

DiDaT “Rough planning” for vulnerability area 03

SMEs, digitalization and digital data

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1. Subject matter, objectives and system analysis

1.1 Developing SMEs’ capacity to participate in the digital value chain: from analysis to socio-technical innovations

The vulnerability area SMEs and digital data examines the unintended side effects (unseens) of digitalization for SMEs. Particular attention will be paid to the negative effects resulting from the interactions of ownership, economic value, access and use of digital data.

This holds true in particular to small and medium-sized enterprises (SMEs)¹, the traditional backbone of the German economy. Type and scope as well as procurement, creation and distribution processes have already changed to varying degrees. For example, with regard to differences in the effects and the extent of digitalization, a distinction can be made between

1. SMEs that (primarily) use data (1a) and SMEs that generate data that can be passed on to other companies to optimise their processes, products or services (1b),
2. SMEs without (2a) and SMEs with direct interaction with end customers (2b), such as print media and companies in the advertising industry.
3. (Primary) manufacturing SMEs (3a) and service SMEs (3b), and

¹ According to the EU definition (EU, 2003), companies with 249 or fewer employees and a turnover of up to €50 million are regarded as SMEs. In practice - and in the context of DiDaT - enterprises up to the order of magnitude of 1.000 or even more coworkers understand themselves as medium-size companies or also as KMU.

4. SMEs in different economic activities or sectors with a similar product and/or service focus, e.g. according to the well-known NACE classification of the EU: agriculture and forestry (A), mining (B), manufacturing (C), electricity, gas and steam supply (D), water supply (E), construction (F), etc. or more detailed (see <https://ec.europa.eu/eurostat/ramon/nomenclatures>).

Many SMEs (e.g., IT system houses and other digital service providers) even represent an interesting dual role with regard to the effects and extent of digitalization, as there are on the one hand drivers of digitization for other SMEs by promoting digitalization processes. But, on the other hand, SMEs are also internally strongly affected by changes in digitization (e.g., with regard to the organization of internal processes or the qualification requirements of employees).

In our understanding, SMEs are small enterprises and companies up to the size of approx. 1.000 employees. The working group starts under the premise that SMEs represent a kind of valuable good and backbone of the German economy. Thus, keeping the viability of SMEs is seen as an important objective.

Digitalization, i.e. the representation of objects and processes in form of digital information that can become subject of algorithmic processing, causes disruptive transformations in many parts of society, economy, and all areas of life. Digital data today has become as a resource and a monetary, tradable good (commodity), which in particular represents a basis for automated processes of production and

various services. Different professions and economic sectors of SMEs are largely redesigned and/or even dissolved by artificial intelligence, big data analytics, GPS-based autonomous driving, big data analytics-based analysis and the IoT technologies, including 3D/4D printing. In the course of this, new economic sectors, products and services are emerging that can be taken over by SMEs. Digital manufacturing, for example, enables manufacturing companies to significantly improve quality and efficiency through end-to-end processes (from design and engineering, through production and shipping, to application and remediation). Platform economics may endangering retailers and other domains of SME as the best

While many publications, studies and guidelines have pointed out the necessity, the possibilities and the rapid implementation of a digital transformation to SMEs, DiDaT will investigate the undesirable and unexpected side effects (rebound effects) of this transformation. In addition, suitable measures will be developed to enable SMEs on the one hand to benefit from digitalization and on the other hand to be prepared for the threats and risks of digitalization.

The WBGU report commissioned by the Federal Government (2019), for example, shows that digitalization not only strengthens the competitiveness of SMEs but also poses threats and

risks. It points out that the digitalization of procurement, production and sales processes now enables many SMEs to obtain goods more cheaply from faraway value-added partners via data exchange, and that this shift means not only a considerable increase in environmental pollution in the medium term, but also a substitution of value added by these faraway partners. The German Federal Minister for Environment Svenja Schulze, for example, fears on the basis of this example that digitalization could thus become a "fire accelerator for the ecological and social crises of our planet". It is therefore a major objective of this project to identify not only the numerous opportunities offered by digitalization but also these threats and risks for SMEs – which are often not recognised in good times – and to consider which measures can be taken to reduce this vulnerability.

The aim of the DiDaT working group *SME, Digitalization and Digital Data* is to describe socio-technological innovations that help SMEs to deal appropriately with the changes and negative effects of digitalization. To this end, we start with an identification and analysis of the origin and nature of the Unseens and the negative effects of digitalization. We distinguish between the company and its environment.

Human species	
Supranational systems	Digital Infrastructure Providers
Human society	
Institutions	
Organisation	
Commercial	Non-commercial
Group	
Small group	Internet group
Individual	

Table1: Levels of a human systems and new layers in the turn to the digital age, (yellow) shaded new levels with the rise of globalization and digital technology (taken from Scholz, Helbing, Kley, & Parycek, 2019).

In Figure 1 (below), the two right-hand columns represent the organizational level and the human resources of companies. With regard to the environment, we differentiate between the market and its actors and processes as well as the framework actors. We thus consider five levels of actors or human systems in industrial society (see Table 1 above). In addition to the individuals (some activities of individuals can be regarded as part of the organizational level, e.g., the activities during their working hours), the commercial organizations, we consider authorities (institutions and other bodies that regulate the market) and society (i.e. the constitutional, legal, cultural, etc.),

regulatory systems and politicians and their decisions). On the other hand, the actions (e.g. support programmes) of politicians or changes in the legislative system in parliament represent important bases for the actions of SMEs.

The European Union is a typical example of a Supranational System as it has the power to penalize its member states.. Scholz et al. (2019) argue, that in the course of the digital transition, Digital Infrastructure Providers (DIPs) are also seen as a supranational system that largely govern basic infrastructure processes and functions and thus have become a supranational actor. The Big Five (Google, Amazon, Facebook, Apple, and

Microsoft) provide a major share of the foundations of the infrastructure, i.e., the storage, transfer (e.g., mail dispatch), access (including search machinee), and processing (e.g., in the context of cloud uses) of digital data. This digital infrastructure is only provided under limited control and supervision by the German political system (i.e., the "German Society"). For this

reason, Figure 1 shows not only supranational institutions (EU, which lays down equally important regulations for the activities of SMEs) but also digital infrastructure providers. The data and the digital infrastructure thus represent a foundation (at all levels) of the activities of SMEs in the post-industrial society, partly determined by the same actors.

Vulnerability Spaces				
	Framing Actors	Market-Actors	Organizational Actors	Human Resources
Trends: Threats/Oppor- tunities (results from the round tables)	1. Legal regulations internally felt as a threat	4. Sharing Economy	9 Reorganization of the organization	10. New/other employee qualifications (also in IT sys-tem houses)
	2. Online trading platforms	5. Industry 4.0 Production networks	4. Sharing Economy (Uber, AirBnB)	11. Surveillance Power (surveillance capi-talism)
	3. Dependence on cloud providers (in product, price, etc.)	6. IoTization (system of system)	5. Industry 4.0 Production networks	
	12 Allocation of data usage rights	7. (Big) Data Analytics	6. IoTization (system of system)	
			7. (Big) Data Analytics	
			8 From „Lean Production“ to „Lean Collaboration“ (agility based short time collaboration)	
	12 Allocation of data usage rights			
	13 Surveillance Power			
Digital Data, Algorithms, and digital networks as basic structure (Digital Structure)				

Figure 1: Important changes or threats by digitization for actors of different levels

1.2 Vulnerability analysis instead of risk assessment

The vulnerability concept is of particular importance for the work in the DiDaT project and in the KMU und digital data working group. The vulnerability of an SME in the course of the digital transition is defined as a function of (1) sensitivity, (2) exposure and (3) adaptive capacity to digital changes and threats.

The sensitivity is determined by Unseens (here events or conditions that have negative effects without appropriate adjustments and changes on the part of the SMEs). These include the competitiveness (due to market losses, poor cash flow or lack of suitably qualified employees) and

the viability of the company, e.g., if no suitable adaptation measures are found.

By exposure we mean the probability with which such an impact will affect a company or a sub-sector.

And adaptive capacity is the ability of SMEs to adapt to negative effects (e.g. reduced order volumes in printing plants). In order to define strategies for the development of adaptability, SMEs and digital data are first identified and structured in the impact area VR03 Unseens.

In the first step, we will analyze the areas of organization and market in the components production, organization and transformation management as well as value proposition and

customers, following Michal Porter (2001) and the action field analysis of Gimpel et al. (2018, see section 2). We will then discuss changes in human resources management and potential changes in framing (framework actors).

In a final step, we will then describe a series of processes and examples for Unseens that allow us to understand the specific processes, causes, affected parties, etc. unseens. These examples can be found numbered in *Figure 1*. The examples were developed in a study on vulnerability and adaptation strategies of organizations or were

derived from the practical experience of the members of the VR03 working group. The examples will serve to illustrate which adaptation measures SMEs have to take and which socio-technological measures are necessary to ensure the viability of SMEs.

All work in the VR03 working group relates to the following key question, which is to be formulated in a discursive process between science and practice by the end of the year (beginning of the main phase, second stakeholder conference):

Guiding Question:

What changes and threats (*unseens*) of digitalization cause vulnerabilities for what type of German SME (e.g., domains of craft, commerce and industry)?

What *unseens* result for SME from interaction between unfavorable relations between ownership, economic value, use, and access to digital data.

What adaptive capacity (e.g., in integrative data analytics) and new competences (including security management) are needed to keep short-, medium, and long-term competitive power with large-scale firms.

2. Which unintended side effects are of interest and why?

The following vulnerabilities have been identified.

<p>1. SMEs have considerable difficulty in implementing and complying with the legal regulations internally. The German economy is still struggling with the basic data protection regulation. Almost one and a half years after the start of application, two thirds of the companies (67 percent) have at least largely implemented the new data protection regulations. Only a quarter (25 percent) has completed the implementation of the DSGVO" (20.09.2019 https://www.it-daily.net/analysen/22381-zwei-drittel-der-unternehmen-haben-dsgvo-umgesetzt). Some CRM databases deleted customer data, as well as personal data of employees for not violating the new legal rules of data protection, i.e., DSGVO.</p>
<p>2. Online trading platforms hold a monopoly position in various areas. The global platforms have unique market knowledge and compete in lucrative business areas with SME tasks.</p>
<p>3. Dependence on cloud providers (in product, price, etc.) Cloud providers closely bind SMEs to their services by contract. Cloud infrastructures are expanded into proprietary systems. The more IT infrastructure is moved from SMEs to the cloud and restructured, the more dependent they become on these providers, because it takes a great deal of effort to switch to other providers or even rebuild their own infrastructure. They can change products and services as well as their prices and conditions of use according to their own strategy.</p>
<p>4. Sharing Economy Processes (Uber, AirBnb, etc.; with sometimes high digital transaction fees) pose acute threats to the existence and profitability of some SME sectors (taxi companies, overnight accommodation). By what means can a positioning be secured while maintaining the quality of the (service) performances?</p>
<p>5. Industry 4.0 Production networks Industry 4.0 is a complete digital representation and management tool for entire production chains. SMEs are part of this process, but usually not the controlling variables. This is expressed by the metaphor "extended workbench".</p>
<p>6. IoTization Many craft enterprises are digitalized and products modularised (within the framework of IoT networks). This leads to innovations in the area of interface management becoming an essential object of the viability</p>

of companies. In the craft sector, energy optimization can be taken as an example through integral solutions for heating, window construction (including ventilation and lighting control) and electrics.
7 (Big) Data Analytics Economic processes become more competitive through the use of digital production data (e.g. when machines are used), company-internal organizational processes, market processes etc. In order to remain competitive, SMEs must acquire a variety of data analysis skills (including big data).
8 From „Lean Production“ to „Lean Collaboration“ (agility based short time collaboration) The use of collaboration tools (e.g., Microsoft 365) enables new forms of collaboration across hierarchies and departmental boundaries. Consequence: Reduction of hierarchies? Middle managers obsolete?
9 Reorganization of the organization SMEs must adapt to the concepts (see e.g., agilization), processes and IT systems of their large enterprise customers. Therefore possible overstrain by scope and variety of changes, depth and speed of necessary organizational restructuring and lack of necessary knowledge (human resources bottleneck).
10 New/other employee qualifications (also in IT system houses) The use of IT systems as well as algorithms and data analytics is changing the roles of employees in almost all areas and consequently also their requirement profiles. Many tasks can be performed by computers. Examples: The classic bookkeeper has had its day; market research is done by algorithms; machine operators become machine supervisors. IT system houses, for example, have recognized that they have to offer much more consulting services in terms of processes – even in general in terms of innovation possibilities – instead of just installing IT systems technically.
11 Human resources monitoring create anxiety of employees Chefs can "track" the screen work of their employees in real time and control it precisely. Younger employees are used to delivering thousands of data to data collectors every day via social media. What is normal for them in their private lives can, however, become a problem for the same people in the company. Older employees are more likely to have control anxieties and, as always, find creative ways to trick these digital controls.
12 Allocation of data usage rights Concepts such as Industry 4.0 enable access to all data in the production and value chain. Which data remain in the sovereignty of the end producers, all participants, SMEs etc.?
13 Surveillance Power (surveillance capitalism) Surveillance capitalism is a system (according to S. Zuboff , 2014) that "uses the personal data collected from human beings by technical means to collect information about behaviours, analyse them and prepare them for market-economic decision-making in order to generate behavioural predictions and profits from their use". https://de.wikipedia.org/wiki/Überwachungskapitalismus

Table 2: List of unintended side effects

A key intermediate objective is to develop a grouping (classification) of the vulnerabilities (risks) for SMEs arising from digitalization and the mechanisms underlying them. On this basis, adaptation strategies (adaptive strategies) and action programmes (social and technological

innovations) which are useful or even necessary for the successful positioning of SMEs.

To this end, we have included the vulnerabilities in Figure 1 (page 3). A detailed description of the 4 rooms can be found in Appendix.

3. Which stakeholders are of particular importance for understanding and managing the "Unseens"? Which scientific fields of knowledge are relevant?

A simplified system model for SMEs as part of an increasing digitalization process will result in the following areas where knowledge should be available:

- New digital products/product ranges: Which transformations will be necessary (e.g., from car mechanics to carchatronics technician)?
- New digital internal processes: What consequences does industry 4.0 have on internal company processes (e.g. in

accounting, administration, monthly statements, digitalized expense reports/recording of receipts
<https://www.lexoffice.de/funktionen/belegerfassung/>, online recording of production, etc.)?

- For companies that do not produce end products for the consumer: How is the interface to suppliers/consumers changing? Which personal interfaces remain via face to face/telephone? Where can SMEs get access

digital processes better/more efficiently?
What do the models of Industry 4.0 look like?

- What special features do IT companies show?
- Data
- What role do industry-specific platform economies play?
- For companies, for consumers additionally: What significance does sales via platforms such as Amazon etc. have for the industry?

Table 3: Stakeholder groups. The 3 most important stakeholders per vulnerability area are marked in yellow

Stakeholders in the vulnerability areas or fields of action

Stakeholders in the "Framework Actors" field of action			
	Perpetrators	Persons concerned	Problem solvers
	National and international legislators	All SMEs	Trade associations
	Platforms	Especially B2C-SMEs	SME-Networks IT-Systemhouses and management consultants
	IT-Infrastructure-Provider	All SMEs, the smaller the more dependent	National and small Cloud-providers IT-Systemhouses and management consultants
Representatives	NN	Lothar Probst (IHK)	Dr. Wolfgang Hofmann (Systemhouse) NN

Stakeholders in the "Market players" field of action			
	Perpetrators	Persons concerned	Problem solvers
	<ul style="list-style-type: none"> • Platforms • Automators, AI-Providers • IT-System houses • IT-Provider • Enterprise customers 	<ul style="list-style-type: none"> • All SMEs In particular, manufacturing SMEs in B2B 	<ul style="list-style-type: none"> • Strategy consultants/-Coaches • IT-Systemhouses and management consultant • Trade associations • Chamber of Industry and Commerce • Innovation consultants
Representatives	<ul style="list-style-type: none"> • Dr. Wolfgang Hofmann (System house) • NN 	<ul style="list-style-type: none"> • Lothar Probst (Chamber of Commerce and Industry) 	<ul style="list-style-type: none"> • Dr. Wolfgang Hofmann (System house) • Lothar Probst (Chamber of Commerce and Industry) • NN

Stakeholders in the field of action "Organizational actors"			
	Perpetrators	Persons concerned	Problem solvers
	<ul style="list-style-type: none"> • Platforms • Automators, AI-Providers • IT-System houses • IT-Provider • Enterprise customers 	<ul style="list-style-type: none"> • All SMEs Especially, manufacturing SMEs in B2B 	<ul style="list-style-type: none"> • Strategic Organizational Developers • Coaches and trainers • IT systemhouses and management consultants • Trade associations • Trade unions
Representatives	<ul style="list-style-type: none"> • Dr. Wolfgang Hofmann (System house) • NN 	<ul style="list-style-type: none"> • Lothar Probst (Chamber of Commerce and Industry) 	<ul style="list-style-type: none"> • Dr. Wolfgang Hofmann (Systemhouse) • NN

Stakeholder of the Action Field „Human Ressources“			
	Perpetrators	Persons concerned	Problem solvers
	<ul style="list-style-type: none"> IT-System houses IT-Provider Topmanager 	<ul style="list-style-type: none"> In all SMEs, especially middle managers and employees, but also top managers themselves 	<ul style="list-style-type: none"> Coaches and Trainer Chamber of Commerce and Industry Trade associations Trade unions Law makers
Representatives	<ul style="list-style-type: none"> Dr. Wolfgang Hofmann (System house) NN 	<ul style="list-style-type: none"> Lothar Probst (Chamber of Commerce and Industry) 	<ul style="list-style-type: none"> Lothar Probst (Chamber of Commerce and Industry) NN
Still missing Representatives	<ul style="list-style-type: none"> Platforms IT-Infrastructure-Provider Automator AI-Provider Topmanager 		<ul style="list-style-type: none"> Trade associations Trade unions

Table 4: Originator, affected persons and problem solvers in the vulnerability areas or fields of action

4. Methodological considerations to support core statements (in-depth research)

There are great uncertainties, fundamental unpredictability about the upcoming changes in areas of German SMEs through digitalization, the depth of change, the speed of change, the negative (and positive) impacts and the measures to be taken by SMEs.

Against this background, it makes sense to conduct an expert based, formative scenario analysis for the change of two or three different SME industries, in which 3-4 digitalization scenarios are created for each

industry. Building on this, innovation/intervention scenarios can then be constructed, the impact of which on KPIs can even be estimated (semi-)quantitatively.

This would have a formative effect for the working groups, since future scenarios would then be jointly formed on the basis of examples, the given and non-existent adjustment possibilities of the SMEs (sectors) would be described and thus a basis could be given for further framing and support of the SMEs.

5. Expected results and follow-up initiatives

In the note book for SME the group will

- outline the main processes and economic changes that SMEs have to respond to,
- give examples of selected industries are used to learn what adaptive capacity SMEs need to have,

- show in which areas corporate strategies and socio-political decisions can help SMEs to adapt and where disruptive changes occur that need to be countered appropriately.



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