A white paper by **objective partner**

On the path to smart manufacturing

Dynamism and innovation in product digitalisation, through Industry 4.0

Executive Summary

"Connecting machines, people and products digitally unlocks opportunities for companies that were once unthinkable – form real-time transparency to entirely new value chains."

Alexander Gordt,
Head of Industrial Solutions
at objective partner

A. Gordt

The industrial landscape is continually changing. Technological progress and evolving market conditions are driving this change. From the first mechanical looms to modern, highly-automated production lines, humanity has always strived to develop more efficient production methods. We now find ourselves in the fourth industrial revolution, in which the smart networking of machines, products, and people plays an important role.

The current economic and geopolitical challenges require companies to adapt quickly to constantly changing conditions. On top of this, there are regulatory requirements, such as the Battery Passport or the Digital Product Passport, which companies must implement in order to be allowed to offer their products on the market. Innovative solutions must not only be found, but also implemented so long-term and sustainable decisions can be made.
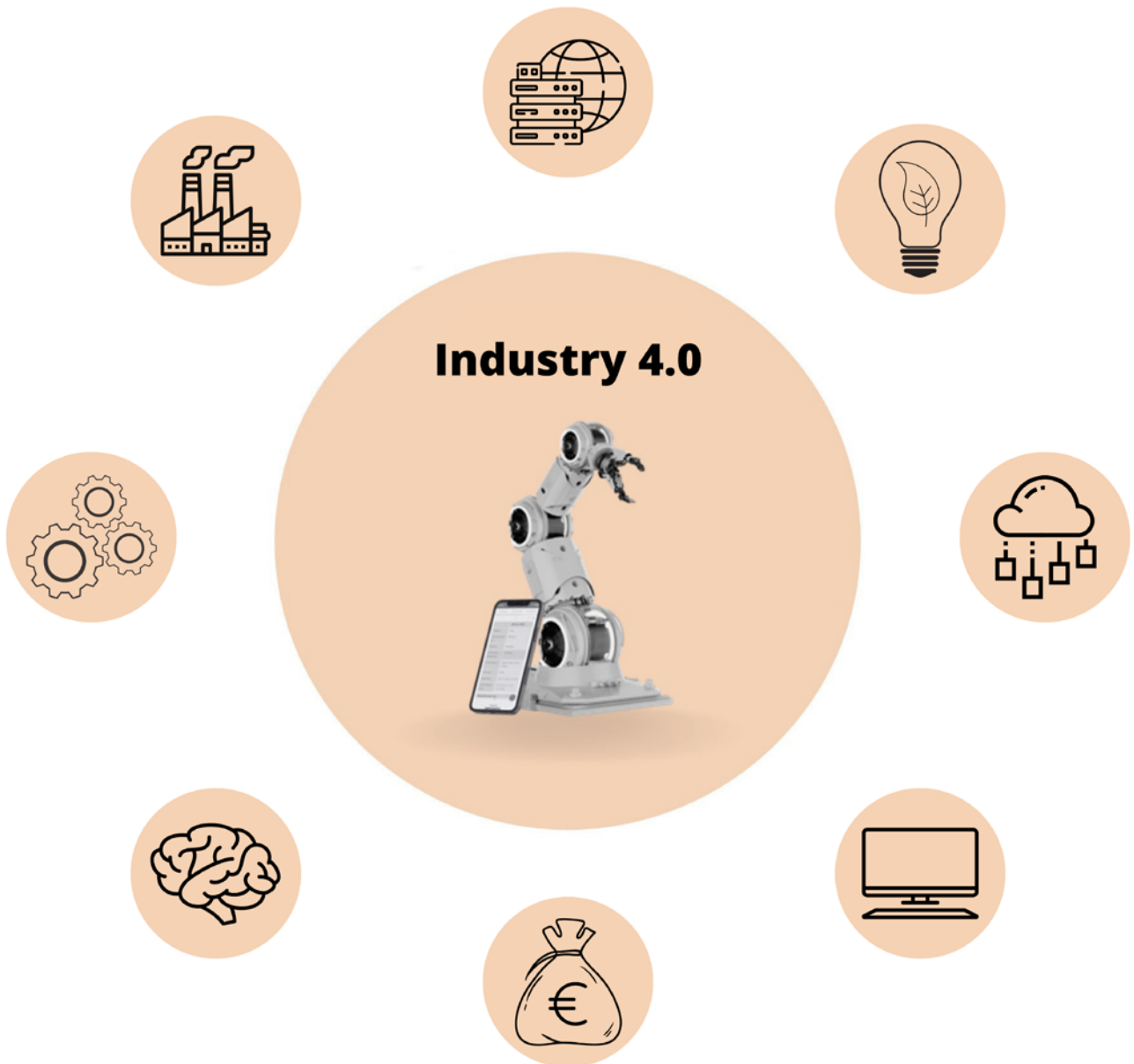
As such, Industry 4.0 is no longer a distant vision of the future, but a reality that must be actively shaped. In this white paper we invite you to join us as we explore the potential of smart manufacturing and Industry 4.0 together.

What you can expect to find in this white paper:
- A specific classification of Industry 4.0
- Challenges and areas showing potential
- A glimpse at the technology behind the buzzword
- Six possible use cases
- Recommendations for your roadmap
- Our service offering

Contents

Industry 4.0

> **Simply put, Asset Administration Shells are digital identity cards for assets.**

01 | Industrie 4.0 – Classification and Status Quo

The "Industry 4.0 Barometer 2024"[1] study conducted by MHP provides valuable insight into the progress of the digital transformation within the DACH region in comparison to other global economic centres such as China, the US, and Great Britain. In spite of the innovative prowess and technological expertise of German industry, there is an urgent need to intensify efforts towards the digital transformation, in order not to lose touch with global developments.

The German Economic Institute (Institut der deutschen Wirtschaft, IW) has repeatedly shown in various studies that companies that use Industry 4.0 technologies can significantly increase their productivity. In addition, the German Federal Ministry for Economic Affairs and Climate Action[2] makes it clear that those companies that consistently implement Industry 4.0 concepts are more successful in international competition and strengthen their market position.

Asset Administration Shells are a central component of Industry 4.0. But what exactly is an Asset Administration Shell (or AAS for short)? It is the digital representation of an asset, i.e. a corporate value or object. The asset can be of a physical nature (e.g. machines, products) or a digital nature (e.g. software, process). The AAS describes the product, complete with its properties and functions for the application case under consideration.

Simply put, Asset Administration Shells are digital identity cards for assets. They store information for the respective application case and enable exchange between devices within a network, and thereby help different systems work together more effectively (for more information on the technology, see the chapter: "Asset Administration Shells The technology behind them"). Asset Administration Shells play a crucial role in the networking of production systems and the integration of data along the entire value chain. They begin on the abstract product type level and are later used on the individual product instance level.

Machines and systems in a company can also be modelled as Asset Administration Shells, which can be used to record real-time data and thus ensure transparency in the production process. Asset Administration Shells not only offer internal advantages such as preventive maintenance, but also support external requirements such as the implementation of a digital product passport. Through inter-company data rooms, data can be forwarded to upstream and downstream companies in an aggregated form.

The analysis of the current state of Industry 4.0 and the significance of Asset Administration Shells show that companies must use these technologies more in order to remain competitive and to overcome future challenges. In addition, through the consistent use of digital twins, investment costs can be reduced and data silos avoided. These integrated digital models enable the more efficient use and administration of resources and promote better data consistence across various corporate divisions. In the next chapter you will learn more about the specific potential and challenges of Industry 4.0 and the use of Asset Administration Shells.

02 | Potential and Challenges

There are countless advantages and areas of potential, however, in our view, the most important of these are:

Increased efficiency: Industry 4.0 has the potential to significantly increase efficiency in production. By networking machines and systems as a basis and monitoring and optimizing production processes in real time, companies can optimize their operating processes and identify bottlenecks at an early stage. This requires a common language basis so that all machines in the network can communicate with each other. One option for this is the use of an asset administration shell in conjunction with BaSyx Enterprise and standardization using IDTA and ECLASS.

Better quality: By using Industry 4.0 technologies, companies can significantly improve the quality of their products. Of course, this assumes that the mapping of the product and the producing machine as Asset Administration Shells for the use case is correspondingly accurate. Based

on this knowledge, production processes can be optimised and error sources can be identified at an early stage.
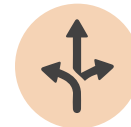
Greater flexibility: Last but not least, we are creating more flexible and agile production through the use of Industry 4.0. This makes it possible for companies to react quickly to changing market requirements. By implementing Asset Administration Shells and the networking of production systems, production lines can be dynamically adjusted. This makes it possible, for example, to manufacture individualized products in batch size 1 in a cost-efficient manner.

For manufacturing companies, the introduction and implementation of Industry 4.0 of course also brings a number of challenges that must be considered in advance:

Security and data protection: Due to the increasing networking of production systems and the exchange of sensitive information, data security and data protection are becoming ever more important. Companies are faced with the challenge of ensuring that sensitive data is protected against unauthorised access and that valid data protection regulations are adhered to.

Shortage of skilled workers: A further obstacle is that posed by cultural change and the need for qualified employees. The introduction of Industry 4.0 requires an adjustment in the working methods and qualifications of employees. It is crucial that employees receive training on the new technologies and that awareness-raising measures are implemented. Experienced employees must pass on their implicitly existing knowledge to their younger colleagues. This can also take place by means of learning machines, which learn based on the behaviours of the experienced colleagues. In addition, a culture of innovation and collaboration must be promoted.

Integration: The vast diversity of technologies and systems in the area of Industry 4.0 presents another challenge. There is a risk that this diversity will lead to the creation of new data silos. To counteract this, intelligent integration is required. Companies must ensure that their systems can communicate with one another and that industry-wide standards are developed and implemented. This facilitates the compatibility and integration of different solutions.

By using Asset Administration Shells, however, you can proactively tackle and overcome these challenges.

03 | Application scenarios for Asset Administration Shells

Even if the individual examples can be implemented without Asset Administration Shells, we strongly advise against it. Without a standardised system, you will create additional data silos, which will have to be linked up again and integrated so that they can communicate with each other. You can save yourself this effort and expense!

3.1 Material Master

Previously, material master data had to be laboriously updated manually – a process that was not only time-consuming but was also prone to errors. Imagine if you could improve the quality of your material data and simultaneously save time and effort. By using Asset Administration Shells, you can establish a seamless connection between the ERP system and other data sources.

The added value for the user is enormous: Reduced effort and higher data quality. The avoidance of media discontinuities represents another advantage. Errors are reduced and efficiency increased. Material data can be directly created and updated within the ERP system – without any manual input whatsoever.
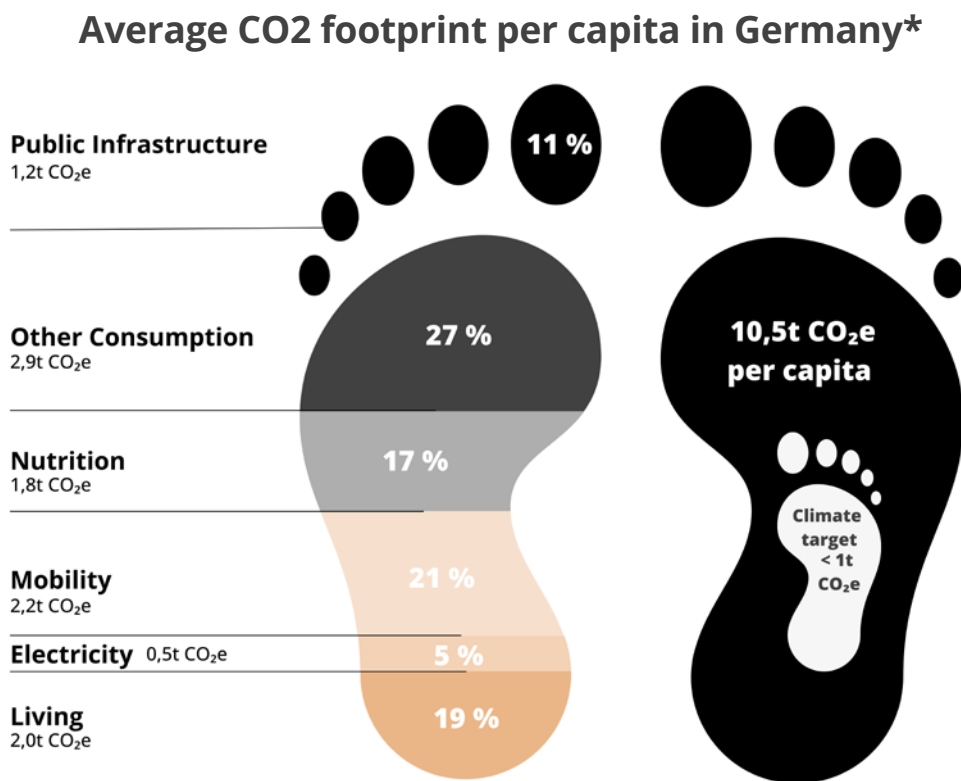
The entire process is accelerated. And there is yet another advantage: The automatic maintenance of handover documentation improves completeness, traceability and documentation. This contributes to a further increase in data quality.

3.2 Ecological footprint

Have you ever asked yourself what your ecological footprint looks like?

A recent study conducted by the German Federal Environmental Agency in 2023 produced the following findings:

Average CO2 footprint per capita in Germany*

Public Infrastructure
1,2t CO_2e — 11 %

Other Consumption
2,9t CO_2e — 27 %

Nutrition
1,8t CO_2e — 17 %

Mobility
2,2t CO_2e — 21 %

Electricity 0,5t CO_2e — 5 %

Living
2,0t CO_2e — 19 %

10,5t CO_2e per capita

Climate target < 1t CO_2e

Now imagine you could accurately measure the ecological footprint of a product rather than relying on estimations. This is no longer just a pipe dream – thanks to Industry 4.0 and Asset Administration Shells it is now reality. They gather information directly from the heart of your production and apply it to the individual product.

Companies can thus calculate the ecological footprint of their products down to the finest detail. And this valuable data does not remain hidden within just one company. It flows on, from one company to another, right along the entire supply chain. The result? A never-before-seen level of transparency and traceability.

The collected data can also be allocated to the categories of the Greenhouse Gas Protocol Scopes 1-3. These categories define different types of greenhouse gas emissions that are considered in calculating the ecological footprint. This enables companies to carry out a standardised and comparable assessment of the ecological footprint of their products.

But the information doesn't flow in just one direction. It is also returns to the suppliers. They can then optimise their production processes and reduce their own ecological footprint. By comprehensively recording and forwarding ecological data using Asset Administration Shells, companies contribute to increasing sustainability along the entire value chain.

The Asset Administration Shells are therefore not only revolutionizing the way we measure the ecological footprint, but are also contributing to a more sustainable economy.

3.3 Onboarding and administration of machines

The introduction of new machines or systems need not be a nightmare.
With Asset Administration Shells, the whole thing becomes a seamless, efficient and error-free experience.

The introduction of new machines or systems can be a bit of a headache. Problems crop up, costs increase. Asset Administration Shells facilitate the integration of new devices into a computerised maintenance management system (CMMS). Manufacturers supply their products with Asset Administration Shells, which enable smooth integration into the CMMS.

Technical data, maintenance schedules, and even the history – everything is already pre-filled. This saves time and minimises errors. Another bonus: standardisation. By using standardised models, product updates can be performed quickly and automatically.

Customers benefit from standardised interfaces. They offer access to important information about the machine, such as status information, utilisation data and measured values. This data can be analysed and evaluated in order to increase the efficiency and performance capacity of the machines or systems.

3.4 Documentation

Most production companies have to manage a huge quantity of information – even with the smallest of production volumes. This is a challenge that is practically impossible to handle manually. Thanks to the use of Asset Administration Shells, there is a solution. They collect important data and distribute it as required. They even document installed parts and thus enable a seamless representation of the supply chain. Suppliers? They also supply their data in Asset Admi-nistration Shells. This documentation is more than just a handover document for customers. It also serves as a means of quality assurance, enabling the tracking of processes and the recalling of products if necessary. Asset Administration Shells also facilitate compliance with legislation. They help ensure the traceability and product labelling required under the German Supply Chain Act (Lieferkettensorgfaltspflicht-gesetz).

And the best part: With Asset Administration Shells, we can dispense with paper documentation. The result is maximum transparency along the entire supply chain. An effective tool that vastly reduces workload and simultaneously ensures quality.

3.5 Transparency & resilience in the logistics chain

Three advantages of transparent supply chains

1	**2**	**3**
Cost & Time Saving	**Resilience**	**Trust & Credibility**
Increased efficiency and lower costs through improved data and collaboration	Identify uncertainties faster and achieve sustainable resilience	Increased trust and credibility with customers and stakeholders

Ready for more transparency and resilience in your logistics chain?

Are you already in the profitable position of knowing the precise location of your goods and being able to accurately predict when they will reach their destination? Is the seamless documentation of your logistics chain feasible? No? With Asset Administration Shells, this scenario can also be realised. They pool all important information and link different systems together.

They integrate tracking standards such as Omlox, which provide real-time information on the location and progress of goods. The result? Companies can track the current status of their shipments at any time and benefit from a high level of transparency along the entire logistics chain.

But that's not all. The collected data can be used for much more than just the accurate prediction of arrival times. It also helps to optimise logistics processes. With the help of Artificial Intelligence, companies can detect bottlenecks or delays at an early stage and initiate countermeasures. They thus increase their resilience against unforeseen events and can design their supply chains more efficiently. Summarised in graphic form, you can read over the most important advantages of transparent supply chains once more above.

3.6 The Digital Product Passport

Sustainability is more than just a trend – it is a necessity. And it's not just about setting green goals, but also about meeting them in the long term. A key to this? Using products for longer. This saves resources and reduces waste. But how can you motivate customers to use your products for longer?

This is where Asset Administration Shells come into play. They also contain information on maintenance and repair. Customers who have access to this information can better look after and maintain their products. This results in a longer service life and reduces the need to purchase new products. A win for sustainability. All of this can be implemented as part of the Digital Product Passport, which will be required by law in the EU from 2027. This passport will make all relevant information pertaining to a product digitally available and thus contributes to increasing transparency and promoting the circular economy.

Asset Administration Shells also offer the ability to create data-driven ecosystems. Companies can use the collected data to develop 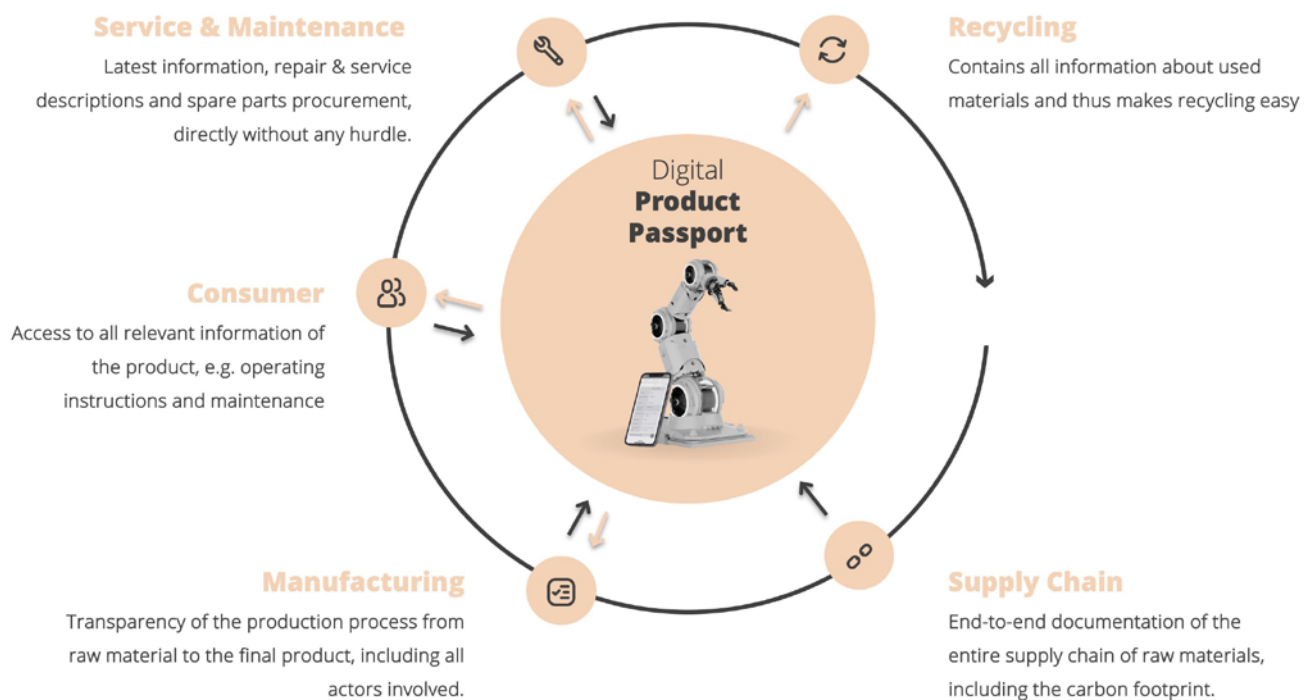innovative services and business models. This goes far beyond mere product procurement. With added-value services, companies can enhance their customer retention and elevate themselves above the competition.

To summarize: Asset Administration Shells are an effective tool with which to ensure compliance with sustainability objectives. They extend product life, facilitate maintenance and repair, and promote the development of data-driven ecosystems. Companies that implement these solutions do more than just fulfil their ecological responsibility; they also remain competitive in the long term

Digital Product Passport: Transparency across the entire life cycle of a product – the cornerstone of the circular economy

Service & Maintenance

Latest information, repair & service descriptions and spare parts procurement, directly without any hurdle.

Recycling

Contains all information about used materials and thus makes recycling easy

Consumer

Access to all relevant information of the product, e.g. operating instructions and maintenance

Digital **Product Passport**

Manufacturing

Transparency of the production process from raw material to the final product, including all actors involved.

Supply Chain

End-to-end documentation of the entire supply chain of raw materials, including the carbon footprint.

04 | Asset Administration Shells – the technology behind them

There exists a need to work more efficiently and more sustainably, not just in production but also in the area of IT. By using a platform based on an Asset Administration Shell, every conceivable use case can be set up easily, cost-effectively and sustainably. And all this without creating any new data silos.

There are three main types of Asset Administration Shells:

» **Type 1:** These provide basic information, which is generally static, such as identification data and technical documentation belonging to the asset. The exchange of information takes place by means of a file transfer.

» **Type 2:** These offer dynamic access by means of service interfaces in order to call up operating data and status information, which may change over the course of time. Here, the exchange of information takes place via an application programming interface (API).

» **Type 3:** These are the most advanced type and offer interactive functions such as control and monitoring options, which enable direct interaction with the asset. Here the assets communicate with one another independently via an Industry 4.0 language.
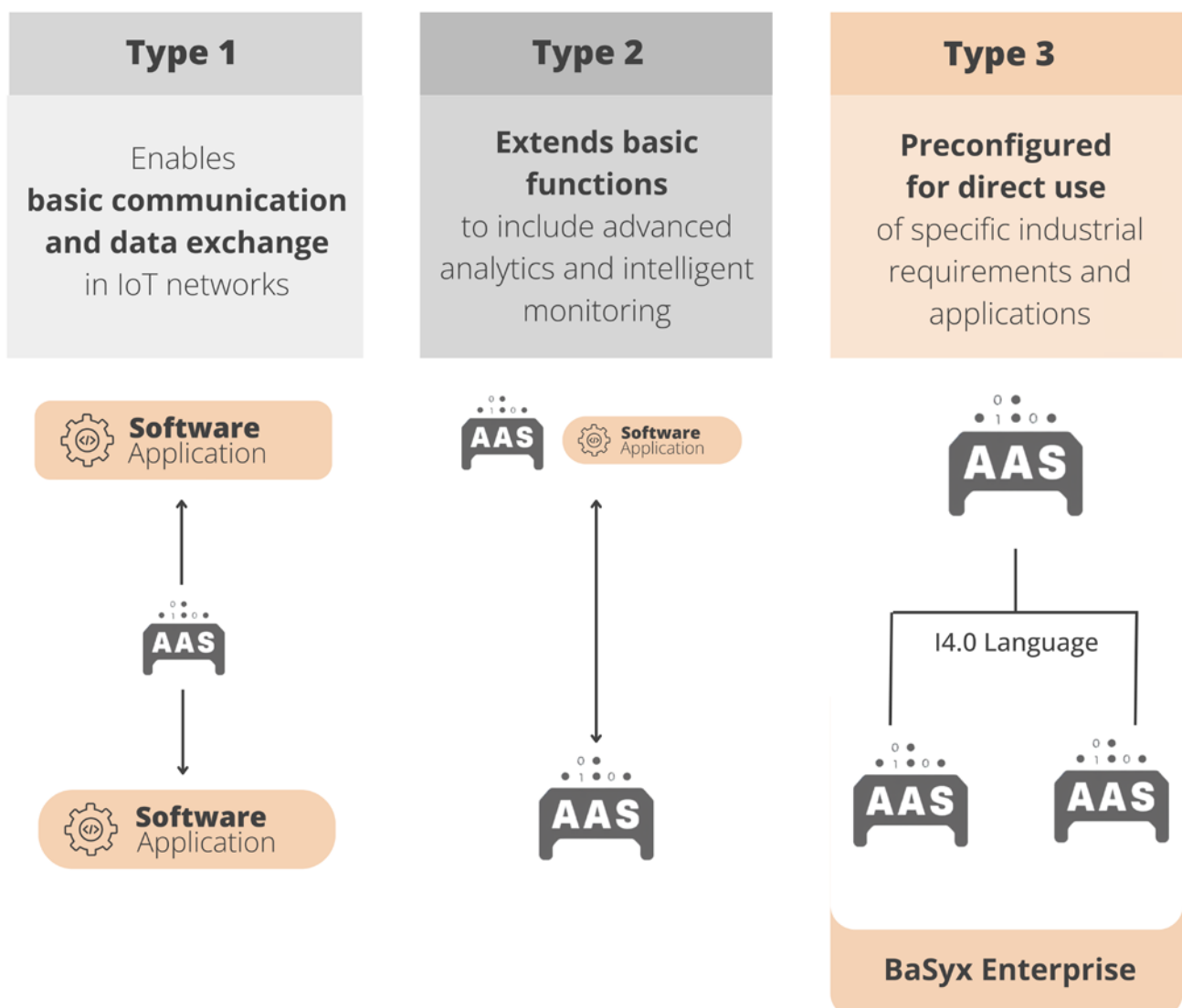
Objects and their Asset Administration Shells can be clearly identified within the system. As such, it is possible to access all of the functions or properties of the asset. So-called submodels form the content of the Asset Administration Shell. They describe content-based or functional aspects of an asset.

Our expert opinion:
The creation of Asset Administration Shells can pose a genuine challenge without the correct support. With our **BaSyx Enterprise** solution, which we developed in-house, we simplify the development, management, and operation of Asset Administration Shells. Thanks to AI, we can also enable intelligent automation throughout the entire process.

Digital Product Passport: Transparency across the entire life cycle of a product – the cornerstone of the circular economy

Type 1	Type 2	Type 3
Enables **basic communication and data exchange** in IoT networks	**Extends basic functions** to include advanced analytics and intelligent monitoring	**Preconfigured for direct use** of specific industrial requirements and applications

05 | **Your Roadmap**

The introduction of Industry 4.0 and Asset Administration Shells within a company requires a well thought-out roadmap that considers both technological aspects and the company's vision and corporate objectives. Your roadmap might look like this, for example:

1 AAS Kickstart
- Creation of Asset Administration Shells for the product catalogue, with Nameplate and Technical Data submodels
- Duration approx. 14 days
- Includes the provision of BaSyx Enterprise and the creation of Asset Administration Shells with remote access.
- Requirements: Product data is available in tabular form, infrastructure will be provided.
- 4-week test period followed by possible switch to licensing model.

2 Assessment of the AAS Kickstart
- Final presentation with stakeholders from the technical departments, IT, and heads of department/management
- Presentation of a catalogue of measures
- Identification of next steps

3 Integration of technical departments and agile development
- Regular meetings and workshops with representatives from the technical departments in order to discuss specific requirements within the technical departments and their progress, and to receive direct feedback
- Application of agile development methods to ensure flexibility in the development process and to be able to react quickly to changes
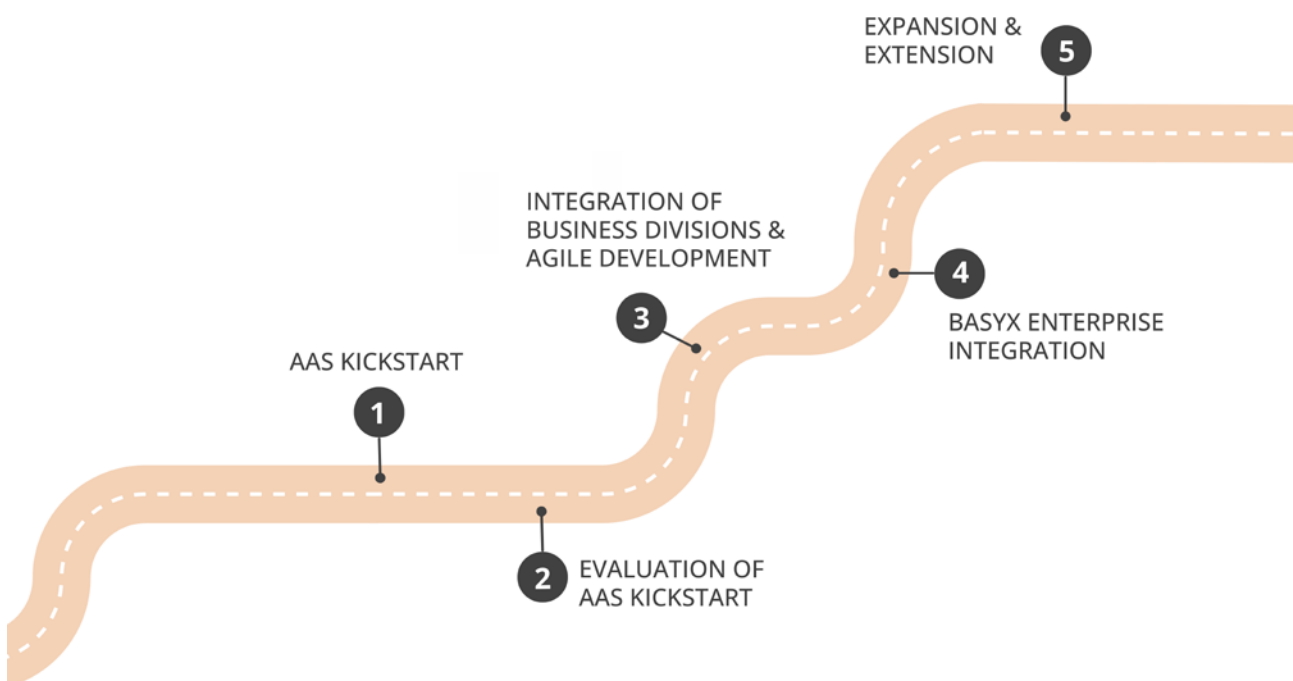
4 **Integration into the company's IT environment**

· Technical preparation and adjustment of the company's IT department to enable the successful integration of the BaSyx Enterprise Asset Administration Shell management system

· Linking of Asset Administration Shells with relevant IT and OT systems to enable comprehensive data collection

5 **Development and expansion**

· Evaluation of the results and experiences from the kickstart and from the agile development

· Planning and implementation of extensions to the functionality and/or expansion to include additional product groups

· Continuous assessment of the technological developments and corresponding adaptation of the strategy

EXPANSION &
EXTENSION **5**

INTEGRATION OF
BUSINESS DIVISIONS &
AGILE DEVELOPMENT

3

4

BASYX ENTERPRISE
INTEGRATION

AAS KICKSTART

1

2 EVALUATION OF
AAS KICKSTART

06 | Summary of Key Facts

Below is a summary of the most important key facts from this white paper, presented once again in summary form:

» **Urgency:** Although European industries boast strong innovative prowess and technological advancement, they still lag behind their international competitors, in particular China and the USA. It is therefore urgent that we work more actively towards the implementation of Industry 4.0.

» **Asset Administration Shells are crucial:** Here, Asset Administration Shells play a key role. They serve as a digital representation of physical and digital assets and facilitate communication and the integration of different systems and data, while also supporting more efficient production processes.

» **Digital twin:** Digital twins and Asset Administration Shells are used together to perform simulations and to predict the behaviour of real objects, which results in more precise and more efficient production.

» **Security:** With the increasing networking of production processes, it is becoming increasingly important that we protect sensitive data and adhere to data protection regulations. This poses a major challenge within the scope of Industry 4.0.

» **Shortage of skilled workers:** The cultural shift and the need to train and develop employees in the use of new technologies are essential in order to reap the benefits of Industry 4.0 to the full.

» **Transparent and resilient supply chains:** Asset Administration Shells enable improved transparency and efficiency in logistics and help you to track and optimise your ecological footprint.

» **Sustainability objectives:** Asset Administration Shells support the extension of product lifespans and assist with adherence to sustainability objectives, which brings not only ecological but also economic benefits.

07 | Our service offering

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We at objective partner would like to accompany you on your journey towards digitalised production. Thanks to the low-threshold introduction to the topic of digital twins, you can gain initial experience within just a few days, and then quickly build on this acquired know-ledge.

Alexander Gordt

We accompany you on your journey to the networked Industry 4.0 – our expert Leon Hinger is available for a free initial consultation.

FREE CONSULTATION

**Alexander Gordt,
Head of Industrial Solutions**
objective partner AG

alexander.gordt@objective-partner.com
+49 172 2931963

Book your free consultation appointment

08 | About objective partner

We have been a successful IT and strategy consultancy for almost 30 years. With our experience and expertise, we can create customised, efficient and digital solutions.

As an agile and project-oriented company, we focus first and foremost on the challenges faced by our customers. We then develop tailored prototypes, which can be quickly tested and scaled up. With Design Thinking and Prototyping Workshops, we solve customer's digital challenges and get ideas up and running quickly. In so doing, we work for medium-sized and global companies (SMEs and LEs) on a cross-sectoral basis, in the following areas:

Industrie 4.0
Today, technology is part of upscaling business models or tapping into new sales revenues. Industry 4.0 offers great potential for this. Using the digital twin as a basis, we develop suitable solutions for you.

AI in the SME sector
AI has the potential to increase efficiency and productivity, to reduce costs, and to open up new opportunities for growth. The possible uses, opportunities, and risks are many. With our AI expertise, you too can exploit the potential for your company.

Custom software development
We realise and scale your digital solution using innovative methods and the latest technologies. Together, we can efficiently and effectively design your custom software solution, quickly generating added value to make it easier for you to react to new developments.

Digital core with SAPP
With SAP S/4HANA as a digital core, efficient processes, transparency, speed, stability and flexibility become a reality. We consider solutions holistically, from SAP S/4HANA transformation to SAP integration & innovation and the customer experience.

Your collaboration with objective partner

SME experts
As an SME company, we understand the SME sector and tailor our solutions precisely to your company.

Local presence
Our employees are deployed and accessible to you throughout all of Germany. You can rely on our expertise and fast response times.

Many years of experience
With almost 30 years of experience in IT consultancy and software development, we are your trustworthy partner – honest and competent.

Collaboration
Our solutions are tailor-made answers to your individual requirements. Together, we will find the best solution for you.

Competitive advantage
Don't fall by the wayside. Use Industry 4.0 to strengthen your competitive advantage – and we'll show you exactly how. Let's drive your success forward together .

Quellen

[1] Section: Industry 4.0 Classification and Status Quo
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https://www.plattform-i40.de/IP/Redaktion/DE/Standardartikel/chancen-durch-industrie-40.html

[3] Section: Deployment Scenarios for Asset Administration Shells / Average CO_2 footprint per capita in Germany
Federal Environmental Agency CO2 Calculator, Competence Centre for Sustainable Consumption: https://www.umweltbundesamt.de/bild/durchschnittlicher-co2-fussabdruck-pro-kopf-in