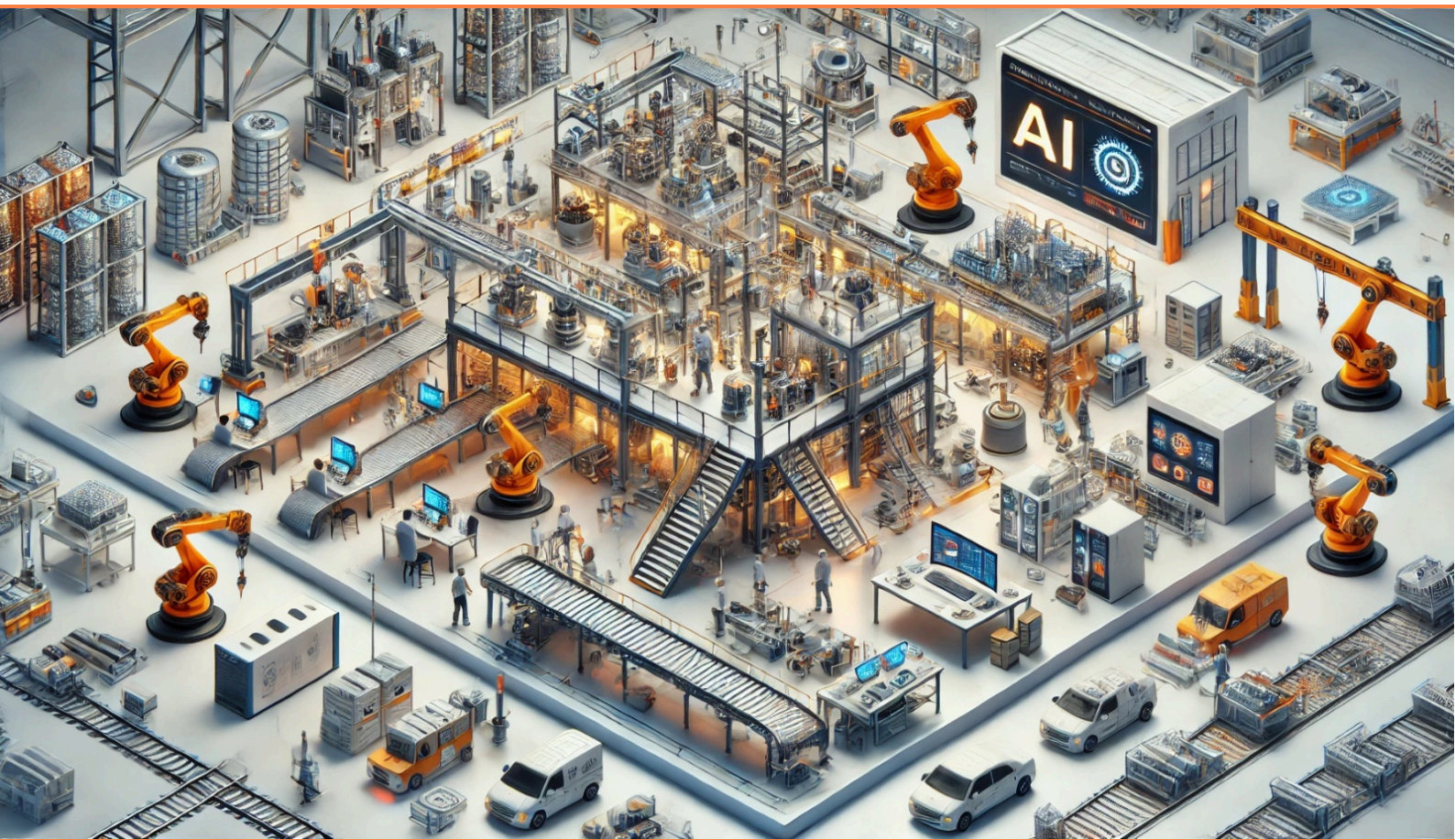


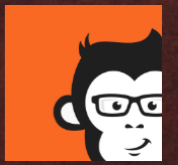


Artificial Intelligence

AI in Manufacturing is now

Unlocking Equipment Productivity with oee.ai





”

The future is already there.
It's just not evenly distributed.
— William Gibson

The manufacturing industry will undergo a seismic transformation, driven by rapid advancements in artificial intelligence (AI) technologies. As cost pressure is omnipresent, customer demands become more dynamic, and resources are scarce, manufacturers are seeking innovative solutions to optimize production and boost operational efficiency. AI, once a futuristic concept, is now at the forefront of this transformation, enabling smart factories and revolutionizing traditional manufacturing processes.

Forward-thinking manufacturers are leveraging AI-powered systems to enhance decision-making, improve productivity, and create a more agile, data-driven production environment. Those who embrace these innovations will be well-positioned to navigate the challenges of modern manufacturing and maintain a competitive edge in an ever-changing landscape.

oee.ai was founded as an AI-first company. In this whitepaper, we will explore the current state of AI inside oee.ai along four supported use cases. Whether you're a plant manager, an operations executive, or a decision-maker looking to future-proof your manufacturing processes, understanding AI's role in this digital era is crucial for staying ahead of the curve.

The whitepaper is structured in three horizons: The Now horizon is available in oee.ai as of 2024. The Next horizon is scheduled for development in 2025. The Beyond horizon sheds a light on our product vision.

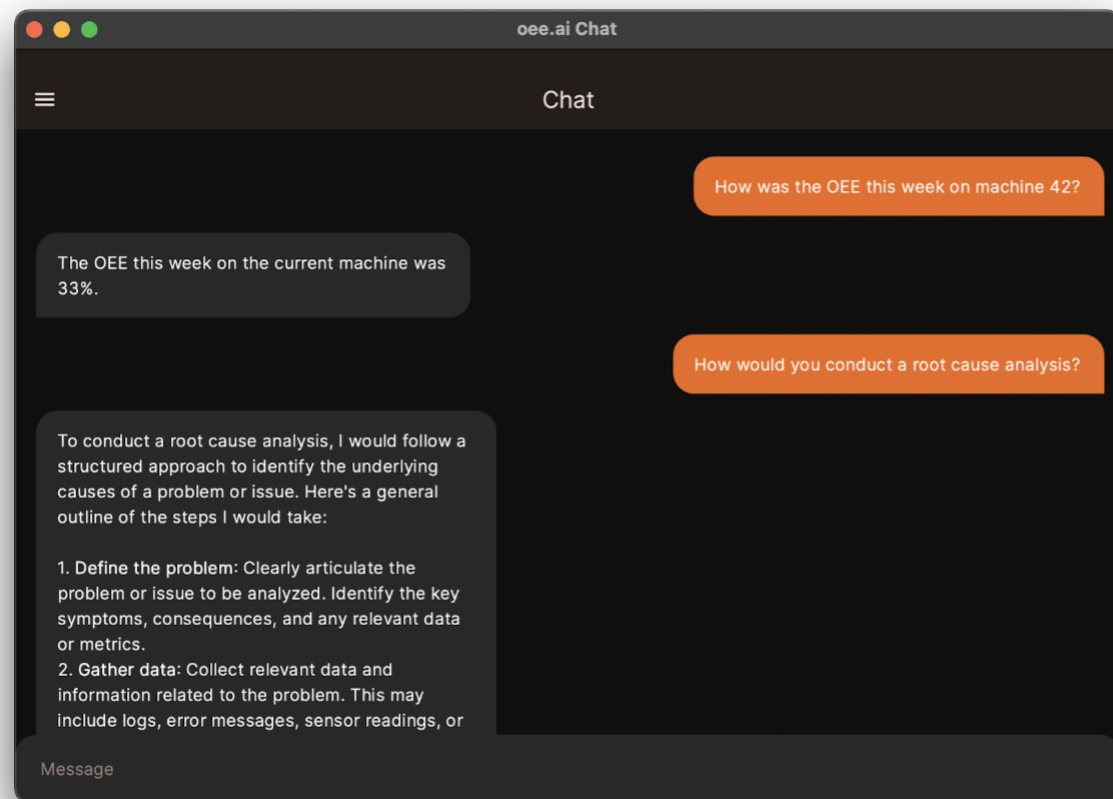


Chat Interface to your Machine

Oee.ai offers a chat interface that provides quick access to machine data and insights on specific machine topics. This intuitive tool complements the detailed, standardized reports available on the oee.ai web frontend, offering a low-barrier way to interact with analytics.

Users can engage with the chat via text or using their device's voice interface. Beyond the web app, oee.ai's chat feature is also available as a native app for both iOS and Android.

A typical query might be, "How was the productivity of the Alpha line during yesterday's late shift?" or "What was the main cause of lost time on the Beta line last week?" Questions can be asked in the user's native language, and the AI will respond in the same language for a seamless experience.



oee.ai utilizes both AI and generative AI, with the latter powered by a Large Language Model (LLM). Given the rapid pace of technological advancement, a flexible tech stack is essential. oee.ai implements the latest instruct versions of cutting-edge, open-source models with up to 80 billion parameters. All AI systems run on oee.ai's secure infrastructure and are developed in-house.

Professional Advisory

In addition to providing access to machine data, oee.ai's AI is equipped with best-practice manufacturing knowledge, covering a wide range of methodologies and tools, such as Lean Manufacturing. This expertise allows the AI to respond to questions like, "How do I perform a root cause analysis?" or "What is the best methodology to reduce changeover time?" by offering detailed, step-by-step guidance.

This feature acts like a highly experienced consultant available 24/7—wi-

thout any additional professional service fees.

Moreover, the AI has access to oee.ai's comprehensive manual, called the Guide, enabling it to answer questions about the platform's functions and configurations as well.

Who is Saru?

Saru is the name of oee.ai's AI, inspired by the Japanese word for monkey. The reference to Japan connects to the origins of lean management, while the monkey, which curiously explores machine data, is also featured in oee.ai's logo.

Root Cause Problem Solving

The root cause problem-solving feature of oee.ai supports the need for structured knowledge management on the shopfloor. In addition to identifying loss reasons, oee.ai can also collect the associated causes and solutions. This information can be entered by the operator after resolving the issue or by a maintenance technician later in the day.

Once enough entries are gathered, the AI will generate a root cause problem-

solving guide. This guide will appear as a pop-up on the operator's tablet the next time the same loss occurs, providing a step-by-step checklist for resolving the issue. This feature helps reduce Mean Time to Repair (MTTR), allowing even less experienced team members to benefit from the accumulated knowledge, presented right when they need it.

Anomaly Detection and Awareness

In the context of productivity, "anomalies" refer to unusual productivity losses. For example, a loss that typically occurs once every four hours but happens three times in a single hour, or a loss that usually lasts 20 minutes but has now extended to 25 minutes, would be considered anomalies. These types of events signal the need for a shift leader's attention, who may be able to assist the operator in resolving the issue.

Machine learning plays a crucial role here by dynamically setting and adjusting the intervention limits. These limits are continuously updated by the AI to avoid becoming outdated, unlike traditional static master data. This ensures that only the most critical issues are flagged, helping the shift leader focus on what matters without being overwhelmed by excessive notifications.



oee.ai's Manifesto

"We believe in a future of industrial manufacturing where...

- Transparency, data, and analytics are the keys to more efficient, flexible, and sustainable production processes. We envision a world where every company can monitor, analyze, and optimize its productivity in real-time, globally, to make the best use of resources and eliminate waste.
- People and machines work together, with artificial intelligence and automation serving as an extension of human labor. Machines support humans, and this collaboration leads to higher productivity, better quality standards, and improved working conditions.
- Production facilities are intelligent and self-learning. By leveraging cutting-edge technologies like Artificial Intelligence and Big Data, manufacturing plants will autonomously detect patterns, make predictions, and proactively initiate processes to improve productivity.
- Innovation and agility drive competitiveness. Companies will be able to quickly adapt to changing market demands and introduce new products more efficiently and rapidly, resulting in a more sustainable and competitive industrial environment.
- Data barriers are broken, and the real-time exchange of data between specialized systems forms the foundation for a connected and robust Manufacturing Execution IT. Such openness between systems and providers drives innovation and efficiency forward.
- Sustainability is not a compromise but a given. By consciously managing resources and continuously optimizing production, environmental impact is minimized, and the ecological footprint of manufacturing is reduced.
- Every production process is utilized to its fullest potential. With the right tools and data, every machine, every minute, and every material in manufacturing will realize its full value, leading to a world where waste is a thing of the past, and efficiency is the standard.

This is our vision of Industry 4.0 – a future driven by transparency, technology, and collaboration, where together we create positive change."

Next

The team behind oee.ai is committed to continuous innovation and constantly enhances its AI to stay ahead of industry trends, delivering cutting-edge solutions for manufacturing excellence. This is why the "Next" horizon is only a glimpse in the future of progressive manufacturing intelligence.

Our customer success and consulting teams spend significant time working directly with clients on the shopfloor. Two frequently discussed topics are worth highlighting for the purpose of this document.

First, many manufacturing organizations face challenges in replicating a successful product run immediately after a changeover. This is often due to a lack of standardized equipment parameters for the ramp-up process – a practice known as center-lining in industries like FMCG. With oee.ai, these parameters can be

captured from both the equipment and the operator, while algorithms evaluate the quality of the ramp-up. Based on these insights, oee.ai will propose the optimal configuration for equipment settings.

Another crucial topic is the growing emphasis on energy savings, which will become even more important in the future. oee.ai is being enhanced with energy consumption monitoring capabilities. By analyzing this data alongside existing operational metrics, the AI can suggest, for example, whether shutting down equipment during a standstill is more energy-efficient than running it idle.

Just two of several use cases on the near horizon. Stay tuned.

AI is a hot topic in C-level discussions right now, and we've dedicated this paper to exploring it in depth. Beyond advanced AI capabilities, oee.ai is driving innovation in other areas as well. For instance, oee.ai calculates precise parameters for Advanced Planning and Scheduling (APS) systems, enabling more accurate planning. With this data, APS systems can better estimate changeover times or work order runtimes, allowing for planning optimal sequencing and precise delivery dates.

In addition, oee.ai provides context-sensitive operational standards directly to front-line workers. For example, if an equipment wasn't running over the weekend, oee.ai offers automatically a step-by-step sequence to restart operations. Or, if 10,000 units have been produced, it prompts workers to check the alignment of the valves. While this feature isn't AI-driven, it's highly effective in nudging shopfloor teams to perform tasks and reducing the mental burden on operators and supervisors.

Another innovation we're excited to highlight are our gamification features. The benefits of gamification are well-established outside of manufacturing, but until now, they haven't been fully utilized in this sector. oee.ai brings gamification to manufacturing by turning tasks like loss reason entry into engaging challenges for operators.

This not only makes the task more enjoyable for workers but also improves data quality, allowing oee.ai's algorithms to deliver more accurate predictions.



Beyond

At oee.ai, we firmly believe in the transformative potential of AI in productivity management for machines – a discipline we call manufacturing intelligence. Our vision is to redefine how manufacturing systems operate by harnessing the power of artificial intelligence to make factories smarter, more efficient, and more adaptable to the complexities of modern production environments. By seamlessly integrating AI into the manufacturing process, we aim to unlock unprecedented levels of efficiency, precision, and insight across entire production lines.

issues before they occur and suggest real-time improvements. Finally, the human operator remains a critical component of the system, empowered by AI-driven insights to make better, faster, and more informed decisions on the shopfloor.

By innovating around these pillars, we are creating an ecosystem where machines communicate in real-time, data becomes an intelligent decision-making tool, and operators are supported by cutting-edge technology to perform at their best. This holistic approach not only drives productivity but also creates a more agile and resilient manufacturing environment, positioning companies to thrive in an increasingly competitive global landscape. Our commitment to pushing the boundaries of manufacturing intelligence will continue to fuel our efforts as we lead the way toward the future of smart manufacturing.

Our innovation is guided by three core pillars of equipment-based manufacturing: the machine, the data, and the human operator. The machine represents the physical heart of the production process, and through AI, we optimize its performance, minimize downtime, and enhance its overall efficiency. The data, which serves as the foundation for actionable insights, is continuously analyzed and refined by our algorithms to predict

#Thought_Leadership



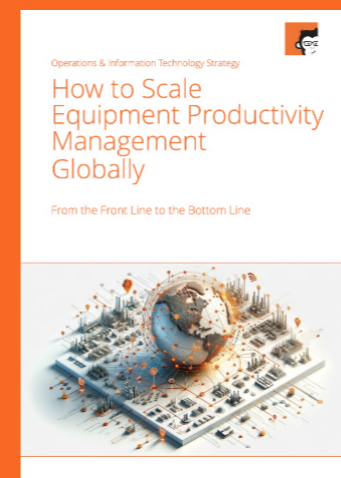
Joern was guest in The Industrial AI Podcast and talked about oee.ai's status and experience deploying META's open source large language model Llama in analyzing OEE. Check it out here <https://aipod.de/272-oee-and-llama/> or at any podcast catcher of your choice.

#Thought_Leadership



The whitepaper outlines nine essential building blocks for manufacturing transformation, emphasizing real-time analytics, leadership transformation, and continuous operational improvement. It highlights the importance of data-driven management and equipment connectivity for real-time decision-making and productivity enhancement. The paper also advocates for adopting specialized apps to drive innovation and improve efficiency. Ultimately, it stresses the need for technology and leadership to work together in optimizing manufacturing processes.

#Thought_Leadership



The whitepaper focuses on how to scale equipment productivity management globally by aligning top-down performance management with real-time, bottom-up problem-solving. It emphasizes the integration of i4.0 technologies to bridge the gap between executive-level reporting and operator-level tools, providing actionable insights for both. The document highlights the importance of standardizing data such as OEE to enable effective decision-making across multiple sites. Finally, it advocates for the adoption of specialized, modular apps to drive innovation and operational efficiency.



Our Offering for Your Transformation

Consulting:

The Aachen-based Institute for Productivity (IfP) offers consulting services to assist in crafting an Industry 4.0 vision for factories. Their expertise extends to designing strategies that can effectively operationalize the broader vision into a value-centered implementation approach. With a team boasting extensive managerial and consulting experience across various industries, and with a background in Porsche Consulting's "Strategic Vision. Smart Implementation," they provide an "Experience-as-a-Service" model to complement and enhance your Industry 4.0 strategy and implementation team or also support companies in special situations requiring process optimization or cost reduction.

Oee.ai Manufacturing Intelligence:

The IfP team has translated its operational manufacturing intelligence expertise into the oee.ai app, which plays a central role in the performance management of various global manufacturing companies across diverse industries. This app is specifically crafted to deliver actionable insights into equipment productivity, leveraging state-of-the-art technology. By focusing on real-time data and utilizing cutting-edge technologies like e.g. AI, oee.ai aims to provide manufacturing companies with a powerful tool for optimizing their equipment productivity. This integration of knowledge and technology showcases the team's commitment to delivering innovative solutions in the realm of operational manufacturing intelligence.

The IfP & oee.ai Management Team



Joern Steinbeck, managing director and globally active as consultant for strategic operations improvement.

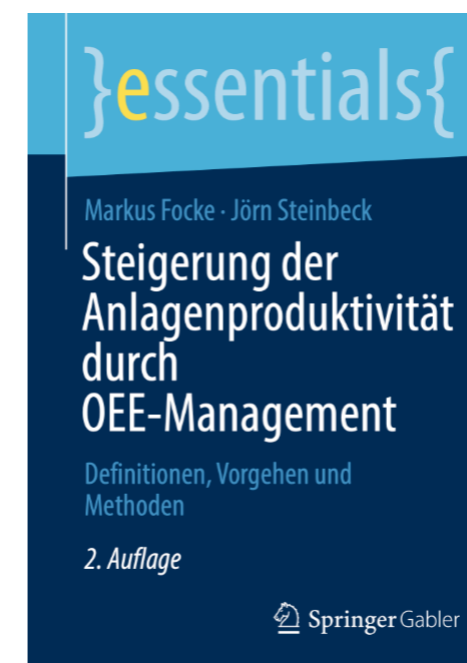
joern.steinbeck@oee.ai



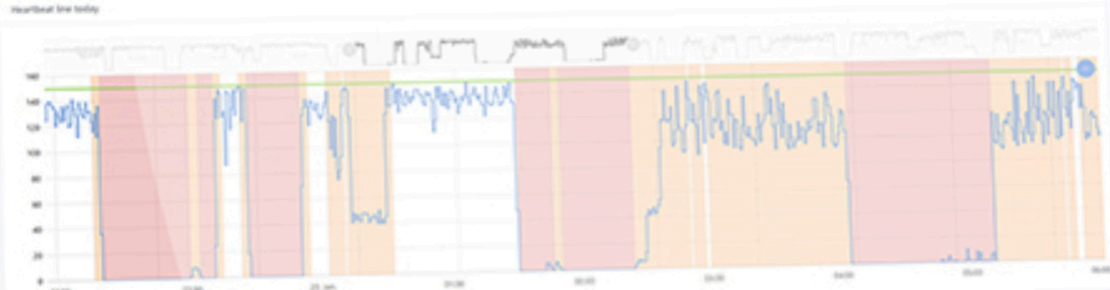
Dr. Markus Focke, managing director and professor for industrial engineering at the University of Applied Sciences, Aachen.

markus.focke@oee.ai

Additional Reading



A book on equipment productivity management published in the second edition with Springer, available on Amazon currently only in German language.



KPIs past shift

51,6%
OEE

62,8 %
Availability

82,2 %
Performance

7
Downtime quality

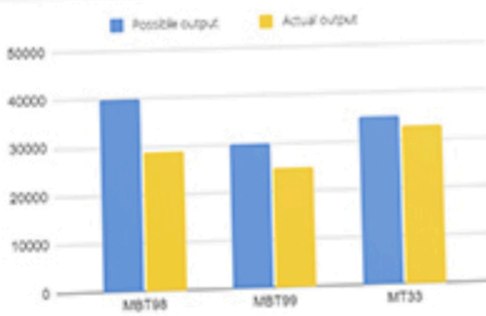
6
Microstop quality

02:38
Total downtime

86.433
Actual output

105.150
Possible output

Output per product



Event History

	FROM	TO
Light shift	2021-01-28 03:00	2021-01-28 06:00
Missing Performance loss	2021-01-28 03:00	2021-01-28 03:15
Downtime	2021-01-28 03:15	2021-01-28 03:12
Downtime	2021-01-28 03:12	2021-01-28 03:52
no finished good	2021-01-28 03:52	2021-01-28 03:52
shortage of material	2021-01-28 03:52	2021-01-28 03:19
Downtime	2021-01-28 03:52	2021-01-28 03:52
Downtime	2021-01-28 03:52	2021-01-28 03:52
Missing Performance loss	2021-01-28 03:52	2021-01-28 03:47
Downtime	2021-01-28 03:47	2021-01-28 03:54
Downtime	2021-01-28 03:54	2021-01-28 03:44
Downtime	2021-01-28 03:44	2021-01-28 03:44
Missing Performance loss	2021-01-28 03:44	2021-01-28 03:30
Missing Performance loss	2021-01-28 03:30	2021-01-28 03:33
Downtime	2021-01-28 03:44	2021-01-28 03:50
Missing Performance loss	2021-01-28 03:52	2021-01-28 03:54

Events

- 00:18 AM: Filter replacement
- 00:53 AM: Drain valve maintenance
- 02:12 AM: Change of cooling water
- 03:55 AM: Cooling tools

Settings

- 01:35 AM: Pressure adjustment 2.9 bar => 3.1 bar
- 04:33 AM: Temperature adjustment 104°C => 102°C

Availability losses today



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