

Federal Ministry of Education and Research

Call for Proposals

Dynamic Value Creation Networks in a Turbulent Environment - Making Manufacturing Companies Resilient (Resipro)

within the Research Program

“The Future of Value Creation – Research on Production, Services and Work”

dated April 24, 2023

(Excerpt)

1 Funding Objective, Funding Purpose, Legal Basis

In the industrial context, resilience is defined as the ability to handle external pressure and disruptive incidents so that the company's ability to act, its success, and thus, its existence is secured. Resilience concerns the entire production system and company organization and is therefore a core competence of the company.

Achieving and maintaining resilience is a continuous strategic process that is closely linked to early detection. The management of networked production and product-service systems relies on implementation strategies, such as agility, adaptation, and innovation, as well as on instruments developed in these contexts, for e.g. Early Detection, Modular System Planning, Reversible Performance Levels, Technology and Data Sovereignty, etc. A particular challenge arises for companies when they are part of value creation networks. In this case, resilience does not only refer to the company itself, but also to the supply chain and the entire value network. Companies are forced to establish cross-divisional and cross-industry collaboration structures, to organize data availability, and to define and allocate roles in the value creation system, or to integrate themselves in existing structures.

However, networking aspects and the use of modern technologies alone are not enough to ensure resilience in companies: The competences of employees and continuous human resources and organisational development are also critical factors for a robust, resilient

company. Employees who are qualified to think in systems and scenarios help to safeguard the value network as a whole.

1.1 Funding Objective

This funding initiative of the Federal Ministry of Education and Research (BMBF) aims to secure the competitiveness of enterprises by the use of resilience management instruments. The funding initiative is in the context of the Federal Government's strategy for the future in research and innovation policy and of measures already taken by various ministries with respect to digital transformation and Industry 4.0. It addresses currently open issues and needs to push R&D on the resilience of industrial companies. It aims at effectively supporting industry, science, and society in acting in an ecologically and socially compatible and economically successful way.

The funding initiative's objective is to achieve resilience in industrial companies, value chains and networks and to enhance and ensure their resilience and their ability to act quickly as such.

Suitable forms of resilience are to be researched, developed and made widely usable for each individual company as well as for value creation networks. At the highest level of resilience, value networks and their partners are in a position to learn from adverse events and developments that have taken place and to generate advantages for the future.

According to the company- or network-specific framework conditions, competences for crisis management must be built up, business models must be made more flexible, robust and trust-based value creation networks must be established and secured, sustainability must be developed, systems must be made resilient and decision-making capacity must be increased. This can be accompanied by a strengthening of technological as well as digital sovereignty. In addition, the advantages of regionalization can be balanced with the requirements of Europeanisation and global orientation in a sustainable way.

Resilience in a trusting environment also requires a shift in thinking away from short-term efficiency orientation towards advantages of highly productive alliances of several enterprises. In this connection, secure information transparency and guaranteed safety factors will play an important role. Development of innovative holistic and systemic solutions, together with their prototype implementation and validation in various applications or use cases, will be required. Resilient value creation is an essential economic factor that can increase the viability especially of small and medium-sized enterprises in times of crises.

The solutions and best practices to be developed must address further crisis scenarios and be made available to a larger spectrum of companies. Aspects of better collaboration in Europe and worldwide must be considered.

1.2 Funding Purpose

The purpose of this funding initiative is to support industrial companies in and with their value chains and networks in achieving resilience through the use of digital technologies and new methods and integrating them into existing or optimized management systems so that companies as well as production and product-service systems can learn from disruptive incidents and their impacts and generate advantages for the future.

Small and medium-sized enterprises (SMEs) play an important role in the application-oriented development and future use of research results. Another important purpose of funding consists in enabling SMEs to participate in research and development, giving them access to scientific results, and in supporting the cooperative further development of solutions.

The results of the funded project may be used in the Federal Republic of Germany, EEA, and Switzerland only.

2. Subject of Funding

With this funding initiative, BMBF will fund specific cooperative, pre-competitive research projects (collaborative projects) as well as one scientific project.

2.1 Collaborative Projects

BMBF will fund collaborative multi- and inter-disciplinary research and development projects with the focuses and key topics outlined below. Research must be carried out systematically and jointly by companies, research partners, and other required stakeholders, if applicable.

Each research project **must** address issues from the following research and development topics. Specific new technological developments or basic further developments of digital, smart technology components shall not be in the focus:

Establishing resilient digital production systems and infrastructures by technology integration

- Instruments and tools for simulating the resilience components to be implemented must be applied. Relevant data must be identified and instruments that can be used rapidly in case of disruptions must be further developed.

- A data infrastructure with data consistency in highly networked production systems must be designed. The availability of information and data-based models must be tested and validated.
- Trustworthy data spaces must be created. Guidelines must be developed to meet the requirements of purpose-driven digital collaboration. Contributions are to be made to standardize the requirements for the partners involved, taking into account the initiatives of Gaia-X, administration shell of the Industry 4.0 platform, and the applications of other domains and key technologies, such as the mobility data space, AI, blockchain, smart ledger technology, digital twins.
- Modular flexible production systems that consume as little resources as necessary and needed, and which can also be used for the production of critical products in crises (horizontal production expansion) must be applied and tested.
- Adaptable process chains combining conventional and alternative production technologies must be investigated. Suitable paths to increase resource efficiency and establish or enhance resilience properties must be used.
- Methods, instruments, and tools must be developed for the design, planning, control, and monitoring of resilient production systems, e.g. for holistic planning of production and maintenance of complex production systems using suitable AI methods. Technologies capable of prognosis and forecast, combined with a high level of process understanding, must be used to ensure the adaptivity and agility of production systems.

The other research and development focal points are structured in three work and design fields. Apart from the above mandatory topic, R&D work in the joint project must address elements from at least two of the three interrelated design fields A), B) and C) below holistically, taking into account their mutual interactions.

A) Design Field: Resilience and Sustainability Strategies

- R&D must cover potential applications of methods to identify developments and trends and to visualize trends of the recent past, present, and future for achieving resilience.
- Methods for determining resilience targets of the enterprise must be developed and tested. In addition, suitable systems theory models must be developed and tested to identify approaches and paths to effective resilience.

- Dynamic resilience management strategies, methods for early recognition, planning, implementation, control, and monitoring of systematic adaptation measures must be developed.
- Work and technology must be designed in a complementary way, as a combination of technical resilience strategies and resilience through work.
- Activities to achieve resilience and the development of concepts of combining and applying identified resilience management methods must be integrated in existing management systems of the organization, in particular in the continuous improvement process and quality management.
- A resilient infrastructure management must be established. Factories, production facilities, and operational infrastructures must be designed according to the principle of Resilience by Design.
- Measurability and controlling in the value network are to be researched. Instruments for the multidimensional consideration of ROI and motivation, of revenue/profit distribution mechanisms must be developed.
- Contributions to standardizable forms of resilience and to certification requirements (cf. e.g. ISO, BS standards, etc.) must be developed.

B) Design Field: Collaboration Networks and Value Creation Networks

- Models and concepts to strengthen flexible, multi-lateral collaboration and communication must be developed.
- Resilient and, where appropriate, decentralized supply chains and production networks (e.g. factory sharing solutions, production as a service) must be developed to analyze aspects of regionalized value creation, the effective use of digitally connected infrastructures, and sustainability principles from different management perspectives. Optimization potentials must be opened up from the dynamic matching of company competencies, services, and materials along the value chain.
- Methods must be developed for the automatic matching of needs and offers along the lifecycle of products and market services.
- Concepts must be developed for the flexible distribution of tasks and redundancy-supporting distribution of shares and roles among the value creation partners, which enhance redundancy and reduce bottlenecks and failures.

C) Design Field: Agile, Adaptable Organization

- Resilient organizational structures with agile internal responsibilities, decision-making competences, and business processes must be developed and established. Concepts must be developed to ensure resilience-oriented company organization with decentralized decision processes and self-organization schemes as well as appropriate staff strategies.
- Synergy effects must be analyzed and used holistically within an enterprise. An adaptive corporate process management covering humans, technologies, and organization must be developed together with adequate tools.
- Cross-hierarchy and cross-departmental collaboration options must be created for teams, structures, and skills.
- Targeted information flows must be established in enterprise processes and all related value processes. They must include adequate communication tools and effective forms of participation of the staff.
- Both human-technology interaction and work processes must be designed to promote learning and experience.
- A comprehensive system understanding must be established. Transparency in systems must be achieved. Development and gradual implementation of a resilience culture that will be accepted on all company levels and in the value creation network are required.

The necessary innovations to achieve resilience will require the developers to work from a holistic, sociotechnical, and system-oriented perspective from the outset. Value creation systems and ecosystems encompass all elements, from a single workstation to a complete factory, an interconnected production system, and value creating networks. With the above-mentioned objective of creating resilience, the systems are to be designed as specific, application-oriented and exemplary solutions that take into account suitable Industry 4.0 methods and tools as well as key technologies for data spaces.

Enabling resilience is a multi- and trans-disciplinary research task that covers research into production, services, and labour equally as integral components. This complexity poses a high research risk, especially for medium-sized enterprises.

Expected project results are methods, tools, approaches, procedures, analytical instruments for the resilient value creation, as well as models for the interaction of humans, technologies, and organizations in a holistic system understanding. Guidelines and concepts must be developed to support the implementation especially in SMEs. Both use of established standards and interoperability with newly integrated systems and components must be ensured.

Major criteria of evaluating results are prototypical implementation of the solutions in at least three different use cases of different manufacturing companies involved in the project and their validation in terms of economic efficiency and sustainability. The enterprises involved in the projects must be able to further adapt, optimize, and extend these solutions after the completion of the research projects.

Funding will be granted to high-risk and application-oriented industrial collaborative projects with an innovative approach that require task split, sharing of work and interdisciplinary cooperation between companies and universities and research institutions.

For the evaluation of the submitted project ideas, it must be outlined how relevant findings from previous research projects will be taken into account. Major scientific results regarding the needs of research and actions must be considered, including the results of other working groups, of the transfer network, and of the research council of the Industry 4.0 platform (see also <https://www.plattform-i40.de/IP/Navigation/EN/Home/home.html>).

Based on the test and validation of the solutions developed, the R&D results will have to be prepared, processed and made available to other enterprises. For the planned exploitation of the project results and the implementation and further development of the solutions in companies, feasible and reliable concepts and comprehensive approaches must be presented.

2.2 Scientific Project

In addition to the collaboration projects, it is intended to fund a scientific project which is to place the results of the funded projects in a socially overarching framework.

The scientific project must scientifically cover the entire field of the funding initiative "Dynamic value creation networks in a turbulent environment - building resilience in producing companies". It must enable foresight and connectivity in the scientific, practical, research policy and societal contexts of the topic - accordingly, its results must be able to be used in resilient value networks.

The scientific project has three tasks:

1. Research:

- Future developments and changes in value networks must be anticipated with regards to the importance of resilience. The scientific project is to be based on a scientific approach and has to systematically identify measures, trends, and focal points in the research field of "Dynamic Networks to Produce Added Value in a Turbulent Environment – Making Manufacturing Companies Resilient." Additionally, relevant developments of technologies, processes, and concepts must be identified and analyzed.

- The R&D Work in the individual collaborative projects must be analyzed continuously. In addition, open research issues and trends must be identified. The research fields of the funding initiative are to be integrated and combined in a strategic synthesis of research and development results based on own conceptual, empirical, and international expertise.

2. Analysis and processing, networking:

- The knowledge gained from the continuous observation of the results from collaborative projects and associated developments must be made accessible to experts from science and industry for discussion. This will require strategy-oriented processing of the project conclusions for the scientific, economic and research policy discourse on innovation potentials and future decision-making and action requirements.

3. Transfer

- By an adequate processing of the findings the scientific project will enable transfer to a broad scientific, economic, and social discourse and enhance cooperation of the relevant partners across working groups, e.g. by regular meetings, workshops, and conferences. The findings and conclusions developed by the project must be disseminated by regular publication and presented at the relevant trade fairs and a final project event.
- Aspects of technology and knowledge transfer must be researched, analyzed, conceptually processed, further developed and implemented in concrete, suitable measures for industrial enterprises.
- Through methodologically sound, target group-oriented dissemination and transfer activities, innovative formats are to be used on the one hand to strengthen the cooperation and networking of all project partners in "Dynamic value creation networks in a turbulent environment - building resilience in manufacturing companies".
- These activities have to include regular meetings and conferences, workshops, and science communication via adequate media. and to transfer best practices to enterprises, e.g. through trade shows, roadshows, network meetings, and a final event presenting the project results.
- Within the constant exchange with the partners of the funded collaborative projects, the following activities must be carried out in particular:
 - Analysis of the interim project results and exchange of information between the collaboration projects and, if applicable, with other important stakeholders. Impacts on the decision process in research policy must be identified.
 - Providing access to urgently required information and cooperation options, e.g. in specific working groups.

- Setup of guidelines and roadmaps for small and medium-sized enterprises.
- Outline of standardized procedures with defined measures for times of crises and identification of sustainability criteria.

Integration of social partners, e.g. through workshops, forums, dialogs, conferences, etc. will be indispensable.

Funding will be granted to R&D works at universities (universities / universities of applied sciences) and non-university research institutions. This project must address all aspects associated with the purpose of funding (see Section 1.3) in a scientific approach. The methodology must be developed, tested, and optimized for concrete use cases to change chains and networks creating added value.

Note: Submission of a project outline sketch for the scientific project will exclude the funding of R&D as a partner in a collaborative project according to Section 2.1.

3. Beneficiaries

The prerequisite for funding is the collaboration of several independent partners from science and industry in joint research projects that provide solutions which by far exceed the state of the art.

Industrial companies, universities, and non-university research institutions as well as other organizations contributing to the issues and work areas listed in Section 2 can apply for funding. At the time of payment of the grant, the beneficiary must have a production site or branch (company) or another facility for non-economic business (university, research institution, other unit or organization) in Germany.

Chambers, guilds, social partners, and associations are important for the transfer of results. Their participation as associated (non-funded) partners is explicitly welcomed.

Research institutions receiving basic funding by the Federation and/or Federal States may be granted funding of their additional project-related expenses or costs under certain circumstances only.

Participation of small and medium-sized enterprises (SME) in this funding initiative is explicitly welcomed

European research collaborations such as EUREKA, are particularly welcome. EUREKA offers the possibility for German consortia to integrate foreign partners if it should be thematically advantageous or necessary to complement research across borders. Funding for German partners is possible according to the provisions of this announcement. Foreign partners can be funded by the respective country.

4. Procedure

4.1. Integration of a Project Management Agency, Application Documents, Other Documents, and Use of the Electronic Application System

BMBF has authorized the following Project Management Agency (Projektträger) to manage the funding initiative:

Projektträger Karlsruhe (PTKA)

Karlsruher Institut für Technologie

Hermann-von-Helmholtz-Platz 1

76344 Eggenstein-Leopoldshafen

Germany

Central contacts are

Mr. Stefan Kuntz

Phone: +49 721 /608-24628

Email: stefan.kuntz@kit.edu

EUREKA:

Ms. Dorothee Weisser

Phone +49 (0)721/608-26150

Email: dorothee.weisser@kit.edu

The “easy-Online“ electronic application system must be used to draft project outlines and formalized funding applications. (<https://foerderportal.bund.de/easyonline>).

4.2. Two-stage Procedure

The application procedure consists of two stages.

In the first stage of the project, the Project Management Agency commissioned must be submitted project outlines initially in writing or in an electronic format

no later than by September 15, 2023

For collaborative projects, the project outlines must be submitted in agreement with the Joint Coordinator envisaged.

This date of presentation is not to be considered as a time bar. However, project outlines received after that date may perhaps no longer be taken into account.

Project outlines should be addressed to

Projektträger Karlsruhe

Zukunft der Wertschöpfung - Produktion, Dienstleistung und Arbeit (PTKA-PDA)

Karlsruher Institut für Technologie (KIT)

Hermann-von-Helmholtz-Platz 1

76344 Eggenstein-Leopoldshafen

Germany

under the code name of **“Resipro”**