

Management Summary of the Report:

Identifying and understanding gaps in the implementation of Industrie 4.0

While much has been said and written about the companies pioneering implementation of Industrie 4.0, far less attention has been paid to those that are not introducing digitalisation measures as quickly as expected. There is a knowledge gap in this regard – very little is currently understood about the reasons for these companies' slower rate of implementation. There are two explanations for why a company may be lagging behind with implementation of Industrie 4.0. The first is that they may have taken a conscious decision not to digitalise (certain aspects of) their business. Alternatively, they may be hindered by internal, company-specific factors or external factors in their industry or macroenvironment.

To gain a better understanding of the extent of the digital transformation and how it is developing, a more in-depth analysis is required of the barriers and factors holding back implementation of Industrie 4.0 measures and activities. This report seeks to drill down into the causes of the gaps in Industrie 4.0 implementation. The report provides answers to the following research questions:

1. Which companies and industry segments have not yet been reached by measures and activities geared towards implementation of Industrie 4.0 or are not really engaged in implementing the digital transformation?
2. What are the structural, company-specific, product-specific and market-specific reasons for this, and what are the transfer barriers to implementation of digitalisation projects?
3. Should the fact that some companies are not proceeding with digitalisation simply be interpreted as a failure to keep up with developments in digital technology, or can it be seen as a company-specific strategy that reflects their particular circumstances?
4. Which measures can accelerate digitalisation, especially in small and medium-sized enterprises (SMEs), and which evidence-based policy options can help to achieve this?

The report also investigates the following research question in the light of the ongoing COVID-19 pandemic and the resulting collapse in companies' sales and revenue in 2020:

5. How has the COVID-19 pandemic impacted companies' Industrie 4.0 strategies and implementation of the digital transformation?

To answer these research questions, the report begins with a review of the literature on existing barriers to digitalisation. This provides the basis for a series of semi-structured interviews with representatives of employer and employee organisations, and subsequently also with representatives of manufacturing companies. The identified barriers to digitalisation and transparent reasons for not proceeding with it are then correlated with different company characteristics. Finally, the report formulates a series of recommendations for policymakers, industry organisations and companies,

together with suggestions for further research. The methodology used for the report was based on grounded theory.

The report's findings reveal that companies have to contend with both strategic and operational barriers to implementing Industrie 4.0. One key strategic barrier is a *lack of momentum to start the digitalisation process*. The reasons for this include a lack of enthusiasm for digitalisation among management and a lack of psychological and competitive pressure to change in companies with a sound financial position. Companies often fail to formulate an appropriate digitalisation strategy because they *lack the strategic expertise and do not clearly evaluate the benefits* of digital projects. Almost all companies suffer from *capacity shortages* during the Industrie 4.0 implementation phase because they do not have or are unable to recruit employees with the necessary digital skills. Moreover, many companies lack a strong digital culture. In addition to *internal problems*, the digital transformation can also be hindered by *unfavourable external conditions* associated with an inadequate funding landscape and the absence of appropriate standards and norms.

Conscious, transparent decisions not to proceed with digitalisation are mostly taken on the grounds that digital solutions are *not cost-effective*.

Whether and to what extent a company is affected by particular barriers is strongly correlated with its headcount, customer structure, type of production and various other characteristics of its business. The most significant and interesting correlations are summarised below:

- Factors that hold companies back **regardless of their specific characteristics** include a lack of clarity about the benefits of digitalisation, a lack of expertise in digitalisation project implementation and a lack of the necessary information and operating technology. The inadequate funding landscape is also a barrier to all but the largest companies.
- The fact that **SMEs** are focused on short-term success means that they tend to reject digitalisation solutions on the grounds that they are not cost-effective. Financing problems can also be a barrier for these companies. In addition, there can be a lack of psychological and competitive pressure to change, especially among single and small series manufacturers, but also among volume producers. This results in a lack of momentum to start implementing digitalisation measures.
- Barriers for **medium-sized and large-scale enterprises** include a lack of enthusiasm for digitalisation and resistance to change among management, a lack of awareness of the opportunities offered by digitalisation and a lack of clarity regarding responsibility for strategic development. As a result, it is these companies that are worst affected by the consequences of not having a digitalisation strategy.
- The barriers for **large-scale enterprises that have already made significant progress with digitalisation** include data protection and data

security concerns, as well as legal restrictions and uncertainty regarding the expansion of their digitalisation activities.

- On the other hand, **companies that are just beginning their digital transformation** have to contend with different levels of digitalisation among their value network partners, and a lack of standards and norms that constitutes a significant entry barrier for digitalisation projects.
- The digital transformation of **companies that are economically or financially dependent** can be held back by the fact that they have little control over the measures implemented.
- **Companies in structurally weak regions** still face the problem of inadequate ICT infrastructure, leaving them unable to access sufficient bandwidth or implement redundant network security measures.
- **A comparison of different industries** reveals that companies in the trades sector and manufacturing industry tend to have made less progress with digitalisation than companies in e. g. the automotive and electrical engineering industries.

The COVID-19 pandemic has caused major financial challenges for many companies. However, the study found that the pandemic is not expected to have a detrimental impact over the longer term – most of the companies interviewed did not think that the coronavirus crisis will fundamentally affect their digitalisation strategy and activities. Indeed, some of those interviewed even reported positive effects, for example a growing awareness of the need for digital solutions. Nevertheless, a shortage of cash caused by the pandemic did bring some individual digitalisation projects to a complete halt.

The report presents a series of **recommendations for businesses, policy-makers, industry organisations and actors involved in implementation.**

Geared towards overcoming barriers and accelerating implementation of Industrie 4.0, the recommendations are divided into the following six areas:

1. All companies must build a strong **digitalisation culture** shared by everyone from trainees to top management. Employees at every level must recognise the need for digital solutions and be able to contribute their own ideas. It is vital to ensure that even sceptical employees are included. Good communication is key to the rapid and efficient implementation of digitalisation measures.
2. **Digital education** and lifelong learning about digitalisation must form an integral part of all training programmes, professions and careers. In the long run, this will strengthen support for digitalisation and digital skills among both management and the workforce.
3. Digitalisation requires clear **accountability at the highest management level** and a long-term corporate strategy with clear objectives.
4. **New methods of evaluating the benefits** of digital solutions are needed, over and above traditional cost-benefit analysis. Standard industry-wide digital solutions should be adopted in order to improve their cost-effectiveness.
5. Government **funding** for digitalisation should **place greater emphasis on implementation**. In order to achieve rapid digitalisation of the full spectrum of German industry, funding must be made available to a much larger number of companies.
6. An **industry-wide innovation environment** that complies with European data protection standards can help companies to identify and implement digital trends.

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