MHP
A PORSCHE COMPANY

INDUSTRIAL EFFICIENCY OPTIMIZATION

Creating Value with the MHP Efficiency Framework

Contents

New Challenges Require New Approaches

Disruptions, volatile demand, and external disturbances are posing major challenges for many companies right now. To succeed in times like these, businesses need extremely resilient, efficient manufacturing systems. By viewing production and all connected processes through a holistic lens, the MHP Efficiency Framework offers new approaches to improving efficiency.

The automotive industry has been hit particularly hard by the current crises, with 60.5 % of companies experiencing a shortage of raw materials. In contrast, 31.9 % of German manufacturing companies face similar challenges. These issues stem from global supply chain dependencies that are vulnerable to disruptions caused by local crises and incidents. Almost daily, new developments emerge that have a direct impact on production and require an immediate response.

60.5 %

Proportion of manufacturing companies in Germany affected by material shortages [1]

1 Source: Shortage of primary products in the manufacturing industry | statista | October 2023

End-to-End Efficiency with the MHP Efficiency Framework

A 20 % increase in efficiency, positive ROI in 18 months, and 99.98 % system up-time: impressive statistics for the automotive supplier Faurecia. By implementing the MHP Efficiency Framework and introducing MHP's FleetExecuter, the company was able to revolutionize its intralogistics. Does your company have the same kind of hidden potential for improvements?

In this white paper, you'll learn the fundamentals of the MHP Efficiency Framework (go to chapter) and find out how you can use the framework in your own business (go to chapter). The case studies from Faurecia and Volkswagen share relevant, real-life examples (go to chapter).

To minimize the negative impact of these disruptions as much as possible, companies need a manufacturing system that offers exceptional end-to-end efficiency and can remain resilient in the face of external influences. But regardless of the current market situation, an efficiently designed value creation process is always an important lever for companies who are aiming for ambitious targets set by either internal or external stakeholders.

At the same time, there is increasing customer demand for individuality. To stay competitive, modern production must be able to react flexibly to changes in demand. That is why, in most cases, we can safely say: Only when a business views productivity and flexibility holistically it can act efficiently and stay profitable.

Supply Bottlenecks of Companies in Germany

All industries

| 36% | 32% | 16% | 16% |

Industry (excluding construction)

| 49% | 35% | 12% | 4% |

■ Considerable extent   ■ Medium extent   ■ Small extent   ■ None

Figure 1: Survey on supply bottlenecks of companies by industry in Germany 2022 (Source: Statista)

Optimizing Efficiency with the MHP Efficiency Framework: The Fundamentals

Cost, time, quality – the balancing act between these three factors moves businesses towards efficiency optimization. But what are the effects of shifting the balance? And which adjustments will lead to the greatest increase in operating efficiency? To answer these questions, we developed the MHP Efficiency Framework. It comprises three aspects: the value drivers, the efficiency drivers, and the business dimensions.

The goal is to make the interrelationships between these aspects visible and measurable, thereby making it possible to influence them. The framework reveals the relationships and dependencies between the individual factors: the individual value drivers, the individual efficiency drivers, and the individual business dimensions. This gives you new insight into your business' overall efficiency.

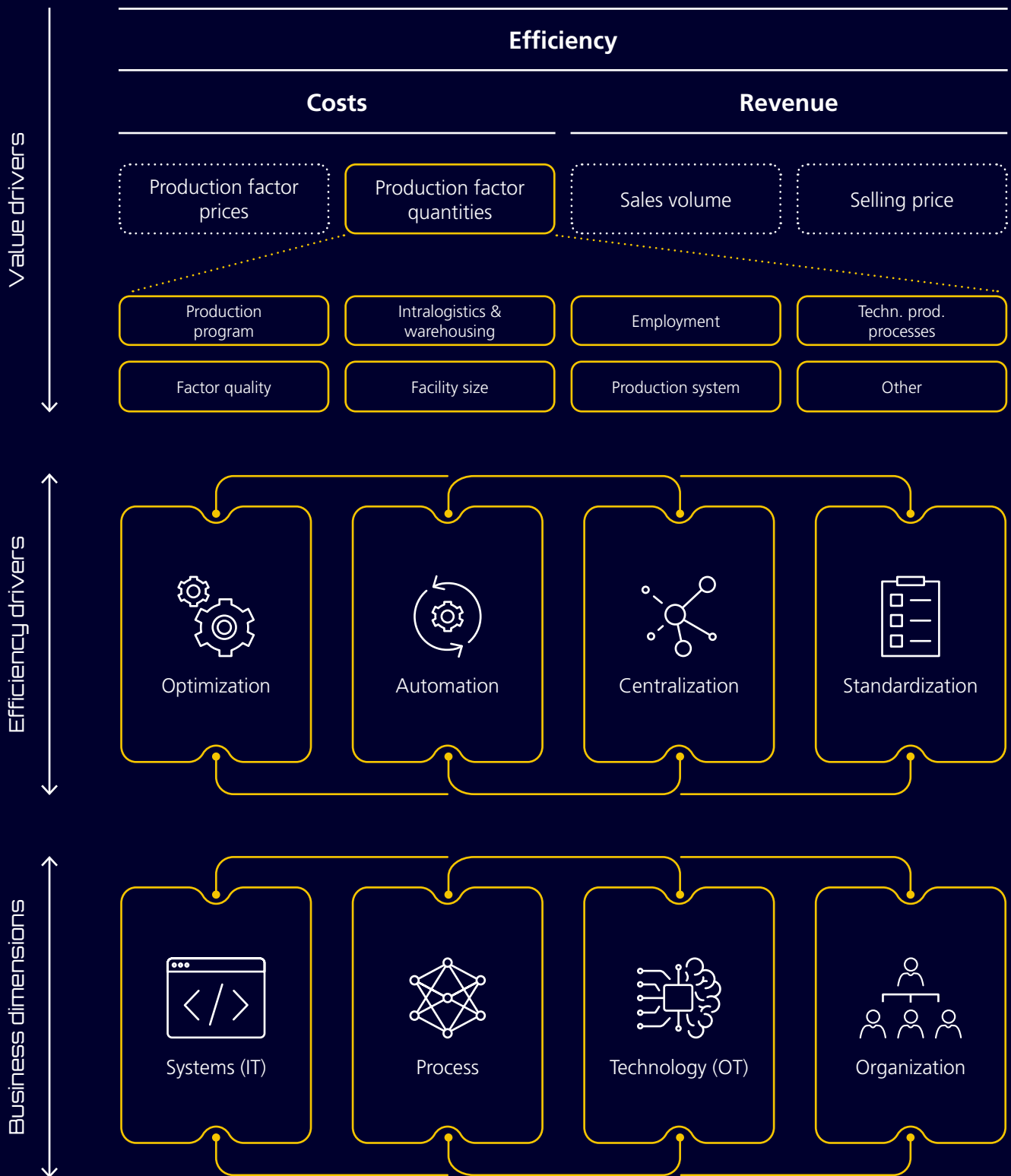Figure 2: Interaction of time, quality and costs

Efficiency Framework

Efficiency

Costs

Revenue

Value drivers

Production factor prices

Production factor quantities

Sales volume

Selling price

Production program	Intralogistics & warehousing	Employment	Techn. prod. processes
Factor quality	Facility size	Production system	Other

Efficiency drivers

Optimization

Automation

Centralization

Standardization

Business dimensions

Systems (IT)

Process

Technology (OT)

Organization

Figure 3: The MHP Efficiency Framework

The Value Drivers

The MHP Efficiency Framework views a company's value drivers as the decisive factors in manufacturing. These are also referred to as production factors, and they include all factors that are applied to the production of a product or service. This means that value drivers have a direct influence on a company's manufacturing costs.

The value drivers and their weighting can vary from company to company. This means that, in order to track and control a business's efficiency as accurately as possible, each driver must be assessed individually.

A business's efficiency depends on additional value drivers, see Figure 3. This also includes revenue, which is calculated based on sales volume and selling price. In addition to revenue, costs are also important. These are the production factor costs and the production factor volume. In this model, however, only the value driver "production factor volume" should be taken into account.

Production program

Production planning in terms of volume, sequence and time

Factor quality

Technical and organizational characteristics

Intralogistics and warehousing

Storage, flow of material and goods in the facility

Facility size

Maximum production capacity

Employment

Capacity and competency, target costs and actual costs

Production systems

One or more devices that work together in a coordinated manner

Technical production processes

Characteristics of the production facilities and processes

Figure 4: Value drivers in the MHP Efficiency Framework

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Efficiency Drivers

The efficiency drivers can impact value drivers and business dimensions. They can be divided into four clusters:
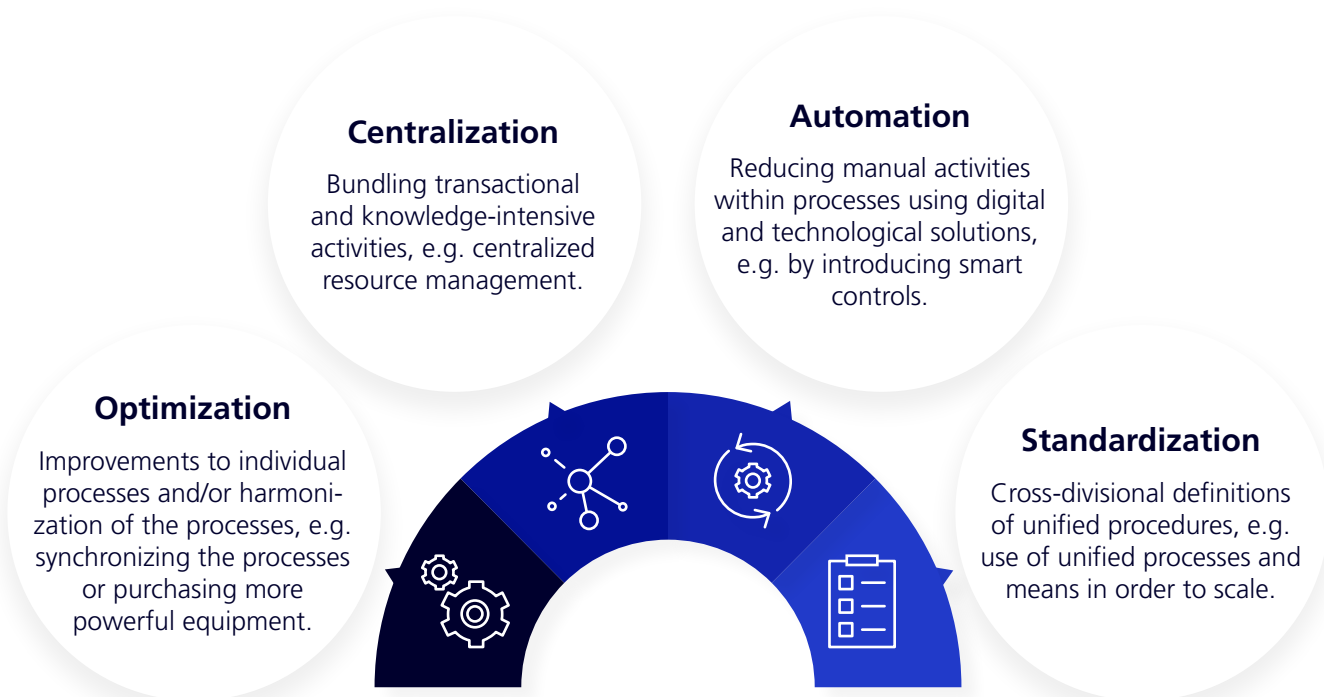
Centralization
Bundling transactional and knowledge-intensive activities, e.g. centralized resource management.

Automation
Reducing manual activities within processes using digital and technological solutions, e.g. by introducing smart controls.

Optimization
Improvements to individual processes and/or harmonization of the processes, e.g. synchronizing the processes or purchasing more powerful equipment.

Standardization
Cross-divisional definitions of unified procedures, e.g. use of unified processes and means in order to scale.

Figure 5: Efficiency drivers in the MHP Efficiency Framework

The specific approaches within the efficiency driver clusters must be coordinated in order to optimize efficiency for the entire company. Because individual efficiency drivers may be found multiple times across the clusters, the efficiency drivers should also be assessed independently of the clusters. This is the only way to ensure that you identify synergies and conflicts early on.

Example

Introduction of automated guided vehicles (AGV) shows how an efficiency driver can influence all four business dimensions. AVGs take over the operative material supply processes. This reduces the workload for the organization's employees and also prevents a shortage of skilled labor. At the same time, IT processes must document and support the control of the AGVs. This, in turn, requires specific skills and competencies on the part of the employees. A cascade of inter-related effects should be expected and accounted for.

Business Dimensions

In the Efficiency Framework, the efficiency drivers are found opposite from the business dimensions, whose inter-relationship must be taken into account in the efficiency assessment. Assessing the individual dimensions in isolation can even lead to a negative impact, as we illustrate in our failure story later in this article.

(IT) Systems

Efficient use of software within the processes, including a seamless digital interface with suppliers, customers and partners.

Technology (OT)

Efficient use of machines, robots, and technological assistance.

Processes

Efficient process design within the business, with suppliers, and with customers.

Organization

Structure of all existing production factors.
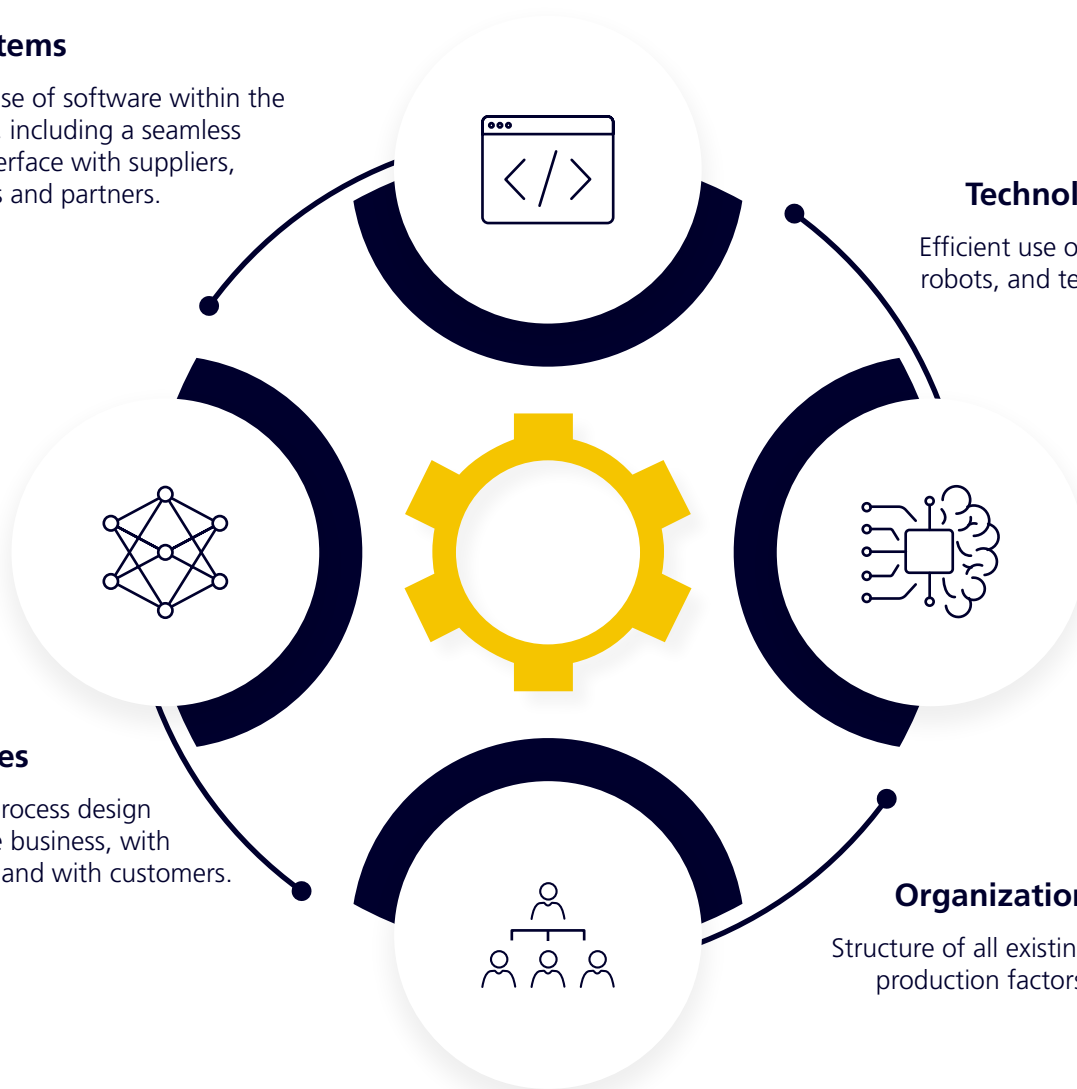
Figure 6: Business dimensions in the MHP Efficiency Framework

Interactions of Efficiency Drivers and Business Dimensions

Optimization

Centralization

Efficiency drivers

Automation

Standardization

(IT) Systems

Business dimensions

Processes

Technology (OT)

Organization
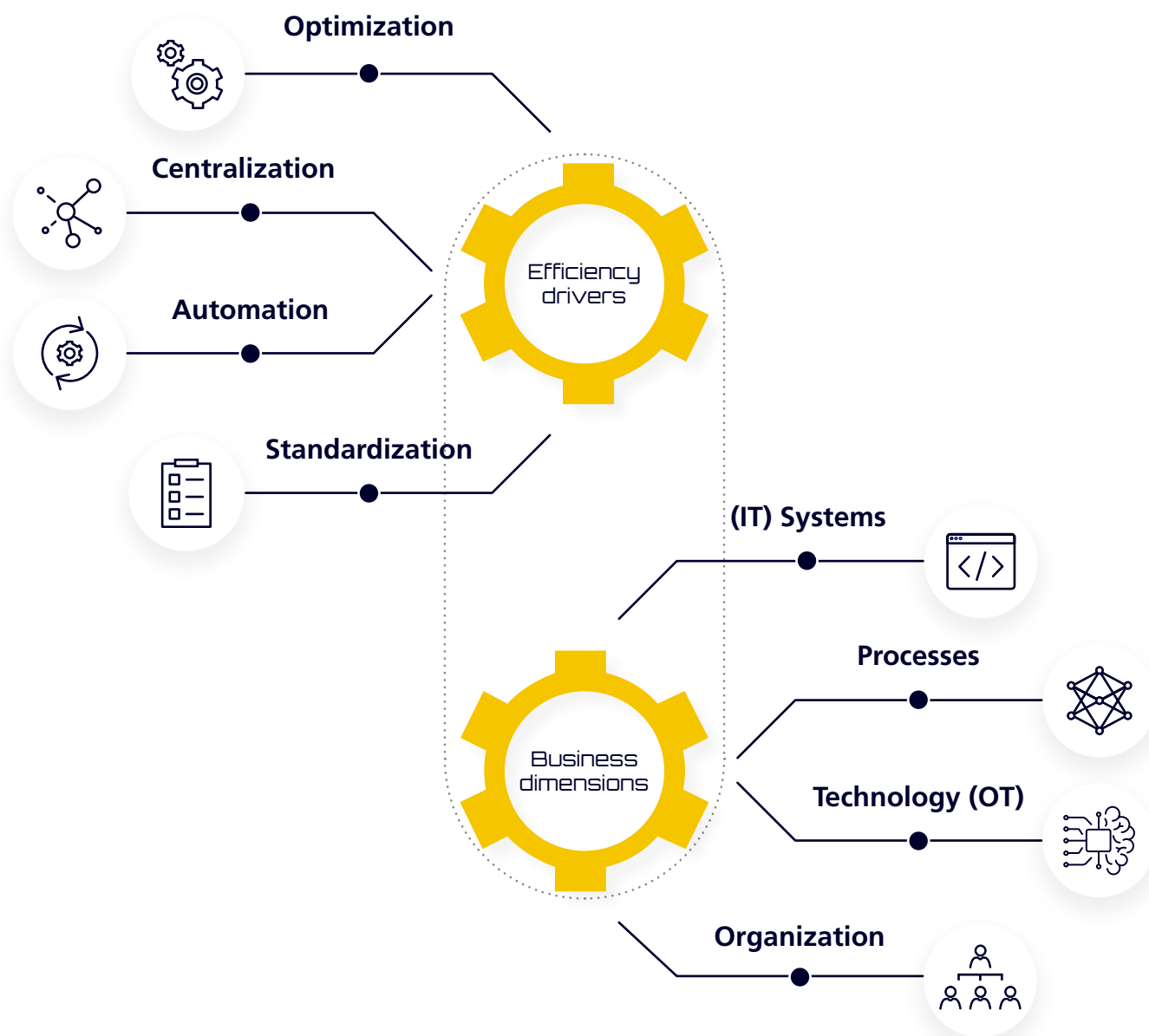
Figure 7: Influence of business dimensions and efficiency drivers

Failure Story

A company is having trouble ensuring deliverability of its products. This is currently possible only with expensive overtime and weekend shifts. But quick delivery and custom production are some of the company's key USPs that set them apart from their competition. To maintain that USP, and perhaps even expand on it, the company had invested in the automation and digitalization of their production and logistics processes.

But contrary to their expectations, these investments did not help to improve the company's efficiency. Just the opposite: First, there were more disruptions in production due to internal retrofitting operations. Secondly, employees were forced to plan for longer waiting times because they lacked materials in the production facilities. But why?

To successfully plan and implement the automation of individual processes, it is essential that the preceding and subsequent steps in the production process are also taken into account. Automated logistics only work if they are dynamically coordinated with the production planning and connected to the necessary IT systems. It must also be possible to control and maintain all automated and digitized processes. If, like in the preceding failure story, this is not the case, even sensible investments in process optimization will not lead to improvements in efficiency.
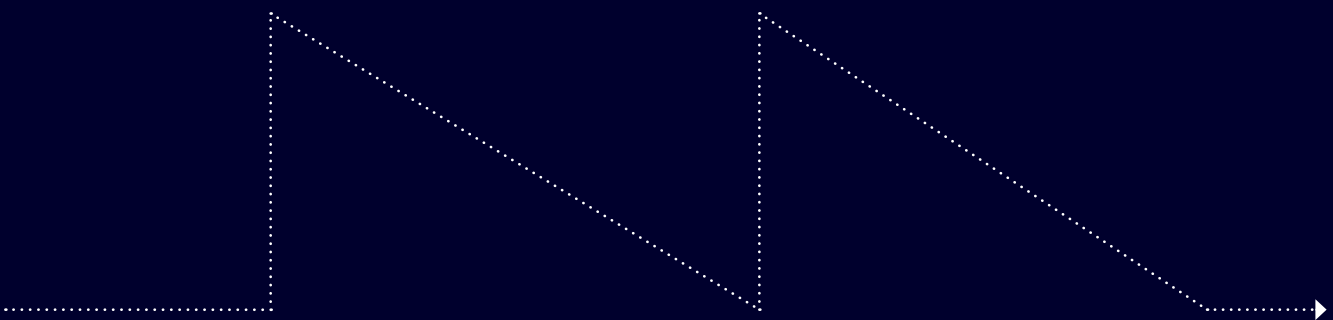
Incorrectly planned automation leads to...

long
waiting times

more
machine downtimes

How the MHP Efficiency Framework Works

If you want to optimize your business's efficiency using the Efficiency Framework, the individual value drivers, efficiency drivers and business dimensions in the framework must be assessed. To do this, record the actual production factors such as the facility size, means of production, key employment data, energy and personnel costs in the framework. Ensure that you also account for the efficiency drivers and business dimensions in the framework.

Building the business's actual parameters into the framework ensures that a holistic perspective will be possible. You can analyze inter-relationships and dependencies and have an overview of all relevant factors. To ensure that the depiction of the existing dependencies within the company is as accurate as possible, it is essential to weigh the individual paths and dependencies in the framework as part of a detailed analysis and validation.

Functionality of the Framework

| Integration of business parameters in the model * | Modeling of the dependencies | Weighting of the dependencies | Modeling of scenarios and changes to individual parameters |
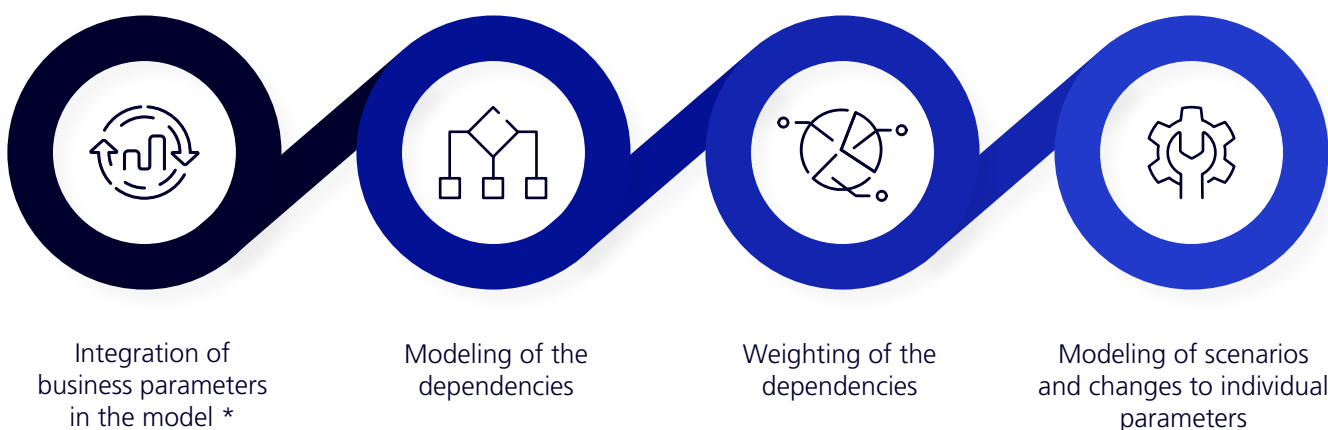
Figure 8: Functionality of the framework

* Value drivers, efficiency drivers, business dimensions

If both the individual parameters and the actual dependencies have been entered into the framework, then it is ready to use. Now the framework can be used to simulate and model both unforeseeable changes (e.g. resource shortages or price developments) as well as planned changes (e.g. measures to improve efficiency drivers). So if you implement efficiency optimizations in one area of the business, you can use the framework to see which effects they will have on other efficiency drivers and business dimensions. This holistic perspective ensures that, when changes are implemented, all factors can be accounted for and the company's overall efficiency and profitability will increase.

MHP's Approach

For our clients, we implement the Efficiency Framework in a software system. We enter the company's individual value drivers, efficiency drivers, and business dimensions in this system, which makes it possible to model specific scenarios. This makes it possible to model dependencies, weighting, and possible effects within the framework and thus determine where efficiency can be improved.

Efficiency Cases

In our consultation and optimization projects, our clients are often confronted with a similar challenge. They view and implement changes in isolation, without considering the impact on the company's efficiency as a whole.

In the following, we will show you how a successful end-to-end approach could look in practice, using two example projects that MHP worked on in the automotive industry: **Faurecia** and **Volkswagen AG**.

Faurecia:
Automation and Optimization with the FleetExecuter

The efficiency driver cluster "automation and optimization" largely represent digitalization at the shop floor level by implementing new measures in operative processes. And that's exactly where the following case study comes into play. Learn how the automotive supplier Faurecia used FleetExecuter to improve the efficiency of its AGV installation by 20 % (AGV stands for Automated Guided Vehicles).

High-powered computing to calculate complex mathematical dependencies in real time was particularly helpful in improving these value drivers and logistics processes (e.g. material supply processes). A classic use case for efficiency improvements is switching from using manually operated forklifts for intralogistics to using autonomous transportation systems.

The automotive supplier Faurecia used the centralized fleet management software FleetExecuter to optimize manufacturing logistics using autonomous transportation systems. The project focused on various value drivers such as employment, in-house logistics, and warehousing as well as the production systems, viewing these through the lens of the efficiency driver cluster "automation and optimization".

The product ensured that the right materials were available in the right place at the right time. The return on investment was particularly impressive: the costs were recouped within only 18 months. The use of AGVs in Faurecia's facilities demonstrates exceptional performance and stability in terms of the flow of materials: system availability is an impressive 99.89 % and efficiency was improved by 20 %.
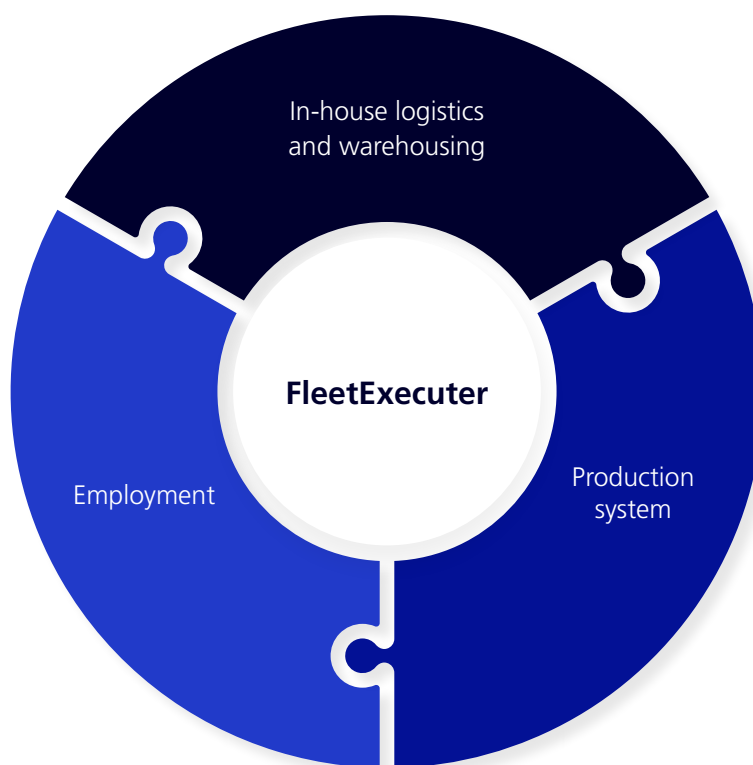
Automation & Optimization

Figure 9: Selected value drivers illustrating the "FleetExecuter" project

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Results of the Cooperation with MHP at a Glance

System availability of 99.8 %

ROI in < 18 months

Efficiency improvement of 20 %

Employment

Manual processes are always subject to human error, which create unavoidable inefficiency. In addition, the costs for forklift drivers in manufacturing logistics represent a major lever for businesses.

When the prevailing shortage of skilled labor leads to additional bottlenecks, process automation becomes a topic of urgent interest for many companies like Faurecia. For the installation of the smart systems, the company needs employees with years of experience. Once the automation of the logistics processes is completed, these skilled employees can move on to more challenging tasks and activities, driving the company's development forward in the long-term.

Introducing AGVs at Faurecia had precisely that effect. The manual material supply process on the production line was automated and costs were significantly reduced.

In-house logistics and warehousing

With the new AGVs, MHP's approach to the project, and the use of the fleet manager FleetExecuter, Faurecia was able to supply their production lines automatically and on demand.

The FleetExecuter offers centralized management and control of all transport units, which makes the transportation process extremely efficient. On this basis, the automated solution allows for just-in-time supply of the production line. Smart orchestration of the vehicles allows the company to avoid material shortages, minimize transportation time and optimize the use of space in the facility.

Production systems

AGVs are a key component in designing flexible production systems. Many companies automate transportation using conveyor belts or roller tracks. If the production system needs to be altered or the material flow needs to be redesigned, however, the conveyor belts would all need to be repositioned. Changes to these fixed points require a significant investment, in terms of both time and money. In addition, individual material flows and customer-specific demands can only be implemented with great effort, because a classic production system requires that all steps in the process be completed.

AGVs, on the other hand, can learn new routes with comparative ease. In a flexible production system, production steps can be skipped or completed in an optimized sequence. This flexibility allows even special orders to be produced with a level of efficiency that is comparable to mass production. But modern transportation systems don't need a standalone infrastructure to make this possible.

With the help of the MHP FleetExecuter, all types of transport systems can be controlled across a variety of interfaces to maximize the efficiency of the pro-

duction logistics. Using this approach, Faurecia is able to ensure flexible, efficient supply of materials to the individual production stations. The company would also potentially be able to integrate self-driving vehicles and drones in their outbound logistics. This means that not only their production system but their entire production logistics can be scaled and operates at optimum efficiency.

A Closer Look at MHP's FleetExecuter at Faurecia

To maintain a cycle time of 60 seconds despite the long distance between the warehouse and the production line, the company installed an additional short-term storage that is saved in the AGV's internal layout. This storage serves as a buffer to compensate for short-term supply fluctuations without endangering the cycle time. The connection with the Manufacturing Execution System (MES) ensures that the prescribed sequence is transmitted to the FleetExecuter.

FleetExecuter also takes care of container management and includes a graphical user interface (GUI) in addition to the control logic. The GUI shows employees which materials from the warehouse should be made available for the AGVs. When calculating the required materials, FleetExecuter takes into account whether the material will be picked up immediately in order to ensure availability of the materials. The ensure the continuous availability of the AGVs, MHP established an opportunity charging concept. This allows AGVs to charge their batteries at various locations in the facility until they are needed again.

Volkswagen:
Centralization and Standardization with the Industrial Cloud

Synergies within the cluster "centralization and standardization" can make systems, processes, and production units more efficient, which can help to optimize entire production facilities. They simplify coordination and planning of in-depth tasks such as the implementation of IT systems. In addition, they reduce the workload in individual areas of the business: redundant tasks are eliminated and the effort required for communication is reduced.

They also offer a standardized basis for developing applications, which is an additional benefit.

Volkswagen developed the Industrial Cloud in cooperation with various partners such as MHP and Amazon Web Services. The goal is to transform production and logistics in the factory of the future: data-driven, autonomous, predictive.

Centralization & Standardization

In-house logistics and warehousing

Volkswagen Industrial Cloud

Production programs

Production systems
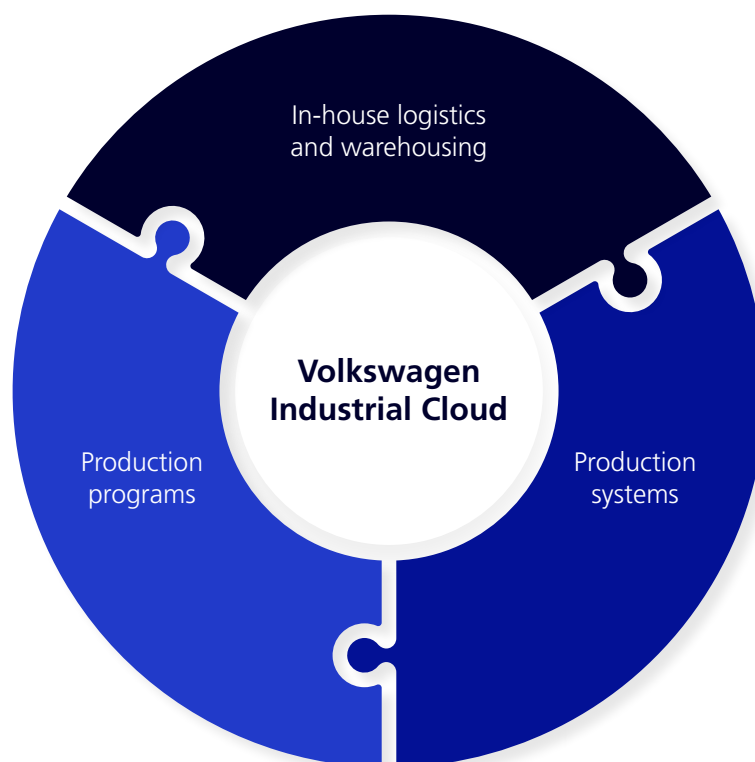
Figure 10: Selected value drivers illustrating the "Industrial Cloud" project

Production program

The production program manages the production of all products within a company. Production volumes, product variants, production timing, production location, and any priorities are captured in the production sequence. External influences such as resource shortages and demand fluctuations make management of the production program, prioritization, and scheduling of individual production orders extremely complex.

A smart production network ensures rapid data transfer and agile production management. As a platform, the Industrial Cloud provides a centralized basis for applications that simplify the digitalization and automation of additional processes within production and logistics. Comprehensive information is stored centrally, and this forms the basis for automated decision-making about how the production program should be carried out (operative production planning). This means that the Industrial Cloud, with its multitude of use cases, contributes to centralization and standardization in production and logistics.

In-house logistics and warehousing

In-house logistics and warehousing have an impact on time, quality and costs. To make efficiency potential and synergy effects apparent, a centralized logistics system can be used. This makes use of logistics data from various supply chains throughout the entire corporation. The prerequisite is an open (data) architecture that unites production and logistics within a central cloud and enables standardized data exchange.

Production systems

Flexible production systems and the products they create generate huge volumes of data – which provides valuable information that can be used to optimize production. Companies can use this information for new production lines and factories, to introduce optimized standards and further increase efficiency. Errors that occur in one production line can be prevented in others.

Networking and the incorporation of various machines and factories, as well as data collection, make it possible to create a digital depiction of individual production lines or even a digital twin of the entire production unit. Networking, the use of different applications, and the centralized architecture can maintain efficiency across the entire production system at a stable level and further improve it.

A Closer Look at the Volkswagen Industrial Cloud

The Volkswagen Industrial Cloud compiles production and logistics data from the Volkswagen's global production facilities. Software solutions using the centralized platform approach are developed by the different departments. The result is that use cases appear all along the value chain, independently of each other. Standardized platform interfaces ensure a unified data infrastructure that makes it possible to perform cross-factory and cross-application analyses.

MHP has worked on this project in several key areas: Alongside project and program development, we are enabling the factories to use the Volkswagen in-house platform by providing support for the technical and general onboarding processes.

To that end, we develop fundamental services in the form of blueprints and make procedural models available. This ensure a quick, effortless connection to the cloud.

With **<u>Industrial Cloud Solutions</u>**, MHP is taking yet another step towards digital transformation. Together with automotive manufacturers such as the Volkswagen Group and Porsche, cloud-based products are being developed to make industrial production processes more efficient, data-driven, and sustainable. The solutions are field-tested right in the factories so that they can later be made available to the external market.

Industrial Cloud Solutions verzeichnet innerhalb des Volkswagen Konzerns bereits weitreichende Erfolge:

- **Increase in efficiency**
  Real-time analysis of production data to identify bottlenecks and potential optimizations. Reduction of downtime; more time spent operating at capacity increases the overall production volume.

- **Improvement in quality**
  Continuous production quality monitoring for early detection of abnormalities increases production quality.

- **Innovation**
  Data-driven production systems allow businesses to make innovative improvements to the production processes that are based on data from multiple facilities and factories.

- **Scalability and flexibility**
  Maximum scalability and adaptability allow for seamless integration of new production facilities and technologies.

The partnership between the Volkswagen Group, Porsche and MHP Industrial Cloud Solutions illustrates how a digital business model can transform the working methods of major automotive manufacturers. Real-time data analyses, improved collaboration and early identification of bottlenecks improve efficiency and product quality, encourage innovation, and pave the way for future developments in the digital transformation.

Benefits of the MHP Efficiency Framework

How Your Company Can Benefit from our Approach

Current trends and geopolitical events disrupt the balance in many companies and increase the pressure on them to maximize the efficiency of their production processes in every way possible. MHP delivers the Efficiency Framework using a comprehensive approach that helps businesses design future-proof production strategies (Figure 11).

Efficient and resilient production design

Measurement and tracking of efficiency and measures

Identification of hidden potential

Specific efficiency cases (measures) can influence the value drivers and help companies to reach optimum efficiency. To that end, it is essential to take a holistic view of the company's particular situation.

Implementing the Efficiency Framework requires a few prerequisites that a project team needs to fulfill with each client. Take the first steps alongside MHP: we will define an individual value driver model to identify the dependencies within the company.

Figure 11 shows how a project might progress.

With our efficiency project, you can identify your company's efficiency potentials at four different levels, create an individual value driver model and implement concrete measures. Contact us for a no-obligation consultation and take the next step forward to helping your company improve its efficiency.

Example Project Approach

I. Analysis of Current Situation

Business dimensions

Analysis of all production-related areas, definition of scope.
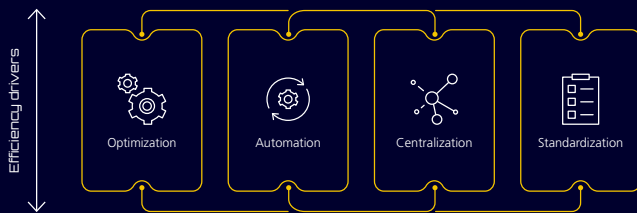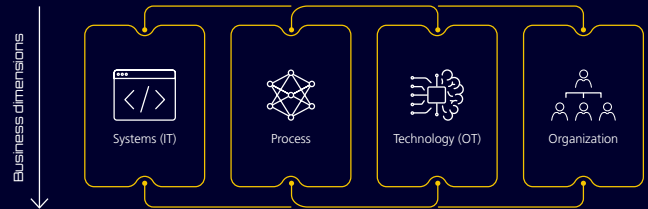
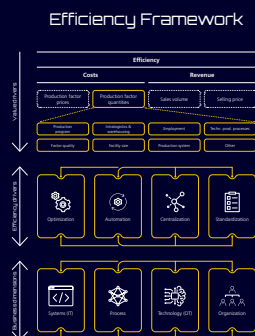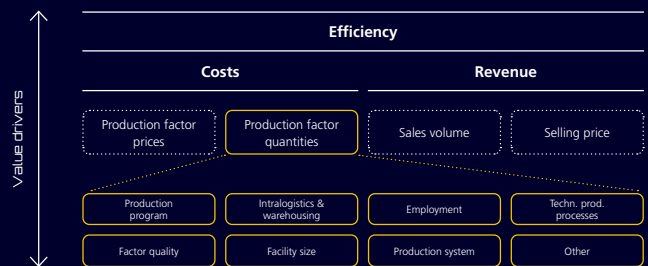
II. Identification

Efficiency drivers

Within the defined business areas, identify possible levers and their potential to increase efficiency.

III. Modeling

Creation of a value driver model

The individual levers and their potential are brought together to create a value driver model.

IV. Implementation

Operative implementation of use cases

Selection and implementation of individual measures to take, based on the expertise gained over many years of working with industrial companies.

Figure 11: The Efficiency Framework's holistic project approach

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