

DESIGNING TECHNOLOGIES FOR THE INTERACTION OF CYBER-PHYSICAL SYSTEMS IN SMART FACTORIES OF THE INDUSTRY 4.0

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An actual task is to project industrial purposes cyber and physical systems interaction technologies in the Industry 4.0 smart factories. Three cyber and physical systems interaction options are described (mechanical, informative and man and machine) which are applied in the item designing components manufacturing technological process. A scheme of system projection route is proposed for the cyber and physical interaction technologies. A scheme of system projection route is proposed for digital production cloud resources (services and applications) which are applied to realize automatic informative interaction for cyber and physical systems digital twins.

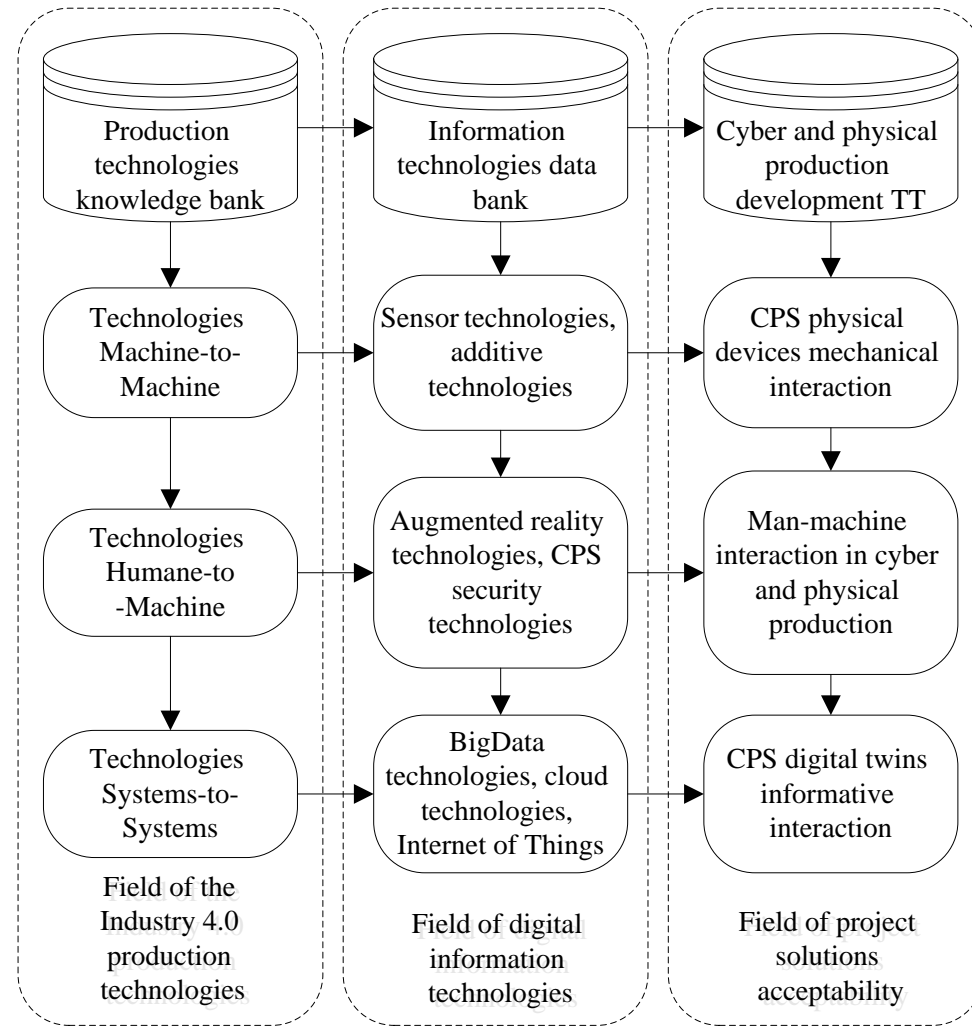


Figure 1. CPS inter-machine interaction technology system projection route.

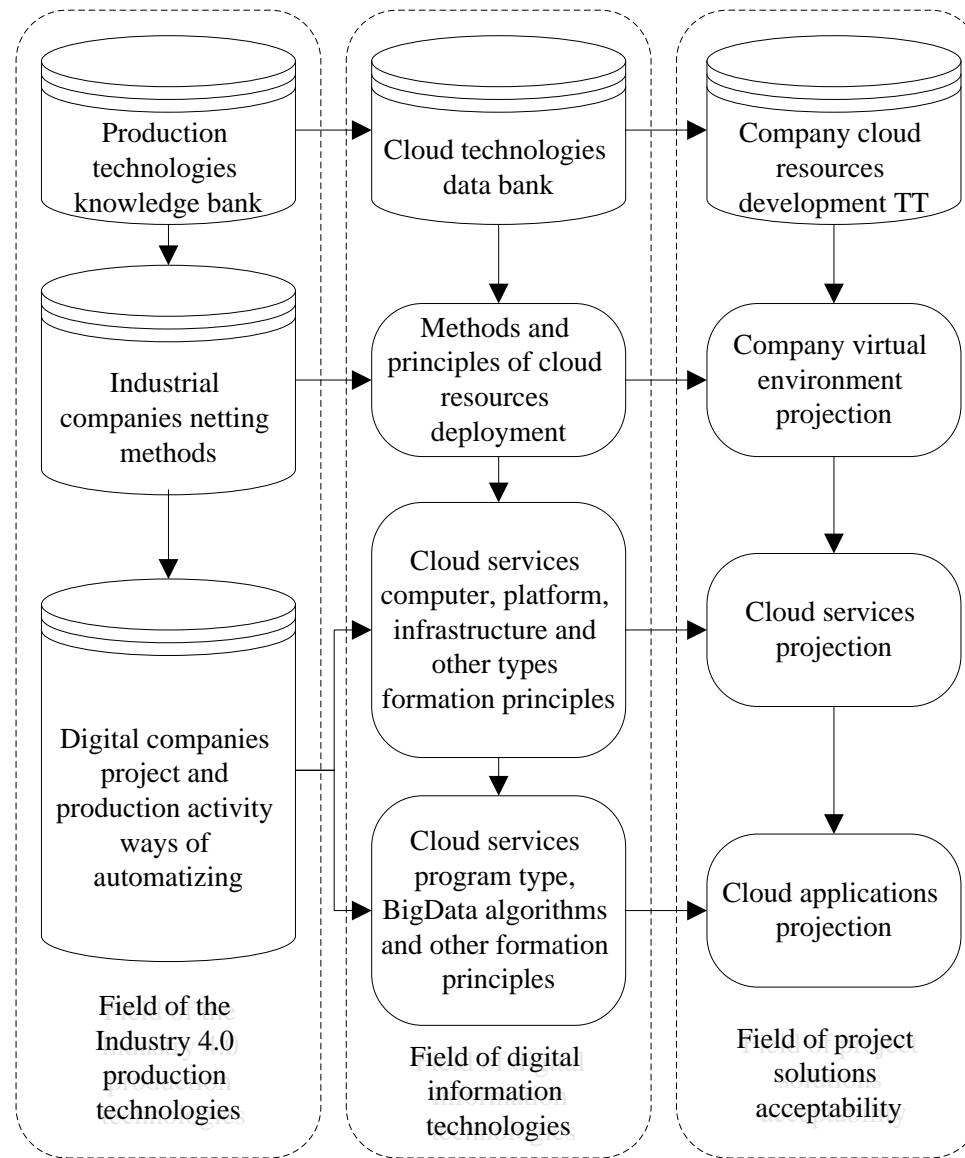


Figure 2. System projection route of the Industry 4.0 smart factory cloud resources.

Development and research of project solutions in how to create a digital automatic cyber and physical production is an actual direction of economy industrial sector development which are being done today as the Industry 4.0 concept. The Industry 4.0 concept means to create new types of item designing companies, which function with digital production and informative technologies to make a high-quality product automatically.

Today some methods how to project the robotized companies are known and the designers pay the most attention to the Industry 3.0 workshop technological arrangement problem. Unlike the Industry 4.0 digital companies which function automatically the Industry 3.0 companies function autonomously (with humans participating). So the existing methods of the digital companies projection cannot be used to develop architecture of the Industry 4.0 digital factories, smart factories and virtual factories.

For such companies they need to develop new methods and means based on cyber and physical production technology application including industrial internet of things, cloud technologies, augmented reality technologies and other because those production infrastructure components were never used in the Industry 3.0 companies.

Science and technical progress in different industry branches led today to the creation of different informative and production technologies, which have a narrow specialty of practical application significance. To organize a digital production it is necessary to define the types of technologies, which have the inter-operability property combined with an application, which may allow the designer to solve the task of the Industry 4.0 smart factories theoretical synthesis. So, this task which is to synthesize a smart factory is rounded down to explain mathematically the technical solutions in selection of digital production and components interaction technology for cyber and physical systems.

Absolutely new for the Industry 4.0 digital production in comparison with the Industry 3.0 companies is the application of cloud technologies, which is used as the base for production company virtual environment creation. Smart factory virtual environment contains the necessary cloud services and applications which access for user and cyber and physical system is realized through the industrial internet of things interfaces. So, the Industry 4.0 digital companies have an absolutely new project task which is to synthesize the cloud resources and interaction order for the smart factory production components.

Structural complexity of projection object and diversity of cyber and physical systems classes, the Industry 4.0 production and informative technologies is explained by the application of methods and means, which automatize the key project procedures of smart factory synthesis. The task to project automatizing means to complete project works is necessary to be solved in parallel of projection tasks of smart factories themselves.