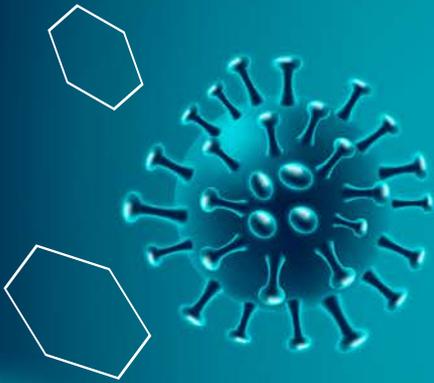


RESEARCH COUNCIL



Expert Report of the Research Council of the Plattform Industrie 4.0
Value Networks in Times of Infection Crises
Short Version

The **Research Council of the Plattform Industrie 4.0** is a strategic body that independently advises the Plattform Industrie 4.0, its working groups and the German federal ministries involved, particularly the Federal Ministry of Education and Research (BMBF).

As a sensor of recent development trends, the Research Council observes and evaluates the performance development of Industrie 4.0 and sees itself as an initiator of future research topics as well as a facilitator or advisor for the implementation of Industrie 4.0. In doing so, the Research Council focusses on the following **topics in the context of Industrie 4.0**:

- Value networks
- Technological enablers
- New methods and tools
- Work and society

This is where the expert reports of the Research Council come in. Against the backdrop of the thematic fields, clearly defined problems are identified, research and development needs are defined and options for action for the successful design of Industrie 4.0 are developed.

The content of the expert reports is the responsibility of the respective authors. All publications of the Research Council that have been published so far are available at <https://en.acatech.de/project/the-research-council-of-the-plattform-industrie-4-0/>.

Resilience in value networks

Against the backdrop of increasingly complex and inter-connected value networks and in times of constantly changing framework conditions, companies increasingly focus on the importance of a resilient design of their value networks. The high degree of interconnectedness in a value network creates strong interdependencies between the actors. Disruptions therefore often not only impact individual companies, but also affect various actors in the value networks. If a disruption occurs, it can spread throughout the entire network. One strategy to ensure performance in a volatile environment is to build resilience: value networks should be designed in such a way that they are affected as little as possible in the event of a disruption and can quickly return to their original state or a better one.

This expert report shows companies measures and options for action aimed at rendering their value networks more resilient.

Building resilience encompasses the resilience strategies **robustness** and **agility**. By increasing robustness, the resilience of the value network is enhanced in such a way that disruptions are less likely to affect a company’s performance. Agility refers to the ability to respond quickly to unpredictable disruptive events. This expert report looks at four drivers for robustness and agility:

Status quo of today’s value networks

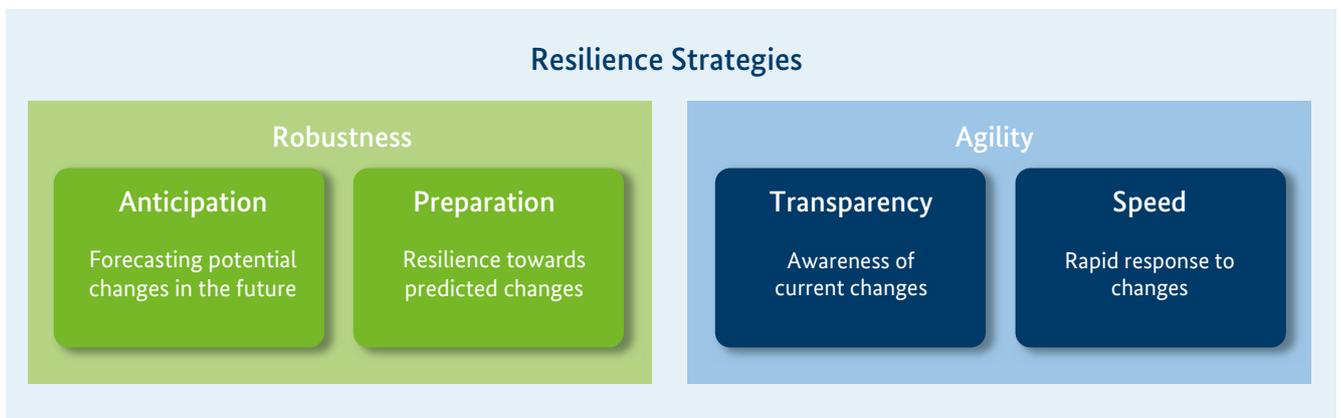
The empirical results¹ illustrate that many of the surveyed companies and their value networks are currently prepared inadequately for crises and the disruptions they cause. The effects of disruption affect all parts of a value network. In a comparison of the different impacts, the company-internal production processes as well as the procurement and sales areas of the value network were found to be affected. What is particularly striking is that in the context of the COVID-19 pandemic, almost half of the companies surveyed even experienced far-reaching consequences such as production standstill, short-term plant closures or liquidity bottlenecks.

In addition, the survey results illustrate the potential for building up the resilience strategies **robustness** and **agility**. About every second company still sees room for improvement in the implementation of the necessary features.

Different measures exist for the practical implementation of resilience strategies, many of which are already being considered by companies, are individually implemented or scheduled for short- and long-term implementation. There is hesitation particularly in the use of Industrie 4.0 technologies to increase resilience.

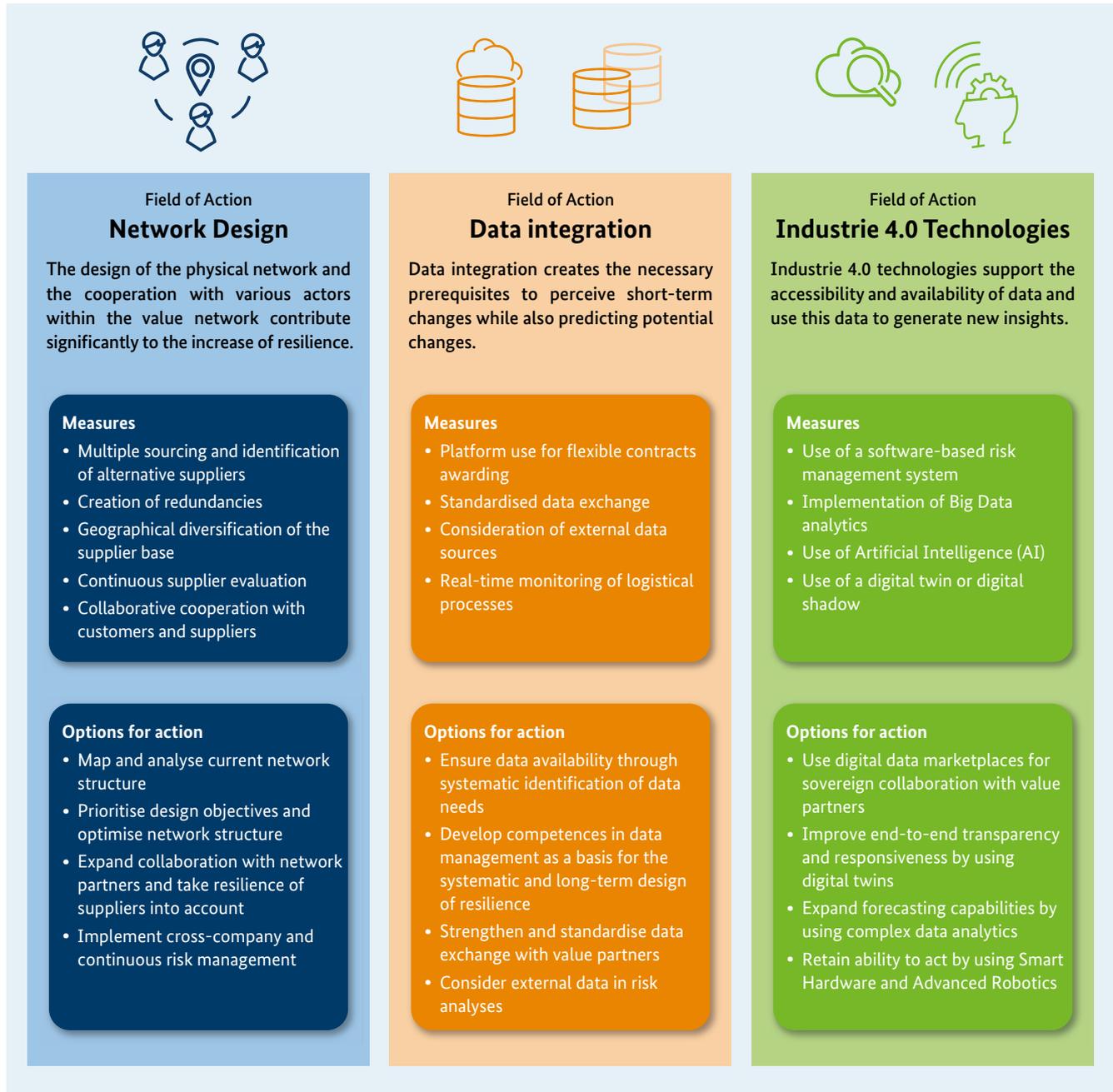
The measures and specific options for action to increase resilience in value networks can be divided into three fields of action: **network design**, **data integration** and **Industrie 4.0 technologies**.

Strategies and drivers for building resilient value networks



1 Quantitative online survey of 117 representatives of manufacturing companies, supplemented by interviews with 20 experts

Fields of Action to Increase Resilience



The potential of available measures is not yet exhausted by most companies, especially concerning the use of Industrie 4.0 technologies. Overall, it becomes clear that companies and their value networks are not sufficiently resilient yet.

The following table shows the positive influences of the options for action on the resilience drivers anticipation, preparation, transparency and speed. Due to interactions between the four drivers, the options for action can also have an impact on other drivers that are not indicated.

Options for action and their impact on the resilience drivers

		Anticipation	Preparation	Transparency	Speed
Network Design	Map and analyse current network structure	✓		✓	
	Prioritise design objectives and optimise network structure		✓		
	Expand collaboration with network partners and take resilience of suppliers into account	✓	✓	✓	✓
	Implement cross-company and continuous risk management	✓	✓	✓	✓
Data Integration	Ensure data availability through systematic identification of data needs	✓		✓	
	Develop competences in data management as a basis for the systematic and long-term design of resilience	✓		✓	
	Strengthen and standardise data exchange with value partners	✓		✓	
	Consider external data in risk analysis	✓		✓	
Industrie 4.0 Technologies	Use digital data marketplaces for sovereign collaboration with value partners			✓	✓
	Improve end-to-end transparency and responsiveness by using digital twins	✓		✓	✓
	Expand forecasting capabilities by using complex data analytics	✓	✓	✓	✓
	Retain ability to act by using Smart Hardware and Advanced Robotics		✓		✓

Responses to crisis situations

In addition to the long-term design of resilience, short-term responses in crisis situations contribute to securing the performance of companies. Therefore, a framework for the systematic derivation of response tactics in times of crisis was therefore developed as part of this expert report. In addition to deriving responses in a crisis, the framework can also be used to prepare for possible crises by proactively analysing scenarios and preparing responses. Various possibilities for companies exist to remodel their value network, to become participants in a new value network and to enter new markets.

The response tactics cover the areas of **procurement**, **internal production** and **sales**.

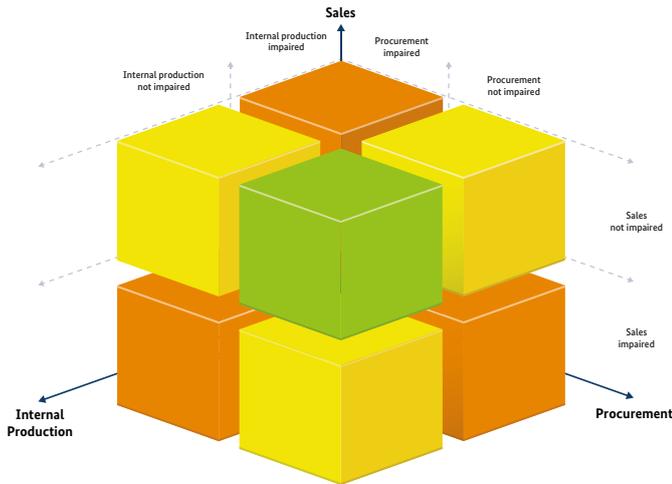
1. **Procurement** includes the parts of the network which ensure the supply of raw materials and intermediate products. The actors of the procurement-side value network – and strategic partnerships with them – represent important potentials for response tactics in the procurement area of a value network.

2. **Internal production** describes those aspects that are involved in the actual production of the product within the framework of a company’s internal value creation. The core competences used for internal production create process and technical know-how, which can be used in crisis situations to mitigate disruptive effects.

3. **Sales** focuses on the market-serving area of the network and includes sales and product demand. For the sales side, markets and market accessibility offer various options for responding to a crisis. Here, a new target group for an existing product can be developed or a new product can be marketed to a new or existing target group to mitigate disruptive effects.

By classifying a company into this three-dimensional framework along the axes of procurement, internal production and sales, possible response tactics are identified.

Framework for deriving response tactics in times of crisis



The following table shows an overview of the response tactics; for matching each tactic with the respective cube in the framework, please see the long version of this expert report. By combining different response tactics, a company can address different fields in order to efficiently minimise the disruptive effect of a crisis.

In addition to deriving responses in a crisis situation, the framework can also be used to prepare for possible crises by proactively analysing scenarios and preparing responses.

Overview of Possible Response Tactics

No.	Response Tactic	Brief Description
1	Internal organisational changes	Restructuring of internal workflows and processes to restore organisational structures temporarily impaired by the crisis
2	In-house production of required resources	Securing production capacity through self-supply with critical resources
3	Shifting the focus within the existing product portfolio	
3a	Shifting the focus to another manufactured product from the existing product portfolio	Capacities are used for another manufactured product within the existing product portfolio
3b	Focussing of services	Capacities are used for the expansion of services already offered for existing products
4	Product diversification	
4a	Product diversification with slightly modified product (category within existing product portfolio)	Expansion of the product portfolio by a new product that is directly related to product categories in the existing product portfolio
4b	Product diversification with a new product (without characteristics similar to existing product portfolio)	Expansion of the product portfolio by a new product that is not directly related to the existing product portfolio
5	Production capacities	
5a	Purchasing production capacities	Use of production capacities of other actors (contracted and commissioned production)
5b	Selling production capacities	Unused production capacities are released for use by other actors (contracted and commissioned production)
6	Substitution of materials and intermediate products	
6a	Adjustment of the real net output ratio within the company	Adjustment of the real net output ratio, resulting in changes in the demand for materials and intermediate products (insourcing and outsourcing)
6b	Use of alternative materials and intermediate products	Substitution of materials and intermediate products used in production by procuring comparable materials and intermediate products. The company's real net output ratio remains unchanged.
7	Adjustment of inventory management	Short-term adjustment of requirements and tolerances for inventories
8	Procurement of materials and intermediate products from alternative suppliers	Use of alternative available suppliers for the procurement of materials and intermediate products
9	Market development by opening up additional and sub-markets	With the existing product portfolio, an additional market or sub-market is developed regarding new target groups. A new submarket can be developed, thus expanding the existing target group, or an additional market with a new target group can be developed.

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