Federal Ministry of Education and Research
Call for Proposals

for Funding Projects on the Topic "Industry 4.0 – Changeability of Enterprises in Future Value Creation (InWandel)" within the framework of the program "Future of Value Creation - Research on Production, Services and Work".

Dated March 23, 2021

Excerpt of the call text

1 Objective and Purpose of funding, legal basis

Germany generates a high proportion of value added through the manufacturing of complex products with digital equipment variants. This proportion is already being generated today through digitized market services (e.g., in the form of product-service combinations) connected with new business models. The short-cycle development of production and product-service systems is becoming a success factor. Currently, value is created predominantly in medium-sized enterprises that are globally networked in their supply and value chains. In addition to systemic economical and political uncertainties, there are new challenges, for example due to ecological requirements such as the reduction of CO2 emissions. In addition, acute crises, such as pandemics, cause disruptions that result in the abrupt loss of orders, manpower and supply chains. In view of these changes and the ongoing structural transformation, industrial enterprises in Germany are facing major challenges.

This is where the guiding principle of changeability comes in: Changeability is the ability of a company to perceive changes that exceed an originally plannable or foreseeable extent in good time and to control them both technically and organizationally. An important component of changeability is the capability of a socio-technicalsystem to anticipate, a socio-techniocal system being e.g., a production system, an entire company or a product-service system, to deal with events that threaten its existence in a resilient and constructive manner.

In order to succeed in mastering these challenges by means of changeability, it is important to use and exploit the opportunities and new possibilities of Industry 4.0 applications. In this respect the sustainable interaction of humans, the business organisation and technology is of crucial importance in order to explore new ways of creating value in the future. Therefore, this funding guideline aims at creating solutions and approaches to successfully master the above dynamic challenges by using Industrie 4.0 potentials and tools in the best possible way.

The employees, the corporate organisation and the corporate culture are in the focus of design. To develop and expand changeability it must explicitly be anchored in the corporate strategy. In order to be able to draw advantages for networked value creation, corporate cultural, organisational, economic and ecological aspects are to be taken into account holistically. The interdependencies between Industry 4.0, organisation and employees must be investigated, tested and validated in order to develop future of value creation perspectives in Germany.

1.1. Funding Objective and Purpose

The Federal Ministry of Education and Research (BMBF) is funding cooperative pre-competitive research projects (collaborative projects) to strengthen the addition of value in Germany, as a part of the High-Tech Strategy 2025 "Research and Innovation for People" and the programme "Future of Value Creation - Research on Production, Services and Work". The intention is to put companies in a better position to react quickly to changes and to actively shape the necessary transformation. The research programme aims for interdisciplinary, application-oriented new solutions by taking an integrative view on the areas of production, services and work.Research in and with small and medium-sized enterprises (SMEs) is particularly promoted.

The aim of the funding guideline is to increase changeability in manufacturing enterprises through the development, design and introduction of innovative system solutions as well as the prototypical implementation of the developed solutions in various applications, including validation, in particular under aspects of economic efficiency and sustainability. To ensure that, facing the economic, social and technological drivers of change, manufacturing enterprises in Germany can continue to meet the challenges of structural change in the future, the aim is to permanently implement and establish human-related changeability in a novel way, exploiting the potentials of digitalisation.-

The purpose of this funding guideline is to support enterprises in developing and implementing their changeability on a higher quality level than before by using the new Industry 4.0 technologies and methods with a socio-technical systemic approach. Industry 4.0 solutions and the application of artificial intelligence (AI) can enable central strategic tasks in the consolidation of modifications. In particular, it is intended that manufacturing enterprises and their service providers are supported in the optimum and long-term alignment of their existing or new Industriy 4.0 systems and structures to change with the help of a systematic, strategic and holistic approach. To this end, specific mechanisms of changeability are to be systemically researched in depth, and suitable recommendations and guides for action, especially for SMEs, are to be developed.

This announcement is part of the funding activities of the various ministries of the Federal Government on the topic of Industry 4.0. This announcement is intended to contribute to the identification, further development and testing of solutions for the design of adaptable, human-centred structures for Industry 4.0 factories and networks.

1.2 Legal basis

The Federal Government will award the grants in accordance with these funding regulations, sections 23 and 44 of the Federal Budget Code (Bundeshaushaltsordnung, BHO) and the administrative regulations issued for this purpose as well as the BMBF's "Guidelines for Grant Applications on an Expenditure Basis (AZA)" and/or - the "Guidelines for Grant Applications on a Cost Basis (AZK)". There is no entitlement to the grant. Rather, the awarding authority will decide on the basis of its dutiful discretion within the framework of the available budget funds. Under these funding regulations, state aid is granted on the basis of Article 25(2) of the General Block Exemption Regulation (GBER) of the European Commission.1 Funding is granted in compliance with the Common Provisions laid down in Chapter I of the GBER, in particular taking into account the definitions listed in Article 2 of the Regulation (cf. the Annex on State Aid Requirements for the Funding Regulations).

2. Subject of Funding

With this funding guideline, the BMBF is supporting the targeted development of cooperative, pre-competitive research projects (collaborative projects) that put manufacturing enterprises and their service providers in a better position to react quickly to changes and actively shape the necessary transformation. Research in and with SMEs is particularly promoted.

The required innovations for changeability require a new player and stakeholder perspective on the design of complex products, product-service and production systems, these needing to be from the outset viewed holistically as socio-technical (eco-)systems. These systems are defined as an organised number of people interacting with specifically structured technologies and networked cyber-physical systems. Production systems can range from a single workstation to a complete factory and beyond to a production network as well as a complete value network. With the above-mentioned objective of changeability, the systems are to be designed as specific, application-oriented and exemplary solutions that combine suitable Industrie 4.0 methods and tools with changeability strategies.

Accordingly, enabling changeability is a multi- and transdisciplinary research task that encompasses production, service and labour research equally as integral components. This holistic and complex approach poses a high research risk, especially for small and medium-sized enterprises.

The research priorities are structured into four design fields. Individual elements from at least three of the four interrelated design fields are to be worked upon holistically, taking into account their mutual interactions. It is obligatory that design field D) must be taken into account in all cases.

A) Design field corporate strategy

- Creation of a holistic modularity of organisation and technology as a basis for faster reactions to change and permanent anchoring of changeability in corporate strategy for effective and efficient reaction to long-term megatrends as well as to short-term disruptions

- Development of new combinations of strategic corporate goals and lean management principles with operational methods and tools for the holistic organisation of production and product-service systems in the digitally driven transformation.

- Development of methods of harmonising production strategy with corporate strategy

- Development of strategic early detection tools to identify change drivers, for monitoring, and for creating transparency and decision support by digital data collecting and evaluating methods (such as smart data approaches)

- Development of approaches to increase the speed of decision-making in the company and the changeability across locations in value creation networks.

B) Design field organisational structure and corporate culture

- Creation of at-hand organisational structures capable of change that allow rapid (re-)structuring of internal responsibilities, decision-making competences and business processes.

- Development of concepts on the scalability of decentralised decision-making and self-organisation across the entire organisation, establishment of a comprehensive understanding of systems

- Enabling a shift between function- and process-orientation; organisational harmonisation of the coexistence between project and line work

- Establishing and validating the company's ability to be efficient and capable of change at the same time

-Development of a leadership culture at all levels of the company that supports the changeability; implementation of cooperative change management

C) Design field of competence development in participative work systems conducive to learning

- Innovation- and participation-oriented empowerment of employees as initiators and drivers of internal and external changes.

Promoting the employees' ability to act, autonomy, self-determination and responsibility, strengthening decision-making competence in work systems conducive to learning, increasing the employees' willingness and acceptance of change

- Developing employee competences in cross-domain disciplines, differentiated according to groups of operational actors.

- Promotion of key competences, especially for lifelong learning, development of solutions for different qualification and competence levels

D) Design field vertical and horizontal integration of technologies for digital continuity

- Adaptation and use of adaptive assistance systems and so-called smart devices

- Usage of progress in data analysis and system forecasting for an overall optimisation with decentralised control

- Creation of a transparent, targeted selection of optimal transformation measures and strategies in response to system changes

-Adaptation and application of cognitive tools and systems to cope with complex control and engineering tasks and to autonomously check and process data; creation of decision support especially for SMEs

- Adaptation and application of cross-manufacturer and industry-neutral information and communication standards with regard to interfaces and infrastructure for ad-hoc value chains

Research and development shall be carried out exclusively under the premise of holistic socio-technical system design as an enabler for changeability. It is to be conceived as an integration and implementation task and to be oriented to the respective industrial application scenario. Changeability is to be anchored in the criteria of system understanding in the company organisation, decision support, economic efficiency, user-friendliness and acceptance on the part of the employees. The focus is not to be placed on the specific technological development or fundamental further development of intelligent components. Industriy 4.0 solutions must be designed and implemented with foresight to establish changeability in the sense of technology integration.

Depending on the maturity of the digital transformation in the participating companies, both the vertical integration (within a company) and the horizontal integration (across the complete value network) of the entire systems have to take place.Design and layout must be based on the guiding principles of changeability: Universality, modularity, scalability, compatibility and mobility must be taken into account as the defining characteristics.

The focus of the funded work is to be placed on applications in medium-sized manufacturing enterprises that produce complex products or offer production-related services and must react to turbulent market situations. The selection of these applications should be typologically representative for the facility location in terms of market situation, company size, range of services and degree of maturity of the digital transformation.

Holistic solutions are required with which individual companies, operational value chains as well as cross-company value networks can adapt economically to the changed conditions in a short reaction time through the application and use of digitalisation.

The primary criteria for evaluating the results are the prototypical implementation of the developed solutions in at least three different applications (use cases) of different manufacturing enterprises involved in the project and the validation, especially from the economic efficiency and sustainability points of view. The participating companies should be enabled to continue to adapt, permanently optimise and expand these solutions independently even after the research projects have been completed.

Funding is provided for high-risk and application-oriented industrial collaborative projects with an innovative approach that require a division of labour and interdisciplinary cooperation between companies and universities or research institutions. The coordination of collaborations shall favourably be executed by companies.

For the assessment of the applications, it must be outlined how the findings from previously conducted research projects in the context of Industry 4.0 are being taken into account for the research work implementation. The identified need for further research and action resulting from the research advisory board of the German Plattform Industrie 4.0, e.g. the documents "T „Themenfelder Industrie 4.0“ und „Wandlungsfähige, menschenzentrierte Strukturen in Fabriken und Netzwerken der Industrie 4.0“ (see also http://www.plattform-i40.de), must also be taken into account.

Based on the testing and validation of the solutions to be developed, the research and development results, methods and findings gained are to be prepared in recommendations for action and guides for other enterprises. With regard to the avised utilisation of project results, robust concepts and comprehensive procedures must be presented on how the solutions will be utilised for the timely transfer of knowledge and results.

3 Special requirements for funding

The partners of a collaborative project regulate their cooperation in a written cooperation agreement. All partners in the consortium, including those that are research institutions within the meaning of Article 2 (point 83) of the GBER, ensure that no indirect aid is granted to enterprises within the framework of the consortium. To this end, the provisions of point 2.2 of the R&D&I Guidelines must be observed. Before a funding decision is made on a collaborative project, evidence must be provided of an agreement in principle on further criteria specified by the BMBF (cf. BMBF form no. 01104).

European collaborations on research for production, such as EUREKA, are desirable. 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. Operation with a Project Management Agency, Application Documents,

Other Documents, and Use of the Electronic Application System

At the present time, the BMBF commissioned this Project Management Agency (Projektträger, PT) to handle the funding measure:

Projektträger Karlsruhe (PTKA)

Karlsruher Institut für Technologie

Hermann-von-Helmholtz-Platz 1

76344 Eggenstein-Leopoldshafen

Germany

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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 July 16, 2021.

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 (PTKA)
Karlsruher Institut für Technologie
Standort Dresden
Hallwachsstraße 3
01069 Dresden
Germany

under the code name of **“InWandel“.**