USETECH

CUSTOMER CASE STUDY

RISK DIGITAL TWIN

OVERVIEW

Digital Twins of a system serve as sophisticated virtual replicas that are created to simulate, analyze, and monitor a wide array of system parameters, offering engineers invaluable insights into system performance. By integrating real-time data, Digital Twins provide a comprehensive view of risk factors, failure dependencies, and the potential impacts of failures, thereby significantly improving safety and reliability in system operations. These digital models utilize advanced analytics and machine learning algorithms, allowing for predictive maintenance and proactive decision-making. As a result, organizations can anticipate issues before they arise, optimize resource allocation, and reduce downtime.

Digital Risk Twin is a Digital Twin, or a digital representation of an intended, or actual physical product that contains the necessary information in terms of functions, flows, components and other criteria that allows a risk simulation to be undertaken, identifying the risks (failures) of a system during operation and their path of propagation through the system.

POSSIBILITIES:

- Conducting thorough risk analysis and assessing the probability of their occurrence.
- Developing sophisticated threat models to anticipate potential issues.
- Identifying the most vulnerable areas within the production system.
- Selecting and implementing effective measures to avert emergency situations.

WORK WITH DIFFERENT LEVELS OF READINESS FOR DIGITALIZATION

PHYSICAL ENVIRONMENT	Connection Computing	Human-machine interface	Augmented reality Edge computing	Additive manufacturing
DIGITAL ENVIRONMENT	**BASIC DT** Security Digital definition	**FULL DT** IIoT platform and analytics Corporate ERP and MES systems	**ADVANCED DT** Cloud applications Real-time IIoT-based data simulation	**NEXT GENERATION DT** Artificial intelligence Blockchain

THE DRT IS USED TO AUTOMATE:

- It streamlines coordination among participants in the risk management process, ensuring that all actions align with established procedures and protocols. This promotes consistency and reduces the likelihood of errors.

- The digital risk twin can perform complex calculations involving vast amounts of data, which is essential for accurate risk assessment and decision-making. By leveraging advanced algorithms, it can analyze potential risks and their impacts more effectively than traditional methods.

- It acts as a Dynamic Risk Register, where it stores not only risk forecasts but also historical events, allowing organizations to learn from past occurrences and improve future risk strategies.

DIGITAL TWIN:

Conventional digital twin

A digital copy of a physical object or process.

Hybrid twin

Software and hardware systems including a digital twin and numerical simulation technologies with machine learning technologies + use of this data in real time.

Comprehensive digital twin

A set of all currently known technologies for aggregation, modeling, analysis, orchestration and visualization of data, allowing to solve problems of predictive service of assets, product quality, as well as optimal operation of equipment and organization of unmanned production.

PROBLEMS SOLVED BY THE DRT

AT THE PLANNING STAGE

1 It facilitates the comprehensive collection of data regarding fundamental production safety hazards and existing barriers. This process ensures that all potential risks are identified early in the planning stages, allowing for more effective mitigation strategies.

2 It plays a crucial role in documenting changes aimed at enhancing or replacing current safety barriers and eliminating identified risks. This systematic approach not only improves safety protocols but also fosters a culture of continuous improvement within the organization.

3 The Digital Risk Twin enables the forecasting of changes' effectiveness through a risk identification and assessment process. By simulating various possible scenarios, it provides valuable insights into potential outcomes, allowing organizations to make informed decisions.

4 It helps calculate safety indicators as mandated by the Board of Directors, ensuring that all safety measures align with corporate governance standards and regulatory requirements. This proactive approach ultimately leads to safer production environments and enhanced operational efficiency.

AT THE OPERATIONAL CONTROL STAGE (EXECUTION AND CONTROL)

1 Information Gathering on Production Safety Hazards: The Digital Risk Twin systematically collects and analyzes data related to current safety hazards and barriers within the production environment. This comprehensive information allows for a proactive approach to managing risks.

2 Real-Time Forecasting of Safety Indicators: It provides online forecasts of safety indicators set by the Board of Directors, enabling organizations to anticipate potential issues before they escalate. This predictive capability is essential for maintaining a safe working environment.

3 Dynamic Safety Level Analysis: The system continuously monitors safety levels and identifies trends, especially when deviations from planned performance occur.
This includes:
• Operators receive alerts when safety indicators exceed acceptable limits, based on real-time forecasts.
• It pinpoints the underlying causes of increased risk levels, such as the failure of specific barriers related to particular production operations.
• The Digital Risk Twin evaluates possible consequences of risks, identifying affected areas and trends, and provides recommendations for implementing temporary barriers to ensure safety goals are met.
• On-site video monitoring enhances situational awareness by capturing any risk events as they occur, allowing for immediate response.

4 Incident Registration and Investigation: The platform facilitates the documentation and thorough investigation of incidents or risk events, ensuring that lessons learned are integrated into future safety protocols. By analyzing past incidents, organizations can refine their risk management strategies and enhance overall operational safety.

AT THE MOTIVATION STAGE (CONTINUOUS IMPROVEMENT)

1 It provides an objective assessment of the effectiveness of safety goals within operational processes. This ensures that organizations can measure their progress accurately and make informed decisions based on real-time data.

2 The Digital Risk Twin evaluates the effectiveness of safety barriers, allowing companies to identify which measures are working and which need enhancement.

3 It offers an impartial evaluation of the performance of individuals responsible for implementing these barriers, ensuring accountability and promoting a culture of safety. This assessment extends beyond just barrier operators, it also includes a comprehensive review of other roles involved in risk management.

PROBLEMS SOLVED BY THE DRT

Simulation + optimization + data analytics

Sensors

Primary Retention Model

Historical data about previous events

Risk monitoring

Prompt information

Integrations with enterprise systems

Manager Monitor

METHODOLOGY FOR QUANTITATIVE ASSESSMENT OF PRODUCTION SAFETY RISKS

INPUT DATA PRODUCTION (STORAGE)

VERIFICATION AND VALIDATION OF THE MODEL

Checking the model for the correct description of the workshop in question
Testing the model for its ability

QUANTITATIVE ANALYSIS OF RISK PROBABILITIES

The accuracy of calculations that a risk model can provide

Quantitative analysis of risk probabilities

QUANTITATIVE RISK IMPACT ANALYSIS

Quantitative scenarios for the occurrence of risk events, including the probability value + the values of the effectiveness (reliability) indicators of prevention measures — all with reasonable accuracy

Calculation of risk consequences with controlled accuracy

QUANTITATIVE ASSESSMENT OF RISK AGGREGATES

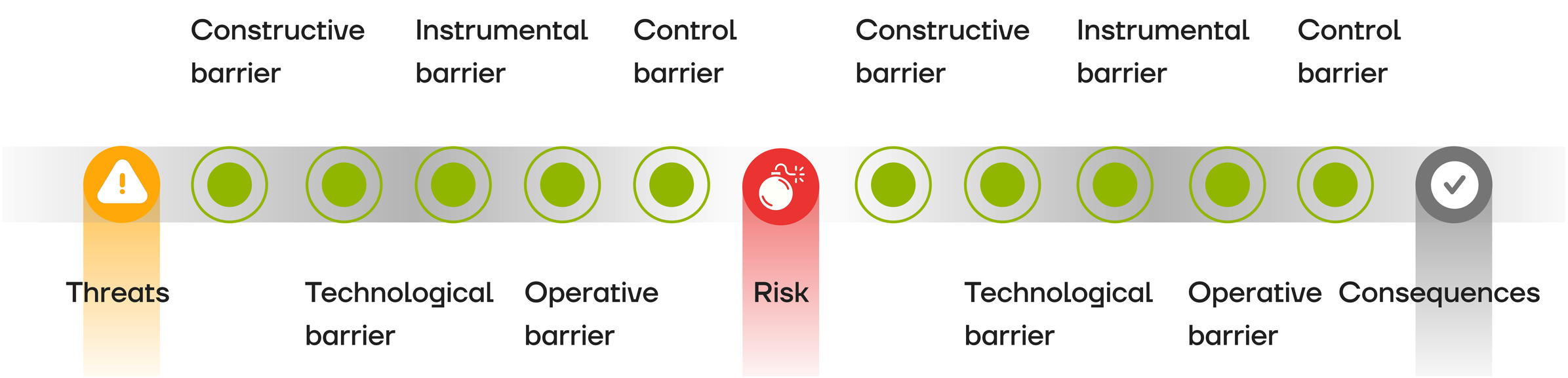
TQuantitative scenarios for the development of risk events, including values of consequences and safety indicators + values of the effectiveness of containment and mitigation measures — all with controlled accuracy

«Bypassing» the set of calculated risks with the calculation of safety indicators

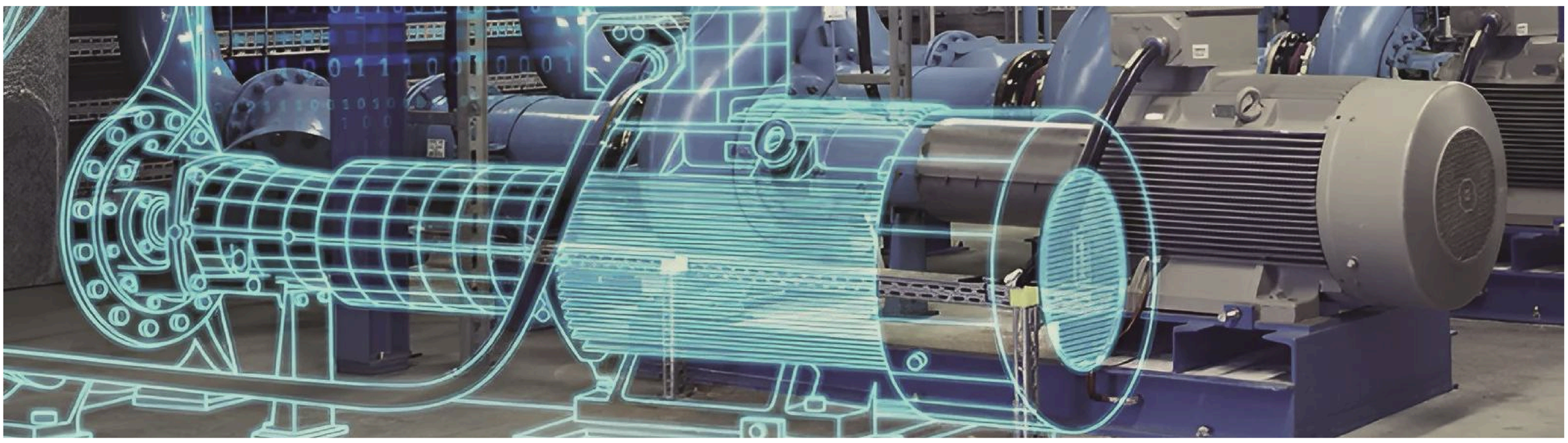
OUTPUT DATA SAFETY INDICATOR

RISK DIGITAL TWIN

The simulation of reaching safety barriers plays a crucial role in risk management within various industries. By modeling scenarios where safety barriers may be breached, organizations can calculate the probabilities of risk events and potential damages that may arise from such incidents. This proactive approach allows for real-time risk assessment displayed on the operator's monitor, enabling swift responses to any emerging threats or protocols that need to be activated. Additionally, the localization of accident sites is enhanced through the integration of photo and video recording technologies, which capture the unfolding events. This documentation not only aids in immediate response efforts but also serves as vital evidence for post-incident analysis, helping to improve safety protocols and training programs. Overall, these advancements in risk assessment and incident response contribute significantly to workplace safety and operational efficiency.



1. Simulation of reaching safety barriers
2. Calculation of the probabilities of risk events and damage
3. Display of online risk assessment on the operator’s monitor with the ability to quickly respond to the protocol
4. Localization of accident sites with photo and video recording of what is happening



RESULTS:

The integration of digital twin technology not only fosters a proactive risk management culture but also facilitates continuous improvement by allowing companies to simulate various scenarios and assess their potential impacts. This adaptability is crucial in today's fast-paced industrial landscape, where the ability to respond to emerging risks swiftly can significantly affect a company's competitive edge.

- A marked reduction in the frequency of risk events, leading to a more stable operational environment.
- Decreased response times for prevention, allowing for quicker adjustments and interventions.
- Optimization of production and business processes, enhancing overall efficiency.
- Improved safety measures at hazardous facilities, safeguarding both employees and assets.
- Enhanced production performance, which can lead to lower operational costs and increased profitability.

OPERATOR'S MONITOR