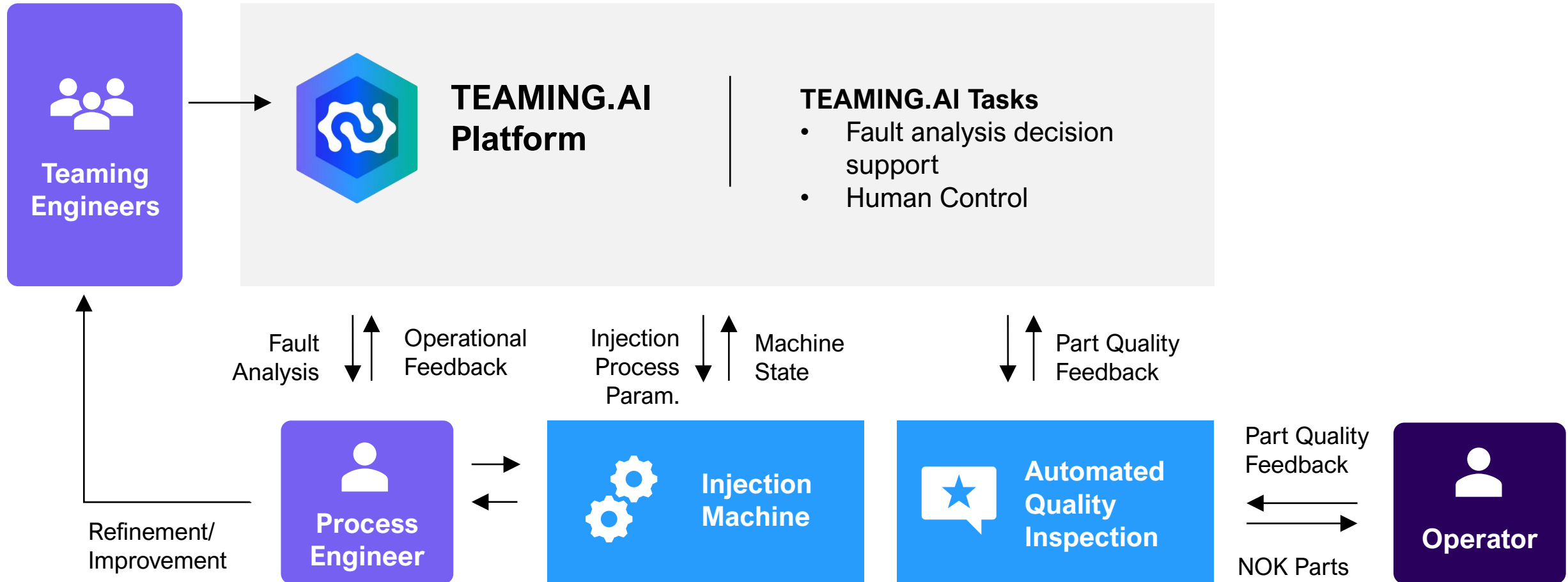
**Ergonomic
risk prevention**

**Ergonomics and risk
prevention in large part
manufacturing**



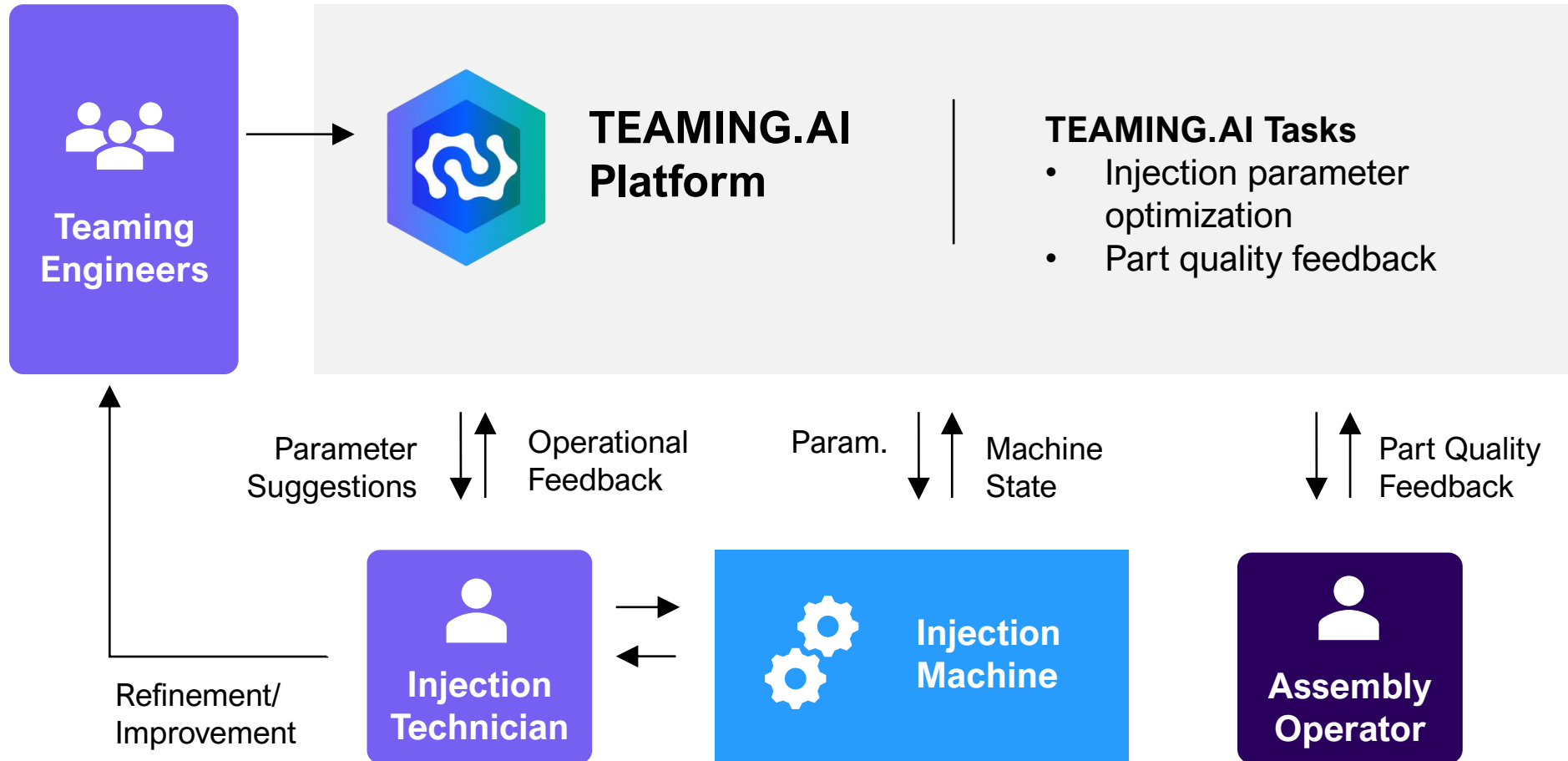
Use Case 1 Quality Inspection

Goal: Automation of a vision based quality inspection tool that can be improved through the operators feedback.



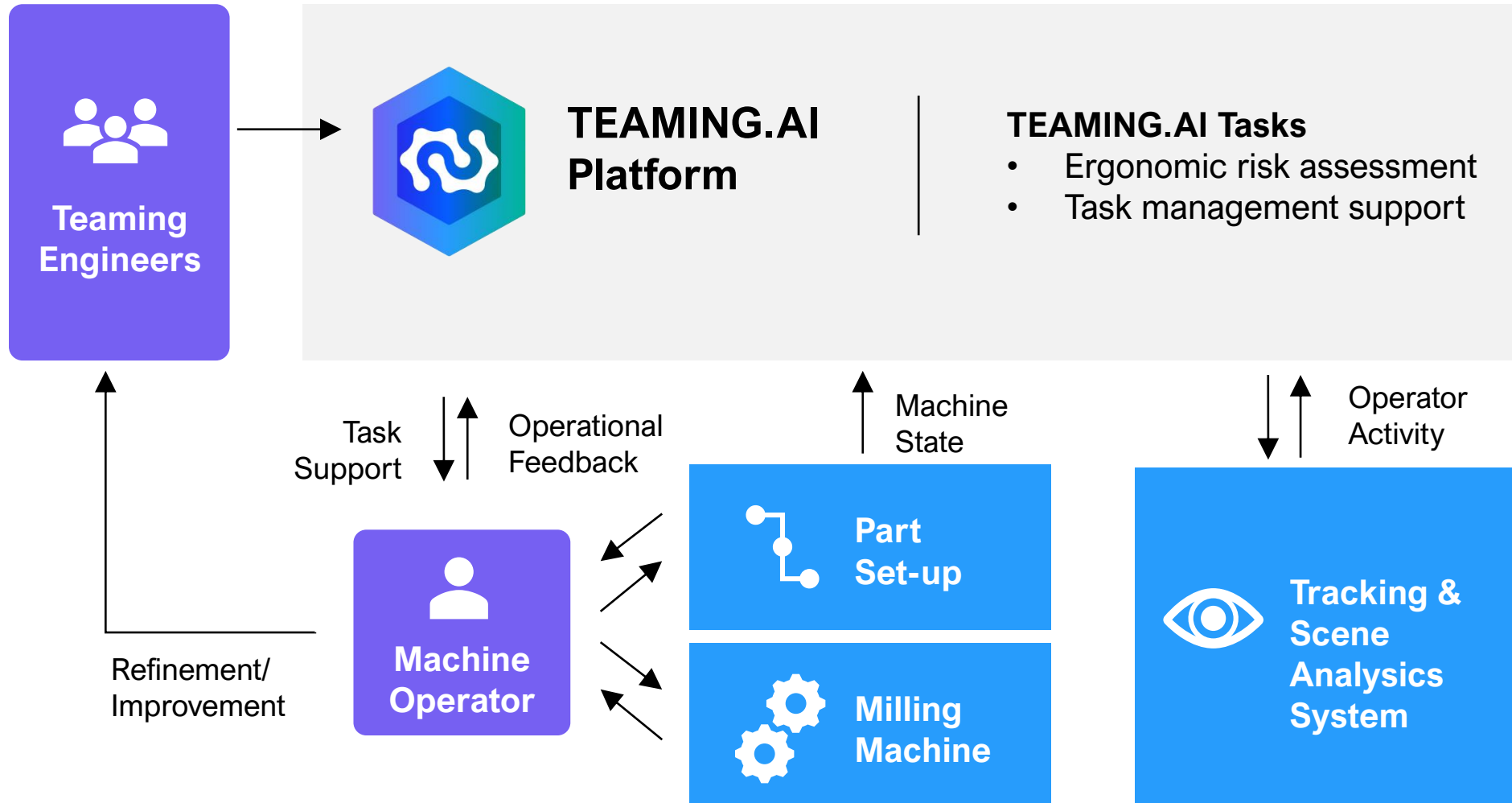
Use Case 2 Machine Diagnostics

Goal: Self-adjustment of process quality parameters based on process diagnostics and operator feedback.



Use Case 3 Ergonomic risk prevention

Goal: To assess the ergonomic risk and to predict which sequences of actions are ergonomically favorable.



Summary

A New Paradigm of Human AI Collaboration

A New Paradigm for KG Dynamics enabling



Auditable Ethics

The adoption of the **ethical principle** of human autonomy by design

An auditable **model of trust** in human-AI interactions based on committed roles and process models



Agile Development

Self-organizing and cross-functional teams of human agents and AI components

Novel software platform for **agile AI system engineering and operation**



Operational Performance

Eased development and operation by **enriched representations** of processable knowledge

Advanced data analytics and optimization in **dynamic manufacturing environments**

Expected Impacts



Certifiable AI for human autonomy



Improved adoption and acceptance of AI



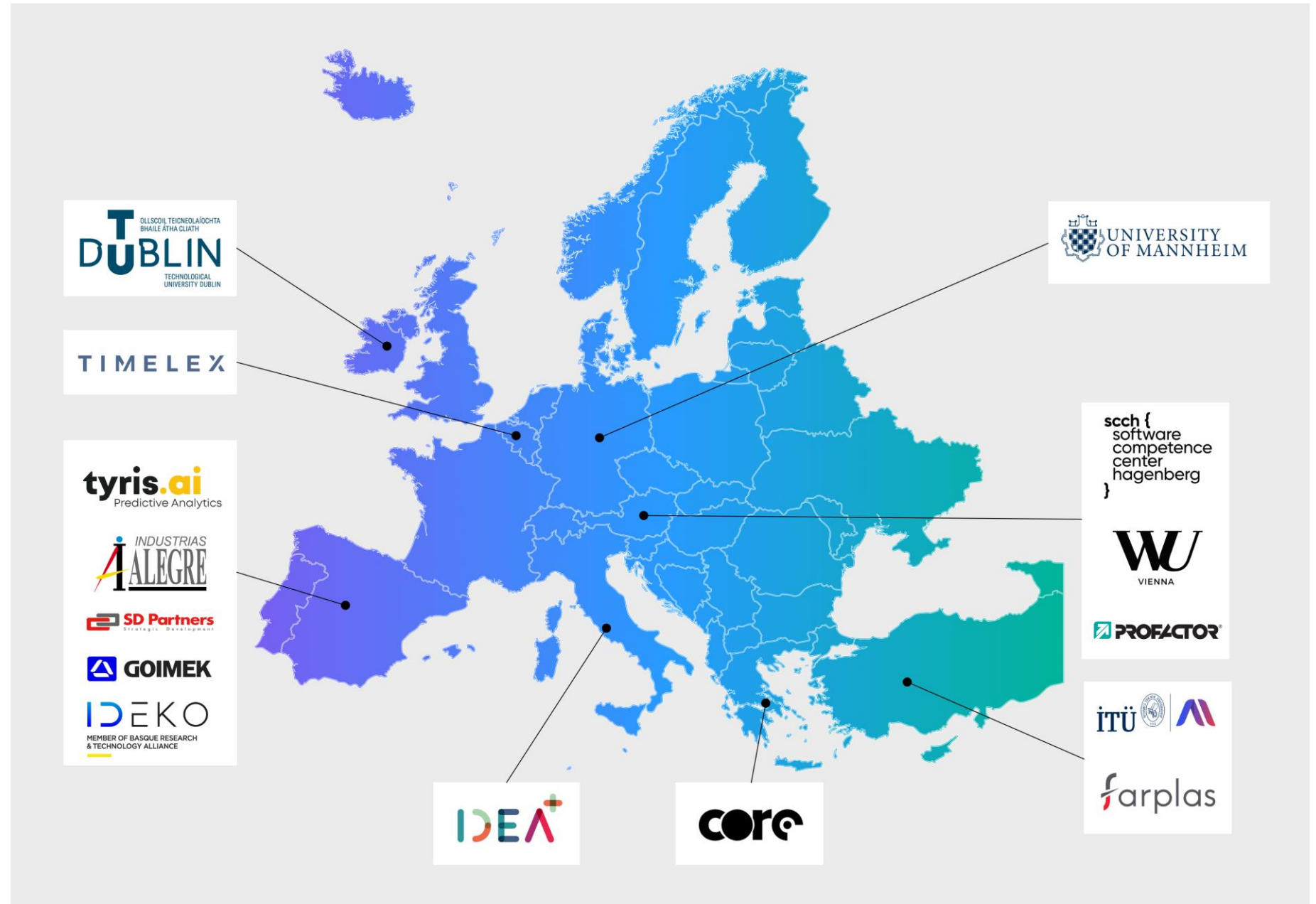
Reduced setup time and maintenance cost



More flexible production processes



Who
we are



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