



Where in the Digitalization Journey is Your Shop-Floor?

Your roadmap to understanding the industry 4.0 maturity index



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Brave New World

Imagine a factory where anyone from any part of the organization can log in to a central system and see what is happening on the shop floor, or anywhere else in the organization for that matter; where information can pass seamlessly from procurement to inventory to production and even to sales and marketing, admin, or finance departments. Imagine complete transparency across the entire manufacturing operation without any productivity-sapping silos or cross-department communication fails. Imagine a factory where data is collected and used so efficiently that accurate predictions are made about future events and processes are automated to boost productivity.

This is no unrealistic utopia; it is the ultimate realization of Industry 4.0 - the fourth industrial revolution wave that is gradually transforming the entire manufacturing industry.

Factories that are Industry 4.0-ready will operate more efficiently and economically while remaining competitive in an increasingly digitalized market.

The problem is getting there.

To reap the full benefit of this industrial revolution, factories must examine their systems, processes, and culture and upgrade them accordingly. This can be a daunting prospect and one that many factories avoid, especially if the status quo is workable. However, with **91% of industrial companies** already investing something in digitalization, staying still is no longer viable.

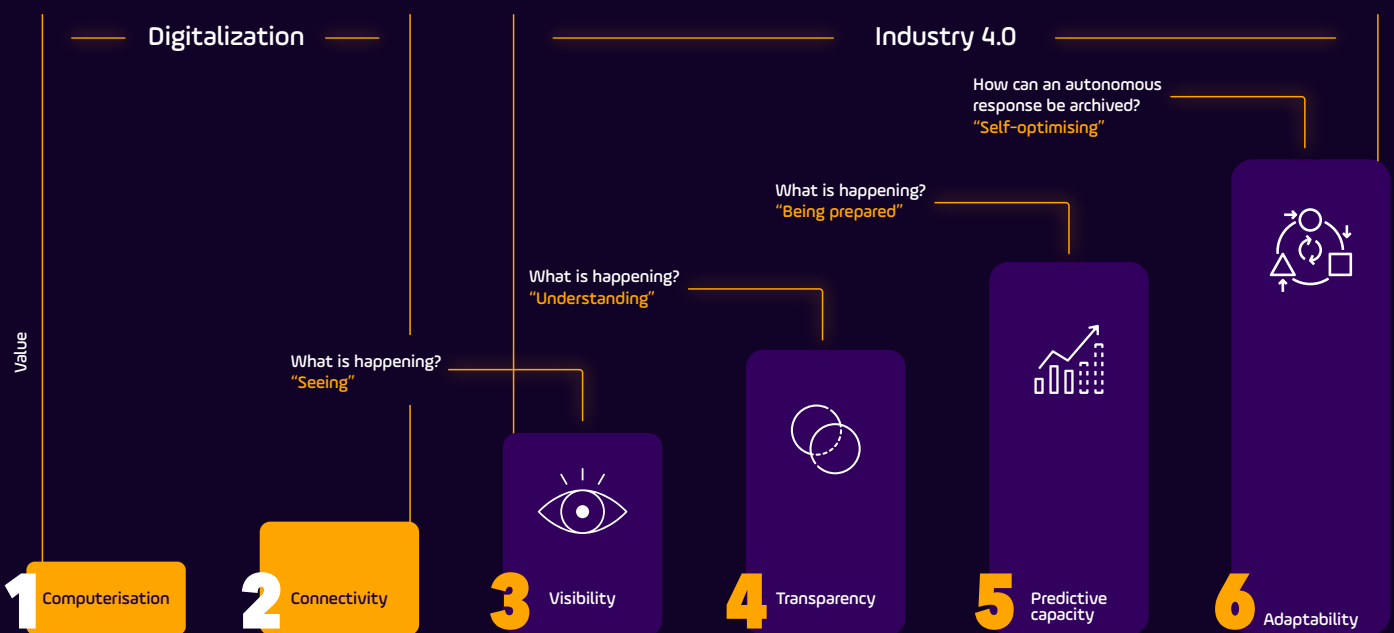


Figure 6: Stages in the Industrie 4.0 development path (source: FIR e. V. at RWTH Aachen university)

“Industrial companies are swamped with information about platforms and technologies - they feel overwhelmed most of the time and do not want to be left behind, but they do not know what is right for their operations.”

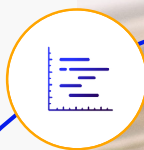
[Ofra Kalechstain, Matics CEO](#)

Like 80% of manufacturers, you may have already taken steps in the right direction. You are likely already using some sort of digital recording system and have onboarded operational technology that connects disparate systems in your organization.

This is just the tip of the iceberg.

The goal is to have ultimate **visibility** into all the processes in your factory in real-time, to achieve **transparency, predictive capacity**, and eventually **adaptability**, and to do this, you will need to make further changes. You may be feeling overwhelmed by an excess of information and confused as to where to begin your transformation.

The good news is that there is information and tools to help you along.



The Right Information

It's impossible to know where you are going without first knowing where you are.

To effectively transform your business for Industry 4.0, you must first evaluate exactly where your manufacturing operation currently stands, and only then can you understand where you have to get to. To then get from Point A to Point B, you need a roadmap, which very few manufacturing organizations have. A McKinsey survey shows that less than 30% of the organizations questioned have an overall Industry 4.0 strategy and even fewer follow a roadmap. It's time to address this flaw.

The Right Tools

According to [McKinsey](#), many manufacturing companies find themselves in the "pilot trap," in which new technologies and Industry 4.0 tools are tried out at one location or on a very small scale but then are never implemented at a wider level. In 2020, 74% of surveyed manufacturers reported themselves in this trap. To break this cycle, manufacturers must be able to clearly articulate their vision for the company's future, understand the challenges they face in reaching that vision, and be open to technologies that can help.

It's that last step that is arguably the most critical - with the right technology, the entire Industry 4.0 process becomes much easier to understand, implement, and then reap the benefits. Once you understand where you are in the process, you can adopt tools and technologies to ease your journey forward. As we take you through the six stages of the maturity index, we

In 2017, a consortium of research and industrial institutions under the umbrella of ACAtech, the German National Academy of Science and Engineering, devised an Industry 4.0 Maturity Index. The model describes 6 levels (or stages) that manufacturing operations must move through on the path to fully realizing Industry 4.0. This ebook outlines the 6 stages and will enable you to evaluate where you currently stand to begin to plot your next steps.

will simultaneously talk about a class of technology known as Real-time Operational Intelligence (RtOI). Solutions that fall under this category aggregate real-time data from multiple sources in your factory and use advanced algorithms to analyze the data within the manufacturing production framework. This contextual analysis of data leads to insights that can help key stakeholders make more informed and better decisions. When used correctly, an RtOI solution will help you implement Industry 4.0 in an efficient, intuitive, and realistic way.

Rather than be daunted by the task at hand, remember that the opportunities created when shifting from siloed, fragmented business practices to a transparent data-driven organizational structure clearly outweigh the risks and hassles involved in the transformation.

Are you ready?



Your Roadmap – The Industry 4.0 Maturity Index

Every ambitious plan needs a roadmap, and that is exactly what the Industry 4.0 Maturity Index is intended to be. Standing at the brink of the next great industrial revolution, a consortium of organizations operating under the umbrella of ACATech articulated the Industry 4.0 transformation process by describing 6 distinct stages that manufacturing organizations must pass through in order to complete the transformation.

Its clearly-articulated stages will help you gain a holistic understanding of where you currently are on the Industry 4.0 spectrum, and understand what needs to happen to attain the next level.

The stages are linear, and each one builds upon the previous one. To transition completely to Industry 4.0 readiness, companies must pass through each stage in **the right order**. In this way, the index makes your journey clear and predictable and can be used to inform your planning process.



The Four Facets of Change

There will always be barriers to overcome when considering any major organizational change. Among the **common barriers to the adoption of Industry 4.0** are:

- Siloed departments and difficulties coordinating across the various business units and ensuring everyone is on the same page.
- Lack of the right talent on the team with the skills necessary to implement Industry 4.0.
- Plain and simple fear of change and taking on something new.

When thinking about digitalization, businesses tend to focus on the technological side and the need to upgrade legacy systems. However, changes must be made throughout the organization, including human resources, organizational culture, corporate structure, communication, and more in order to be long lasting.

To satisfy the requirements for each particular stage, your factory's transformation must be complete across the four facets outlined here:

- **Resources** = human resources and physical resources (i.e., machines, etc.) used in the production process.
- **Information systems** = all processes involved in the collection, organization, storage, and communication of information for effective implementation of industry 4.0
- **Organizational structure** = corporate structure around communication and tasks related to the implementation of industry 4.0
- **Organizational culture** = attitude towards industry 4.0 and willingness across the organization to embrace change

Where Are You?

While transformation should never be a race, it is natural to want to understand how you compare to others in your industry. Despite the clear benefit to be gained from Industry 4.0 transformation, many organizations are lagging far behind:

Industry 4.0 readiness in the manufacturing industry:

80%

of manufacturers are still in stage 1 or 2 - computerization and connectivity, i.e., they use information technology that is connected to other systems in their organization to some extent

24%

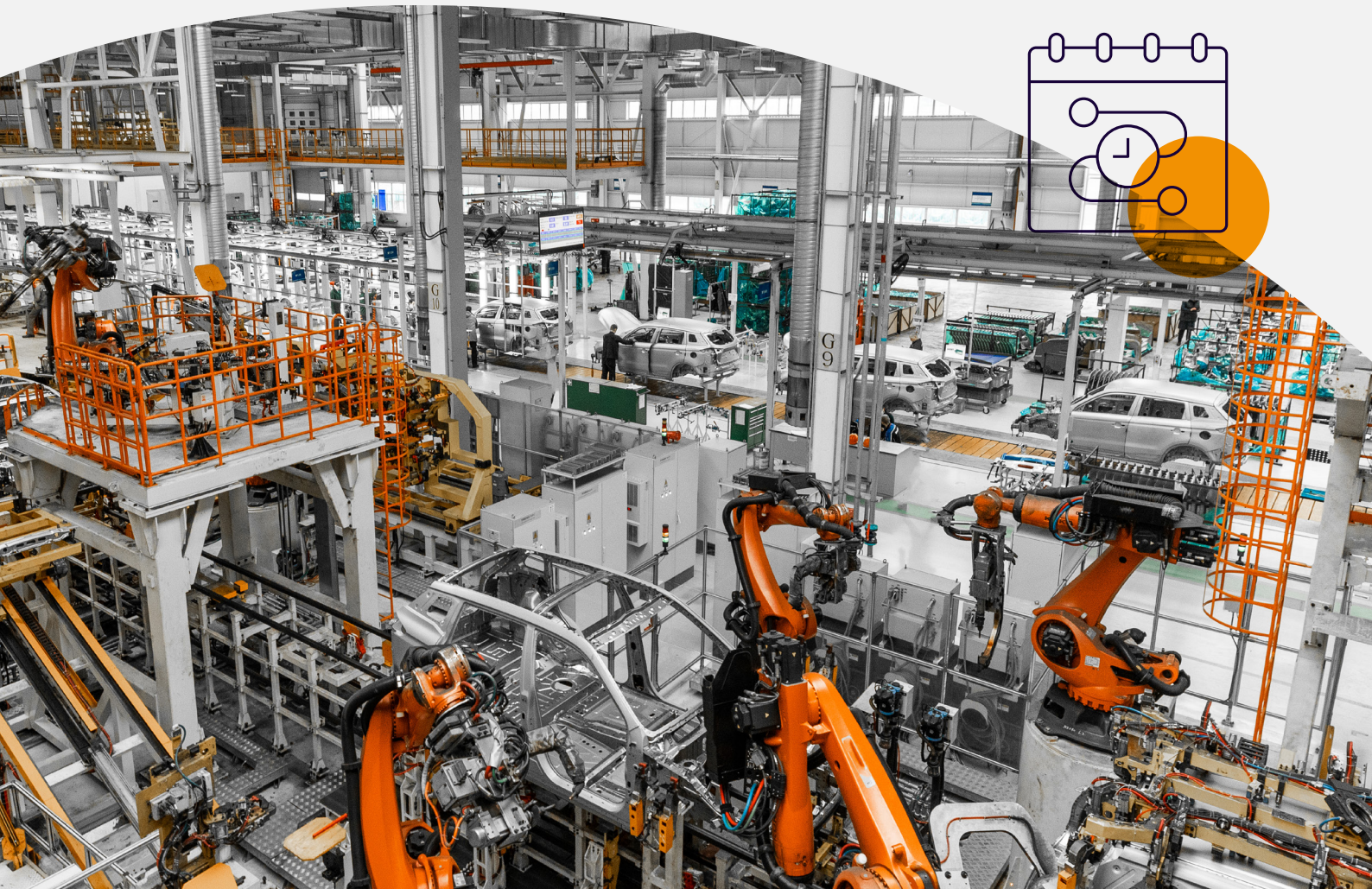
of respondents said they don't even collect data at all (According to a [2020 survey by PEX and Matics](#))

28.5%

28.5% of respondents use real-time analytics as part of their operations

The current slowness to embrace Industry 4.0 across the manufacturing industry may be largely attributed to fear and confusion that results from not having a clear roadmap or information about tools that can assist with the transition.

In the rest of this book, you will gain the clarity you need.



Stage One: Computerization

Things are computerized in different departments, but nothing “talks” to each other.

What is it?

This stage is the foundation of digitalization, and it is one that almost all manufacturing companies have reached. Companies at this stage use some information technologies, especially to perform repetitive tasks more efficiently, but they stand alone and are not fully integrated with other systems. In factories at this stage, some departments might use digital systems for isolated functions such as order fulfillment, procurement, or billing, while others are still manually-based, and the overall organizational structure is still very siloed. Each department is focused on its efficient operation rather than on the organization as a whole.

What’s needed to achieve it?

IT systems adopted in some departments.

What’s the result?

- Repetitive manual tasks are more efficient.
- A higher degree of precision and efficiency is achieved.

How do I know I’m at this stage?

- You use some computerized processes (i.e., devices that process orders on their own).
- You use data processing systems for some tasks.

What are the key challenges in this stage?

The organizational structure is still siloed, with each department focused on its own operation rather than on the organization as a whole.

What are the barriers to reaching the next stage?

- Reaching Stage One is easy, and most manufacturers are already there. Taking the plunge to the next step is a challenge for those with an aversion to change and a fear of the unknown.
- As not a huge jump in technology is needed to get to Stage Two, the major barrier here are culture and attitude.



Stage Two: Connectivity

Some computerized systems “talk” to other systems, but the integration is not complete.

What is it?

More than 80% of manufacturing companies have reached this point. At this stage, the business applications in use are connected to each other and mirror the company’s core business processes, but they are not yet fully integrated into the IT and OT layers of your business. For example, a design that has been created in engineering can be pushed directly to production without human intervention, but no data is collected or analyzed. Companies at this stage are more efficient than before but are still neither agile nor competitive and therefore must prepare to move to the next level.

Culturally, there is a widespread willingness to embrace change; however, traditional project management methods and the organization’s lack of agility mean that the process of change is cumbersome.

What’s needed to achieve it?

Implementation of some IT systems that speak to each other, but the change is not as widespread as it could be.

What’s the result?

- Production processes are more efficient.
- Data is passed automatically from one department to the next - i.e., once a design is created in engineering can be sent to production and confirmation recorded in the MES.

How do I know I’m at this stage?

- You have systems that connect and speak to each other.
- Your MES or ERP system is connected to some of your other systems
- All your core business processes are supported by technology.

What are the key challenges in this stage?

- The “pilot trap” - beginnings of experimentation with new technology but no scaling-up.
- Lack of agility and inability to enact real change to existing processes.

What are the barriers to reaching the next stage?

- Existing business processes include traditional project management methods, and creation of change is cumbersome.
- No system in place for collecting data.

What tools can help me advance?

Real-time Operational Intelligence (RtOI) solutions gather real-time data from machines, humans, sensors, and ERP, MES, or other information systems in place, and provide unified visibility into the full picture of what is happening in the factory at any given time. This “single source of truth” allows you to easily transform data into action.

An RtOI solution can integrate with all existing systems and ensure that they all work together.



Stage Three: Visibility

Sensors gather data from multiple touchpoints across the organization to create a digital shadow and inform decision-making.

What is it?

At this stage, data comes into the equation and forms the first building block to the later, more transformational, stages. Companies that have reached the visibility stage use sensors to capture data related to business processes in real-time. Widespread use of data capture technology enables the creation of a snapshot of the entire company rather than just individual areas. Using data capture technologies creates a “digital shadow,” depicting what is happening in the company at any given time and allowing management to make decisions based on accurate real-time data.

What’s needed to achieve it?

Sensors that can capture processes from beginning to end with large numbers of data points.

What’s the result?

- Events are recorded in real-time throughout the entire factory floor and the rest of the company.
- Digital shadow provides continuous visibility so decisions can be based on real data in real-time.

How do I know I’m at this stage?

- You use systems and tools to collect real-time data.
- You use sensors to collect data from key machinery.
- You use a system to create a digital shadow.
- You base key decisions on actual data.

What are the key challenges in this stage?

Decisions may be based on data, but there is often a lack of context, making it difficult to prioritize the next steps.

What are the barriers to reaching the next stage?

No process for sharing data efficiently with the relevant people - there is plenty of data, but different stakeholders require specific information to make decisions, and there is no way to ensure that the right information is getting into the right hands.

What tools can help me advance?

An RtOI system provides contextual meaning to the data analysis. It ensures that data is prepared and processed in a way that makes it easy to understand and use, sifting out the irrelevant information and presenting the right people with the right information in the right format.

An RtOI solution gathers real-time data from machines, humans, sensors, and ERP, MES, or other information systems, and provides unified visibility into the full picture of what is happening in the factory at any given time. The real-time and comprehensive visibility provided by an RtOI solution can help you collect real-time data from across all types of machinery as well as human inputs. In this way, it can be used to create a “single source of truth” and allows you to easily transform data into action.



Stage Four: Transparency

Analytics are applied to data to derive deep insights and begin to make predictions.

What is it?

At the transparency stage, companies can analyze captured data and use it to understand why certain things are happening on the shop floor and in the wider organization. This is achieved through the new “big data” technologies that can process and analyze large volumes of data.

Greater understanding leads to greater transparency across the entire manufacturing process. At this level, serious and complex data analysis takes the data that’s become visible in stage 3 to the next level.

What’s needed to achieve it?

Advanced engineering and data analytics, including AI and machine learning capabilities.

What’s the result?

- Decisions are not based on historical data alone.
- Predictive maintenance starts to become possible.

How do I know I’m at this stage?

- You have and use data analysis tools.
- You use data in your decision-making process company-wide.

What are the key challenges in this stage?

Knowing how to create real value out of the data analysis conducted.

What are the barriers to reaching the next stage?

Lack of ability to accurately predict future events makes it difficult to plan ahead.

What tools can help me advance?

An RtOI solution continuously compares current activity to past performance and industry standards, and issues an alert as soon as there is an indication of a deviation. Advanced algorithms make it possible to predict events before they happen so that you can be well prepared and take preventative action.

An RtOI system provides contextual meaning to the data analysis. It ensures that data is prepared and processed in a way that makes it easy to understand and use, sifting out the irrelevant information and presenting the right people with the right information in the right format.



Stage Five: Predictive Capacity

Data analysis is used to predict and plan for future events

What is it?

This is the stage where the fruits of earlier labors begin to pay off. The ability to predict and plan for future events is dependent on the groundwork that came before. Once data has been collected, a digital shadow has been constructed, and analytics are used to derive insights, the next step is to simulate different future scenarios, identify the most likely ones and adequately prepare for them.

A natural follow-on from being able to anticipate future developments is the ability to make more informed decisions and implement appropriate measures in good time. Organizational and cultural changes must occur within the company to ensure that there is a readiness to respond to these insights and take full advantage of this new predictive capacity.

What's needed to achieve it?

More complex systems that analyze big streams of data and identify patterns that can be used to predict future scenarios.

What's the result?

- It's easier to plan when you know what's going to happen.
- Decisions can be based on anticipated future developments.

How do I know I'm at this stage?

- You implement things like predictive maintenance.
- You have discussions about taking action to minimize the potential negative impacts of anticipated future events.

What are the key challenges in this stage?

Having the right processes in place and employees trained to use all of the technology efficiently and to be able to respond immediately to calls to action when necessary.

What are the barriers to reaching the next stage?

Openness to letting automated processes take over for human involvement in certain situations.

What tools can help me advance?

Smart manufacturing solutions that analyze multi-source data in real-time and are able to identify trends help manufacturers predict events before they happen. This ensures that manufacturers are well prepared for whatever happens and are able to take significant preventative action to ensure operations are streamlined.



Stage Six: Adaptability

Fully adaptable and able to respond rapidly to a changing business environment and delegate decisions to automated IT processes

What is it?

This is the climax of the Industry 4.0 transformation at which a company has attained the highest level... until more new technologies are introduced. This is the "continuous adaptation" stage in which certain decisions are automatically delegated to IT systems. A direct result of the predictive capacity developed in stage 5, this stage enables fast responses and rapid adaptation to changing business environments. Adaptability requires the full cooperation of management and willingness to "let go" and let technology make decisions.

What's needed to achieve it?

Successful achievement of the first 5 levels, especially predictive capability.

What's the result?

- Certain decisions are outsourced to IT systems that adapt to changing business environments as quickly as possible.
- The system controls itself autonomously and self-adjusts to new circumstances in real-time.

How do I know I'm at this stage?

Congratulations - you've reached the highest level! You have automated systems that react autonomously to different circumstances.



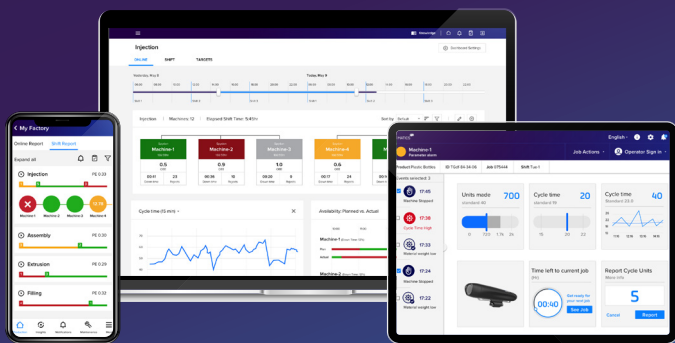
Over To You

Although the benefits of a complete transformation to Industry 4.0 are clear, it is up to each company to decide the strategy that best meets their business goals and the stage which will best support those goals. In most cases, this will involve striking a balance between the costs, capabilities, and benefits while taking into account your company's individual circumstances and targets.

The advantage of the Industry 4.0 Maturity Index is that it provides a clear means by which to evaluate your current status and your future targets.

While not necessary in the first two stages, Real-time Operational Intelligence solutions provide real value when climbing into stage three and beyond. Deploying the right solution will enable you to benefit from data capture, analytics, and advanced prediction and decision making with low hassle and greater efficiency. What's more, an RtOI can adapt and grow with you as you progress through each stage.

Book a demo with Matics to learn more about the Matics RtOI solution for manufacturers.



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