# Public summary of the BAPISCO project

Negotiation and conclusion of contracts in automated value networks is one of the key challenges to leverage the full potential of Industry 4.0. In the value creation processes of supply and demand, different parts of the value network must be enabled to flexibly connect and contract with each other in an automated way. A major potential lies in significantly reducing the "trust tax", by e.g. complex contractual agreements, Smart Contracts, that will be established between cyber physical systems (CPS). Smart Contracts can be built on a technology called blockchain and enable "self-executing contractual states" while eliminating the risk of relying on others to follow through their commitments. This refers to much more than mere data exchange and demands for innovations in all fields starting with semiconductor innovations to provide reliable trust anchors. The project "Blockchain-based Autonomous Processes for Industry 4.0 built on innovations in Semiconductor Technology, BAPISCO" aims for advanced chip technologies to enable end-to-end security for Blockchain processes in Industry 4.0. It will demonstrate a simple and cost-efficient way to establish trust in shared, distributed and secure manufacturing value chains and reduce the "trust tax," using blockchain technology.
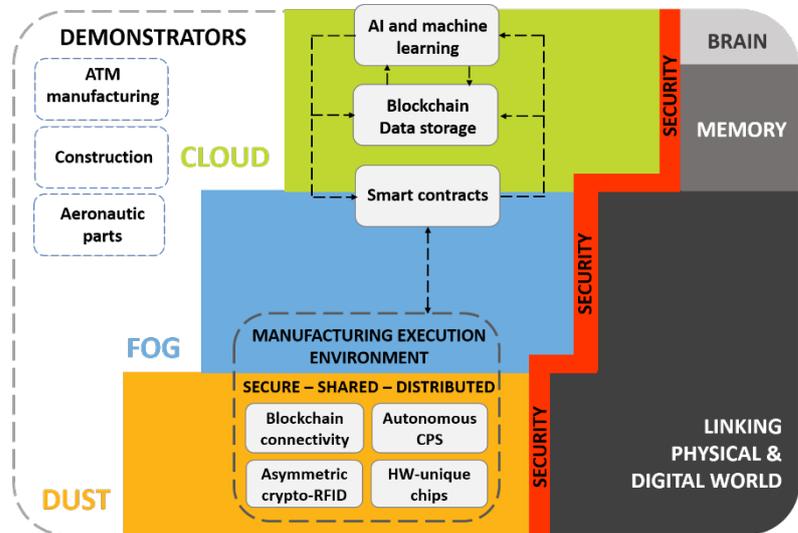
The core approach taken in BAPISCO is to implement blockchains in distributed manufacturing environments built on advanced chip technologies at three levels of the stack: dust, fog, and cloud. At the dust level, cyber-physical systems, such as sensors for collecting data and RFID for communication, of the stack are located. In BAPISCO, the blockchain connectivity from the dust level to the upper stacks are handled by passively powered asymmetric cryptographic RFIDs, and IC's with unique individual encryption, which both form core innovations in the BAPISCO project. They will significantly increase the level of security for RFID components and make such passive devices integrable in Blockchain based ecosystems.

At the fog level, the data collected from the CPSs is computed to be used in smart contracts and agreements using business logic processes. In addition, the near field communication from RFIDs is transferred to the WLAN or wired connections. The data coming from the dust level is handled within the same manufacturing execution environment as where the dust is.

At the cloud level, the gathered data from the dust level, via fog computing, is stored, and the high-level computing and intelligence are done. At this level, the business aspects become evident: the reduced trust tax for which BAPISCO is to offer a solution with crypto-economics mechanisms, and thus bringing added value to Industry 4.0. Artificial intelligence and machine learning will help to improve security and system performance and creating a self-learning and self-improving system of systems.

Dust and fog together link the physical world with the digital world: here the real-world information from the factory floors, the manufacturing execution environment, is transformed to digital form and moved to the digital world for processing. In BAPISCO, the security is handled throughout all levels, starting from asymmetric-crypto enabled RFID chips as security anchors to Blockchain security mechanisms at the cloud level.

BAPISCO's approach starts from the demonstrators: they define the needs, the requirements, and the final implementation. In BAPISCO, there are three different types of demonstrators: the first one, ATM manufacturing, represents a distributed manufacturing. The second one is construction, where especially managing the supply chain and its logistics and procurement are taken care of. The third is the aeronautics parts manufacturing, where supply chain management, safety and security play major roles.