Head of Project
Prof. Dr. Dr. h. c. Bernhard Müller
Director
Leibniz Institute of Ecological Urban and Regional Development (IOER)
Weberplatz 1
01217 Dresden
Bernhard.Mueller@tu-dresden.de

Deputy Head of Project
Prof. Dr. Otthein Herzog
University of Bremen
Am Fallturm 1
28359 Bremen
herzog@tzi.de

Coordination
Dr. Karin-Irene Eiermann
Scientific Officer
Department of Technologies
acatech – NATIONAL ACADEMY OF SCIENCE AND ENGINEERING
Unter den Linden 14
10117 Berlin
eiermann@acatech.de

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Social Consequences
There are also critical questions that come up with regard to the concept and implementation of Advanced Manufacturing/ Industry 4.0 in the context of developmental policy: For the most part these pertain to unintended effects and consequences, for instance regarding a loss of jobs and social segregation. These aspects will be considered as well.

> TARGET GROUPS

The target groups of the project are the German Federal Ministry for Economic Cooperation and Development (BMZ) and its implementation agency GIZ, which has commissioned this project on behalf of the BMZ. The recommendations are addressed to them as agents of German state-sponsored developmental cooperation.

Photos: Hans-Ulrich Osterwalder/Peter Schrader, acatech/Thomas Ernsting, acatech/David Ausserhofer

> DELIVERABLES

The following outputs are anticipated as results of the project activities:

A final report of the results, including an executive summary and recommendations for action for the realization of ICT-driven value creation and logistics chains within the framework of Advanced Manufacturin/Industry 4.0 in an urban context, with India as a specific case study and a more general assessment pertaining to other partner countries of German developmental cooperation.
A documentation of the international conference/symposium in India, including a short documentation of the various experts' contributions.
Reports containing the results of 3 expert's reports (two from Germany, one from India, 20–30 pages each plus appendices) und 3 corresponding commentary reports to each expert's report from the respective other country (two from India, one from Germany, up to 20 pages each plus appendices) about development perspectives and selected aspects of Advanced Manufacturing/Industry 4.0 in an urban context considering the strengths and weaknesses of the approach employed by the project (i.e. how advanced manufacturing can be promoted and the possible impact it can have on urban development and vice versa). These reports will be developed in close cooperation with the scientific board of the project and the GIZ.

> DURATION OF THE PROJECT

The project will run for a period of ten months. It has started in December 2013, and its results shall be available by the end of September 2014.

BMZ Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

> ADVANCED MANUFACTURING/ INDUSTRY 4.0 AND URBAN DEVELOPMENT –

THE CASE OF INDIAN METROPOLITAN AREAS

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> BACKGROUND

Worldwide, there is a discussion about "Industry 4.0" and "Advanced Manufacturing" in the framework of which enterprises are interconnecting their machines, their storage systems and their material resources based on Cyber-Physical Systems (CPS) on a global scale. Consequently, working and living environments are changing fundamentally. Industry 4.0 may result in more flexible and more efficient production and value chains, and it may contribute to more resource and energy efficiency, and better environmental protection. Considering this background, the questions arise:

a. whether Industry 4.0 and more specifically Advanced, i.e. Integrated Manufacturing contain potential for international development cooperation, for example by contributing to sustainable economic growth and strengthening economic development in the rapidly growing cities of the developing and newly industrialized countries or by facilitating eco-friendly and sustainable settlement patterns ("cities of short distances"), and
b. how these potentials may be made better use of within the framework of international development cooperation.

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), has commissioned the German National Academy of Science and Engineering (acatech) to search for answers to these questions. India (and selected metropolitan areas there) is taken as a model country for the project. Among the thematic areas of German development cooperation are urban as well as economic development, which are combined in this research endeavour. Economic growth, which must be inclusive and ecologically sustainable, is considered as the absolute precondition for reducing poverty and attaining prosperity.

> OBJECTIVES, PRIORITIES AND TARGET GROUPS OF THE PROPOSAL

> OBJECTIVES

The objective of the project is the identification of potential future courses of action of the German Federal Ministry for Economic Cooperation and Development (BMZ) regarding ICT- and technology-driven industrial urban production and logistics in the context of urban development. Special attention will be given to

a. Integrated Manufacturing, i.e. capabilities and requirements for the integration of local industries into global production networks, and
b. local manufacturing of components (e.g. electronics, automotive, plant construction).

India serves as a case study. Its regional development processes and experiences regarding industrialization and promotion of small and medium-sized enterprises serve as a point of reference. India shall serve as an example to illustrate how companies from partner countries of the German developmental cooperation can be integrated into globally interconnected production and logistic processes through the concept of Advanced Manufacturing. Numerous questions arise in this context, ranging from quality standards, bottlenecks in cooperation, product development to the role of the agents of German developmental cooperation as facilitators of the cooperation.

However, the scope of the recommendations will be broader. Based on the findings regarding the Indian case it is planned to examine their validity and applicability for German developmental cooperation with other countries depending on their respective socio-economic framework conditions, urbanization trends, and state of infrastructure provision, growth strategies, and perspectives with regard to industrial development.

> PRIORITIES

Innovation Potentials of Advanced Manufacturing
The dimensions and the complexity of the topic Advanced Manufacturing/Industry 4.0 in the context of urban development require strategic focusing on a few key questions. The proposed project focusses on the innovation potentials of Advanced Manufacturing/Industry 4.0, i.e. the Smart Factory and its environment, for industrial policies or urban production respectively, and for sustainable urban development. Questions concerning logistics and a green urban economy play a vital role in this examination of innovation potentials.

Infrastructure requirements
With regard to the intelligent factory (Smart Factory) for instance questions arise regarding infrastructural requirements and management, resource optimization, the industrial and commercial environment (especially flexible cooperation between enterprises in the realization of value creation chains), human capital as well as required technologies, among them transportation of goods, procurement and distribution with their ICT infrastructure. Efficient logistics are an integral part of the Smart Factory and essential for a resource-efficient and eco-friendly urban production. This aspect especially concerns supply industries and accordingly small or medium-sized businesses which ought to be promoted.

Human Factors
It is important to note that from a management perspective Advanced Manufacturing is not a matter of course. Instead suitable framework conditions for integrated approaches and the availability of well-trained graduates as well as managers and engineers are crucial for dealing productively with the challenges of an integrated approach. This point could result in future research questions and requirements for action, especially against the background of the Indian realities.

Sustainable Urban Development/Clean Environment
In addition, the ICT and sensor-based Smart Factory is a future-oriented, clean technology and can serve as a demonstrator for Clean Tech projects. Because of its potential conducive for a "city of short distances" with distinct urban-functional mixed structures (for example regarding the connection between work/employment in the industrial sector and attractive living spaces close to the workplace) questions pertaining to sustainable urban development (Smart/Eco-Cities) and regarding local conditions, availability of land and the regulation of land utilization are of considerable importance here.

Photos: Thilo Reiter/pixelio.de, iStock.com/habari1, pixmac/mediterranean