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HIGH PERFORMANCE THROUGH **CONTINUOUS** **IMPROVEMENT**

Uncertain Times Require Agility



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High Performance Through Continuous Improvement

Uncertain Times Require Agility

The process industry is under unprecedented pressure to adapt to a changing environment. Algorithmic activities must be aligned with strategic priorities – even when framework conditions are rapidly changing. The key to success lies in the concept of the Continuous Improvement Process (CIP). But the guided, continuous improvement process is not a foregone conclusion. It requires a constant flow of ideas and adjustments. Goals must be readjusted and, if necessary, new, integrated tools must be introduced as part of lean management.

Process optimizers and lean experts are faced with challenges due to global market shifts, energy and raw material bottlenecks and rapidly changing requirements. Unpredictability and high volatility of the framework conditions make process management more difficult. To stay competitive, plant operations must be continuously optimized. At the same time, process reliability must be guaranteed and innovation potential exploited. The development of state-of-the-art, partially AI-based modules such as individualized human-machine interaction, digital twins and

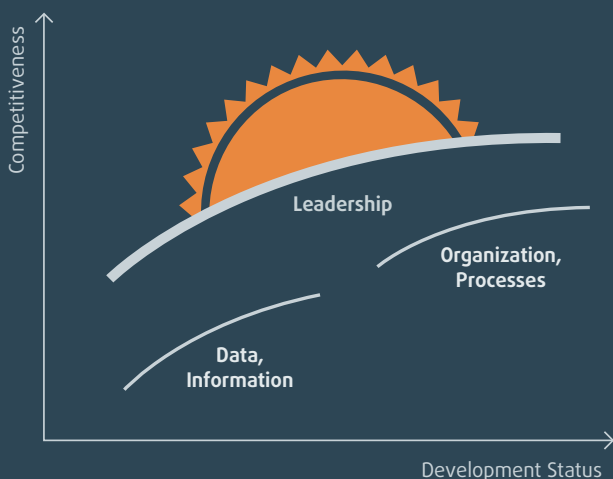
simulation, as well as data transmission and analysis technologies, offer new potential for the process industry. But algorithms are not able to react to completely unexpected events. The implementation of state-of-the-art modules is only successful if people are extensively involved using CIP. People can critically question given paths and combined with creativity, create forward-looking processes. Foresight, judgement and the ability to make differentiated decisions are instrumental in moving optimization forward.

Despite the high level of complexity, the process industry needs agility in a 24/7 shift operation. Adaptive systems can be an opportunity to unleash the potential of machine-assisted humans. In this whitepaper, find out how a digitally supported continuous improvement strategy can ensure future-oriented, long-term successful Plant Process Management (PPM).

Strategic Concept: Value Stream Management

For many decades, continuous improvement has ensured stability in companies in the face of disruptive changes. Changing market conditions, the integration of the latest technologies, as well as business mergers and acquisitions, require existing processes to be reconsidered. In this context, CIP is not a singular tool but an integral part of the management strategy and the corporate culture. The development status of the high-performance culture can be ascertained as part of a three-horizon assessment (LDP Three-horizon model) and is presented in detail below.

Three Horizons Perspective to Relaunch Continuous Improvement



1 Leadership

Leadership enables a culture of change and is particularly important in times of crisis. But without the underlying horizons of data and organization, leadership is blind.

1.1 Operational Management Thrives on Communication

In the process industry, information must be communicated in a timely and understandable manner. Especially at the production level, the operations manager should maintain a regular exchange with all levels of the organization. In addition to production targets, concerns about system conditions and performance needed to be communicated on a continuous basis. Especially in crisis situations, it is important for management to ensure dialogue between various organizational units to identify pitfalls and opportunities for optimization at an early stage.



1.2 Strategic Goals

In addition to financial goals, company goals should include extensive content from the areas of health, safety and the environment as well as employee satisfaction. In the area of the environment, the topics of climate neutrality, energy supply and use of resources are becoming increasingly pressing. These developments illustrate that goals must be regularly reviewed and continuous improvement in the form of new ideas and adjustments is required.

The introduction of additional tools can help in particular with more complex issues, such as Six Sigma. This may include the skills matrix and employee training. It is important that employee representatives are involved in anchoring CIP in the company.

Production processes in the chemical and pharmaceutical industry require a 24/7 alternate shift model. In Germany, the 5-shift system with five teams and three eight-hour shifts per day is very common. Complex information must therefore be passed on at least twice a day. While the shift handover for the night shift takes place at 10:00 p.m. and for the morning shift at 6:00 a.m., the morning briefing takes place at 8:00 a.m. This means that there is no way for the operational management to speak directly to the late or night shift. The importance of shift handover in 24/7 production operations is explained by US communications consultant Dr TJ Larkin: „50% of all critical incidents in operations occur in the first 30 minutes after shift handover.“

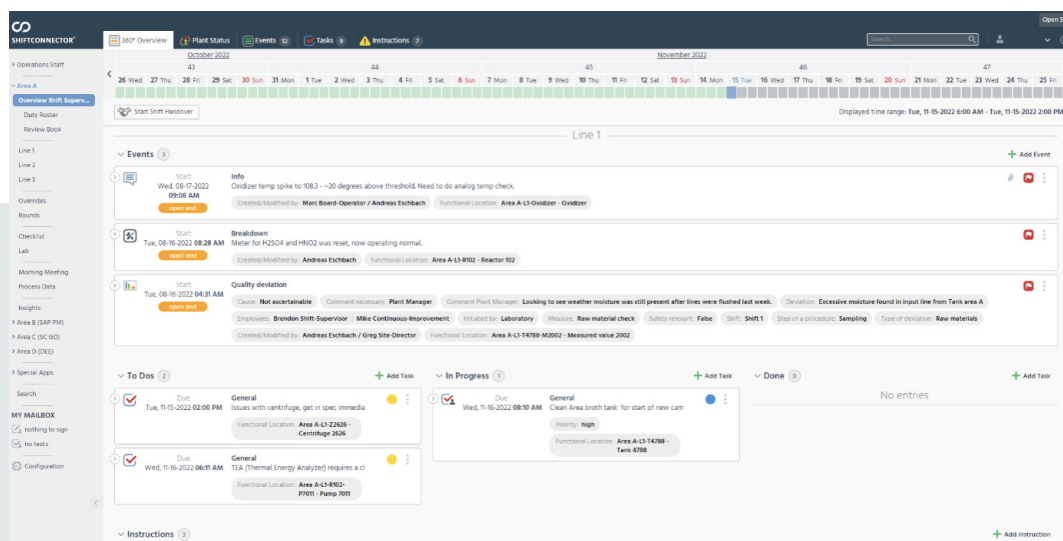


1.3 Digital Solutions for Interactive Processes

While personal contact remains the strongest form of communication, digital collaboration platforms strengthen shift work. In addition to plant management, production teams should be involved in the exchange of information. A guided and digitally organized communication process brings production employees out of the shadows – they are given a digital voice, combined with

the opportunity to communicate events in the organization and, if necessary, escalate them to the morning briefing. For communication in shift work, a distinction must be made between three main types of information, that are used with the help of PPM in a guided process for digital communication and documentation:

- Events:** What happened on shift?
- Tasks:** What needs to be done on shift?
- Instructions:** How must something be done on shift?



The digital communication process enables interactive shift work and ensures transparent operational processes.

Digital PPM solutions interface with operation-critical systems, making them an ideal starting point for the development, recording and status tracking of improvement suggestions. Managing these suggestions can then be mapped using specialized

idea management software solutions. The use of intrinsically safe tablets and video conferences brings with it a physical and virtual proximity of the communication partners. During the pandemic, companies conducted Gemba Walks online, and were able to gain experience in virtual leadership.

1.4 Employee Motivation

1.4.1 Participation

Despite the already strong affinity of today's Millennial or GenZ generations for digital solutions, precautions are required to ensure reliable use of the new solutions. As soon as employees have the chance to design optimizations for their area, the practicality of an application increases along with a sense of ownership. With the higher identification of the employees with the company, a constant improvement in the competitive position is achieved. Employees involved in all phases of the project see the new digital processes as the result of their own work. This engagement at the beginning of a process to digitize ensures acceptance and the transfer of knowledge to new colleagues.

1.4.2 Incentives and Training

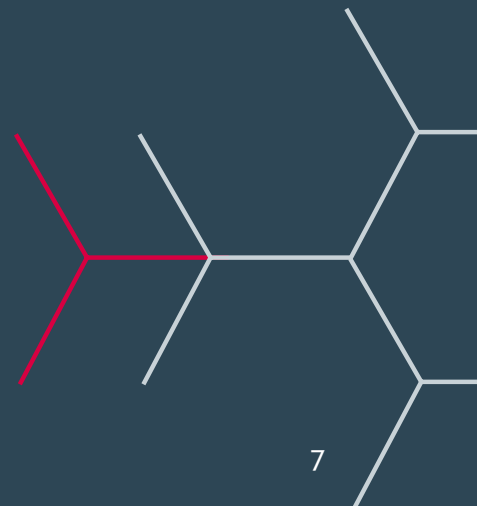
Suggestions for optimization are part of the continuous improvement process. Encouraging suggestions furthers development and at the same time stabilizes existing work processes. Another important success factor is the training and education of employees and economic, personal recognition based on the achievement of goals.

2 Organization

In organizations, processes are implemented, put into practice and optimized.

2.1 Agility Through Value Stream Management

In order to deliver an optimal business workflow, many organizations use Value Stream Management (VSM), a process of bringing all workflows to the end user with no interruptions. Lack of communication often results in an inconsistent delivery process that can create costly delays. VSM identifies the existing workflows, allowing for analysis of weak points. Each workflow is mapped out to identify all the steps that the product will take during the production process. Once the mapping is completed, optimization can occur that results in a new mapping of the workflows that will reduce wasted time and increase performance. Implementation of the new process then creates increased value for the product line.



2.2 Representation of the PDCA Cycle

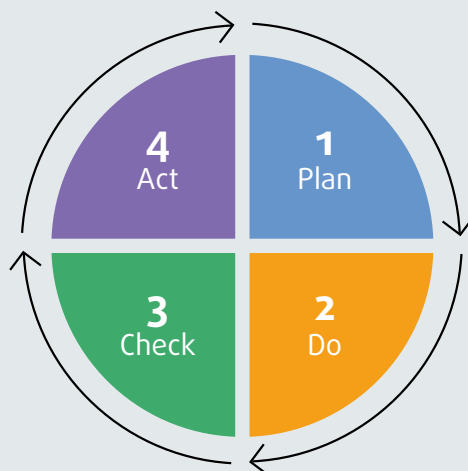
Improvements are developed in a structured process. Optimization suggestions are checked and evaluated for usability to adopt them in the company processes. The PDCA cycle is a continuous loop of Planning, Doing, Checking and Action.

1. Plan – 2. Do – 3. Check – 4. Act

- 1 Steer and make improvements.
- 2 Implement them.
- 3 Check whether the goals have been achieved.
- 4 Standardize and stabilize.

This continues until all processes are evaluated. Using a PPM to digitally support and manage the PDCA cycle ensures that data is captured and analyzed thoroughly during the cycle, ultimately providing more efficiency in the final implementation.

Improvements Are Developed in a Structured Process



This involves employees at all levels.

2.2.1 Plan

Goals must be clearly visualized and, above all, be present. They should be easy to understand, digitally available, and influenceable by shift teams. They are therefore created in the „SMART“ model:

Specific
Measurable
Achievable
Reasonable
Time-bound

Information must be adapted for the employees at the various levels of the organization in such a way that it is also relevant for them. For exam-

ple, the technical aspects of plant utilization (OEE: Overall Equipment Effectiveness) should be incorporated into each shift worker's goals. The use of PPM systems leads to contextualized data that can flow into a dashboard in real time. The dashboard can be customized for each operator to view relevant data that is measured against goals.

For operations, absolute KPIs are preferable to relative KPIs; The basis is the operational framework. For example, the indication of the number of accidents is clearer and easier to remember than the quotient of the number of accidents per one million working hours.

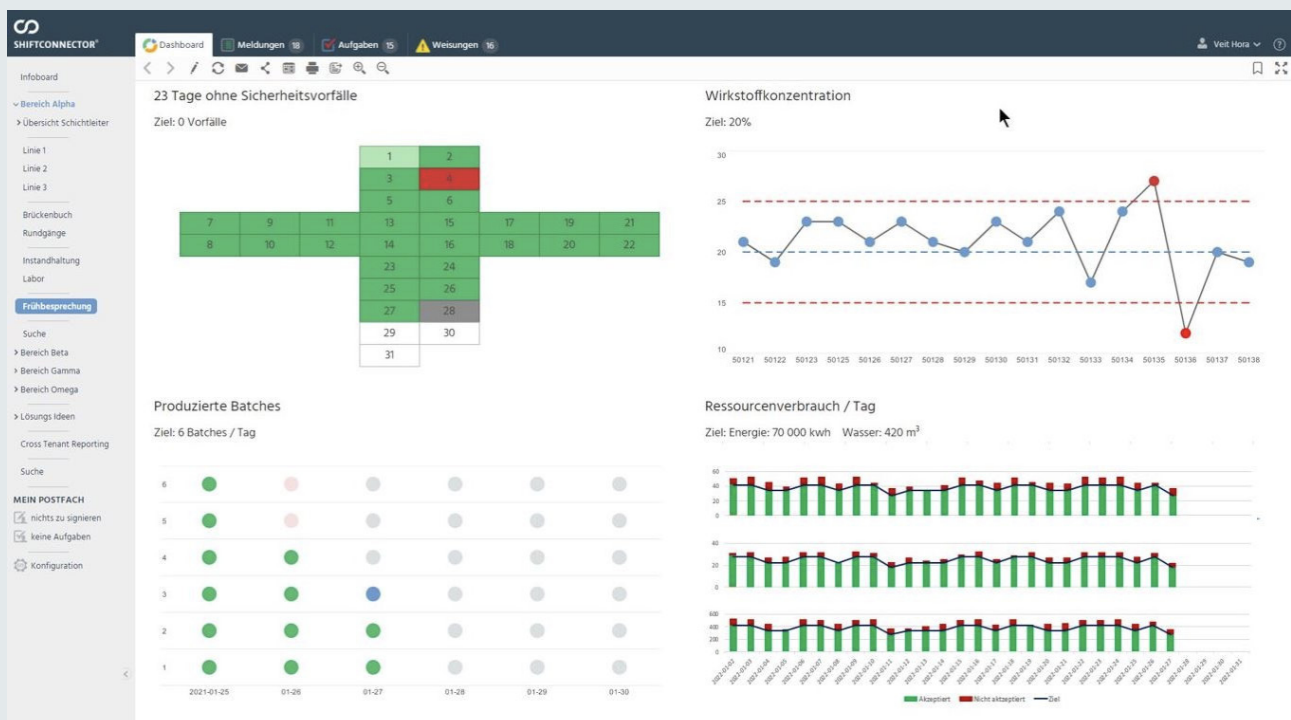


Fig.: Kaizen progress charts – visualization of goals and goal achievement from an enterprise platform that embraces digital collaboration



A PPM solution enables shift workers to directly document causes of deviations from target values (see chapter: Data and information). Critical information is collected in each shift, which is then available for evaluation. For example, the plant operator on the night shift documents the reasons for a deviation in the batch runtime. As soon as process optimizers have been able to identify the recurring problem, a thorough root cause analysis follows, taking into account that problems often occur in a chain. A proven method for this is the 5W technique. The question is asked five times: Why does the problem occur?

CIP Requires the Analysis of the Problem To Be Worked On



The information obtained can serve as a basis for the application of the traditional Kaizen quality tools; the main cause can be determined using the Pareto principle, for example. For the “most causal” reason, the next step is the solution search provided that the operating personnel have an influence. Process optimizers evaluate and prioritize suggestions by comparing effort and benefit to identify the most promising topics. For selected solutions Measures are described in detail.

The suggestion for improvement is then submitted to the operational management for approval. Important here: the dialogue! The suggestion should be presented by a member of the submitting shift. Together with a person responsible for lean management, goals are defined, tracked and mapped in a digital, structured workflow. This ensures the quality of the submissions and the process.

2.2.2 Do and Check

In many cases, further investigations and elaborations are required across shifts before implementation. It may be necessary to involve other departments outside of the company. Sometimes a test is carried out in sub-areas of the company such as technology or the laboratory. The PDCA cycle turns here. After implementation, a check is carried out to determine whether the goals have been achieved. If this is not the case, the PDCA cycle is set in motion again.

These two stages may require activities that the initiating team is not directly involved in. It is important that all process optimizers can keep themselves informed about the processing status. Digitally organized teams can use PPM functions to make the overall status or milestones of individual initiatives visible to all employees in the company.

2.2.3 Act

A change is followed by stabilization to anchor the measures in the organization. If the measure was only tested in some areas of the company, it will now be comprehensively implemented within relevant areas. In the chemical industry, a so-called MOC (Management of Change) process often takes effect in the „Do“ phase. Depending on technical and chemical criteria, certain licensing and approving authorities must be involved. If necessary, operational documents (according to the DIN-ISO standards 9000ff), e.g. procedural and work instructions or the technical operational documentation, are adjusted. As part of the MOC, the employees in the shifts are demonstrably trained. Corresponding instructions are distributed to the operating staff via the PPM solution

in an audit-proof manner, tracked and confirmed with a digital signature. Recurring tasks must be tracked automatically. Training courses and tasks with checklists can be enriched with learning videos or photo documentation, for example.

All business processes in the company must be checked for their suitability for the CIP and adjusted if necessary. Measures and projects resulting from CIP should be an integral part of a company's project management. Required budgets and resources must be planned accordingly.



2.3 Coordinators and Teams

A continuous improvement coordinator is to be provided for each organizational unit, also in each shift. Their job is to ensure that the improvement process takes place with the basic steps. In the role of contact person for colleagues, the coordinator knows how to use the quality tools and the process steps. The request to suggest improvements should not be solely directed to

the coordinator. A CIP group could pick up, evaluate and prioritize suggestions from the workforce. The advantage of the group is clearly the expansion of expertise and the wealth of ideas when it comes to finding solutions.

Operations Management

Shift Teams

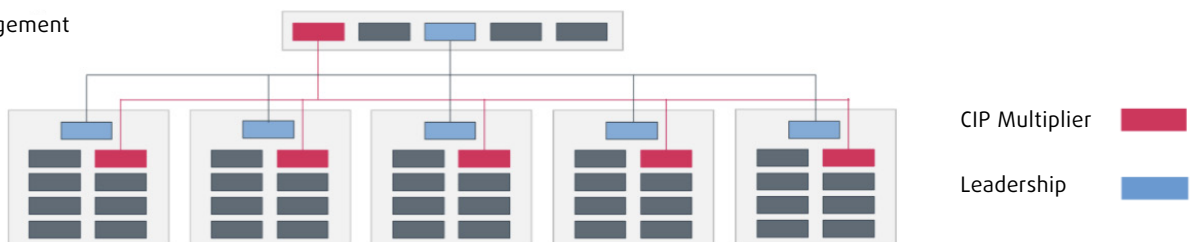


Fig.: CIP is an integral part of the company organization. In 24/7 operation, a responsible person must be defined for each shift team.

3 Data and Information

Data and information are the substance from which improvements can be made and the basis of a successful CIP.

3.1 Shift Change as an Information Hub

The production process supplies extensive raw data, like measurement and time series data, from PLS systems, IIoT sensors or the laboratory. This data is increasingly standardized in the process industry and made available within the company. To further increase the usability of the data, it is crucial to enrich the background for deviations in the production process with additional information. Production employees of the current shift are involved in the contextualization and log information about safety, productivity and quality as part of the shift documentation. In this way, information on the operating status is recorded

several times a day. Incident plants are obliged to keep an audit-compliant shift log. Corresponding regulations for documentation also apply in GMP companies.

Instead of self-created Excel spreadsheets, forms and programming, digital solutions for PPM offer a new way of mapping interactive shift work in a guided process. Events in occupational safety, for example, are recorded digitally using a form as part of shift communication and supplemented with relevant details such as category and severity. Technical malfunctions and planned and unplanned downtimes are also part of the shift report. Many deviations in the production process can be detected in the process data and the shift teams can be automatically required to add relevant data to these events. The events of each shift are thus digitally encoded.

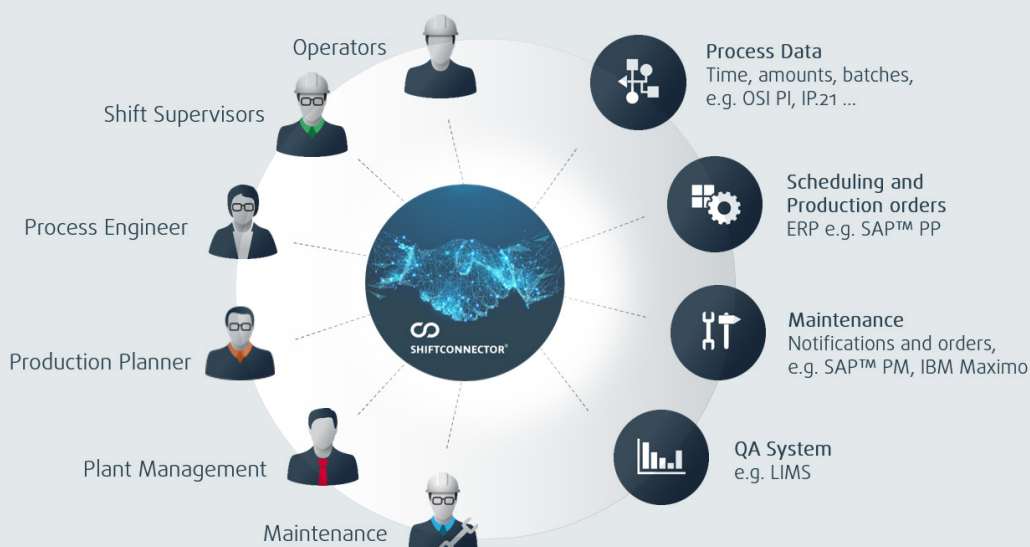


Fig.: Plant Process Management - Which parties and units are involved in the process



3.2 Availability of Data

With digital PPM solutions, the data obtained is standardized and transparently available. A guided, digital process is essential for data-driven collaboration across departmental boundaries, for example in root-cause analysis or in the aggregation of data on operational productivity. With the strategic introduction of PPM, in addition to higher data availability and quality in operation, many costly individual solutions are saved. If they are based on web technology (e.g. HTML5), digital dashboards can be displayed on a wide range of end devices - from large screens in the control room to the PCs of the plant operators to the tablets of the process engineers.

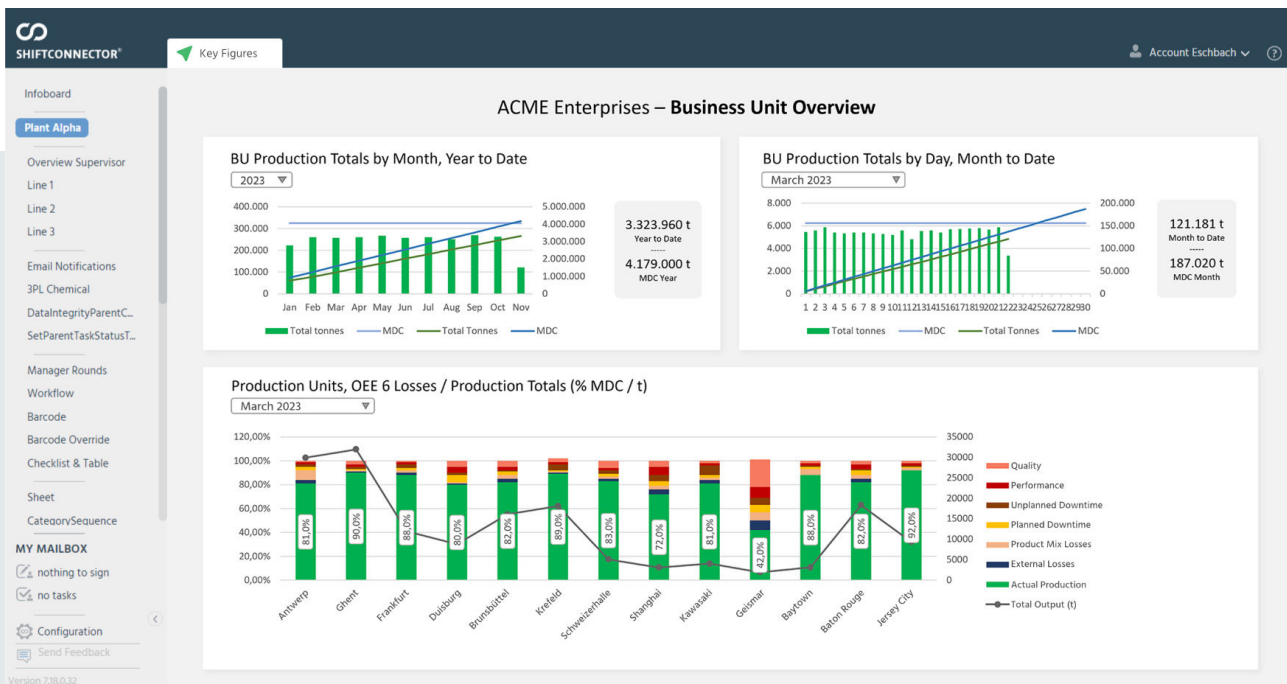
While at the beginning of the era of industrial automation data was stored locally and centrally in the plant, today process data is largely available in the IT environment and in secure cloud systems.

Solutions such as the AVEVA PI system or Aspen-tech IP.21 are common. Stream processors for real-time data and cloud-native data stores such as Amazon Timestream are increasingly playing a role in the process industry. The classic automation pyramid, the ISA-95 standard, is being questioned in its original form. This development has numerous advantages with regard to CIP and promotes cooperation between different experts in problem analysis and brainstorming. Process engineers on the day shift or data experts in the home office create mathematical-statistical representations in the self-service principle, for example a dashboard with process control charts of important operating parameters. Experts in a Remote Center of Excellence (CoE) for production processes develop data analyzes and train AI models to identify and provide early warning of recurring problems. Established best practices for cyber security separate the networks from unauthorized access. Reporting, data analysis and visualization of goals and goal achievement use this infrastructure to be available at all relevant points.

3.3 From Sensor Data to Productivity Improvement

Time series data from the production process are initially relevant for productivity improvements. An example is sequences of batch processes in the ISA-88 standard. This data can be used to determine deviations in the process, e.g. batch run times, flow rates or quality parameters. Specifically: If an OEE loss occurs due to a longer batch runtime, this must be described by the plant operator or shift supervisor in a structured digital form with a reason code, functional locations and a description of the incident. This context is crucial to be able to assign connections and frequent occurrences to a cause that can be operationalized for an improvement initiative at company level.

Improvement initiatives can also be large capital improvements that result in extensive engineering projects. Aggregated production key figures such as OEE, product mix losses or the fulfillment of production planning across several companies can provide an important basis for decision-making, especially for these comprehensive investment decisions. A CIP in the sense of the three-horizon model can also support these decisions and produces correspondingly standardized data to provide relevant evaluations for decisions at all levels of the organization.



Conclusion:

When Does Continuous Improvement Flourish?

In the coming decades, chemical production will increasingly require short-term adjustments. In a continuous improvement strategy, the focus on people in particular has a positive effect. The active involvement of shift workers ensures a motivating improvement culture that drives optimization. Transparent processes and infor-

mation flows as well as interactive collaboration between management and shift teams increase understanding of production goals and ensure a high-performance culture in which everyone takes responsibility for improvements.



Fig.: Digital solutions for high-performance teams

While face-to-face communication remains the strongest form of communication, a digital enterprise platform can enable greater exchange between production teams and management in which a sustainable, binding dialogue of the organizational levels can be established. Plant Process Management enables a comprehensive yet intuitive improvement process that identi-

fies opportunities and minimizes risks. Continuous Improvement proves its worth especially in times of crisis when improvements and optimizations continue to be part of the daily routine and CIP establishes itself as a central means of coping with the new challenges.



„The crisis shows whether continuous improvement is flourishing!“

Quote: European Commission, Directorate – General for Research and Innovation, Brussels (2021), Industry 5.0, Towards a sustainable, humancentric and resilient European industry.

Shiftconnector®, an enterprise Plant Process Management solution offers one possibility. In contrast to conventional solutions that address layered documentation or idea management, Shiftconnector® combines process data and carefully captured contextual information for guided Continuous Improvement at the production level and beyond. Would you like to find out more? Visit us at www.eschbach.com

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