Glossary of terms in Industry 4.0

3D Printing

A specific additive manufacturing technology, however, this term has gained common usage to describe all manner of additive manufacturing. See Additive Manufacturing. [*Source: Manufacturing USA*]

Additive Manufacturing

The construction of complex three-dimensional parts from 3D digital model data by depositing successive layers of material. Metal, polymer, and ceramic materials can be used to manufacture parts of a geometry that often cannot be produced by any other manufacturing technology. The names of specific additive manufacturing technologies include: 3D printing, layered object manufacturing, selective laser sintering, selective laser melting, LENS, stereolithography, and fused deposition modeling. Synonyms include layered manufacturing, solid freeform manufacturing, direct digital manufacturing, rapid prototyping. [*Source: Manufacturing USA*]

Advanced Manufacturing

Use of innovative technologies to create existing products and the creation of new products. Advanced manufacturing can include production activities that depend on information, automation, computation, software, sensing, and networking. [*Source: Manufacturing USA*]

Agile Manufacturing

Tools, techniques, and initiatives (such as lean and flexible manufacturing) to help a plant and/or organization rapidly respond to their customers, the market, and innovations. It can also incorporate “mass customization” concepts to meet unique customer needs as well as "quick response manufacturing" to reduce lead times across an enterprise. [*Source: Manufacturing USA*]

Artificial Intelligence (AI)

The term Artificial Intelligence refers to programs which map human intelligence by deploying cognitive technologies – for example, by speech control or machine learning. AI programs are independent and are based on the recognition of patterns which on the basis of the analysis of behavior and habits allow them to align themselves to the individual users. Artificial Intelligence or "virtual agents" are deployed in objects of daily use (for example, security mechanisms in the car to prevent microsleep). But they are also used in industry, for example, in robots used for process management or production. [*Source: LBBW*]

Augmented Reality (AR)

The term relates to a computer-based extension of human perception. The respective real experience is enriched by additional virtual information or the opportunity for interaction. A key function in augmented reality is played by cameras which now can be integrated into a

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wide range of mobile devices to give the user a view on the real world and on multimedia contents on a parallel basis. The user perceives augmented reality via an optical head-mounted display, a smart phone monitor or also special data gloves. [*Source: LBBW*]

Beacons

Low-cost devices that communicate with smartphone apps indoors, without the need for GPS. Beacons use BLE and are key enablers for the smart retail category, triggering messages as consumers pass through locations or near products. [*Source: AERIS*]

Big Data

With technology progressing, more and more devices are being connected to the Internet. The resulting enormous volume of unstructured data sets is analyzed and assessed using data management platforms – traditional software for data processing cannot cope with the huge data volumes. With the appropriate analysis tools, big data can help companies to optimize their processes, determine trends and address customers in a targeted fashion. [*Source: LBBW*]

Bluetooth 4.0 (BLE)

The latest iteration of Bluetooth, also called Bluetooth Low Energy (BLE). It offers lower power use for portable devices and new profiles including Bluetooth Mesh, a Bluetooth topology that allows devices to be connected together, sending/repeating commands from the hub to any connected device. Apple's iBeacon is an example of a BLE application, and BLE as many potential uses for IoT devices. [*Source: AERIS*]

Blockchain

Blockchain technology is being internationally recognized as one of the most disruptive innovations of the 21st century. Technology which, in spite of being complicated to understand, represents a transformation in the way we currently conduct transactions. The first application of this technology was with the appearance of the famous "Bitcoin" cryptocurrency, but it has both financial and non-financial applications. Blockchain technology allows virtually everything of value that can be expressed digitally to be recorded: birth certificates, title deeds, votes, financial accounts, product data, formulas, contracts, etc. All this is performed more quickly, securely and transparently than with traditional alternatives. [*Source: SPRI - Basque business development agency*]

Cloud Computing

In principle, cloud computing covers all activities taking place via an online service, e.g. sending e-mails, processing documents via an online platform and saving them there, playing videos or analyzing data. What is meant is an IT infrastructure which makes it possible for data to be saved on decentralized computer systems via internet and in principle to be available at any time at any place as long as there is an internet connection. Thus a cloud provider offers a complete working place in virtual form – computer, memory, platforms and software applications – creating a high degree of flexibility for each user. [*Source: LBBW*]

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Collaborative Robotics

Industrial robots are no longer in closed work environments and isolated from each other, but will operate next to workers, share their space and collaborate with them. A new generation of manageable lightweight robots will form the so-called "smart factory". [*Source: SPRI - Basque business development agency*]

Computer Vision

Computer vision enables a computer to be able to detect the characteristics of an image, through the recognition of patterns and training and, with the support of certain computer programmes, extract information from the image for decisionmaking. [*Source: SPRI - Basque business development agency*]

Cyber Physical Systems (CPS)

CPS are objects which have embedded software and electronics connected to each other in a system, for example, robots, drones and other movable machines. This way physical and mechanical objects and processes are connected with software-controlled objects and processes – with the real and virtual worlds converging. CPS can be used for traffic control or for managing intelligent electricity networks. [*Source: LBBW*]

Cyber Physical Production System (CPPS)

If Cyber Physical Systems (CPS) are used in production, then the designation is CPPS. In intelligent production, the CPPS unit controls itself. It can make decisions on the basis of individual parameters - does the relevant function/capacity exist for the requested version of the product? Accordingly the implementing system is controlled by the CPPS, which at the same time monitors production. An example for deployment is avoiding measurement errors, securing uniform quality and streamlining the entire process. [*Source: LBBW*]

Cyber Security

In a digitized environment, the protection of any important company information, or cyber security, becomes increasingly important. Cyber security means all the technologies and services that protect the company from any attack or loss of data. [*Source: SPRI - Basque business development agency*]

Digital Innovation Hub

Connected Asset Network - A series of facilities, laboratories, equipment, software and innovative and excellent scientific and technological capabilities in the advanced manufacturing environment. It is an offer that will enable companies to cover their potential needs for learning, testing, developing products or processes, carry out R&D projects, scaling, testing, training and demonstration, all oriented to Industry 4.0. [*Source: SPRI - Basque business development agency*]

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Digital Manufacturing

Aims to improve product design and manufacturing processes across the board seamless integration of information technology systems across the supply chain. Digital manufacturing focuses on reducing the time and cost of manufacturing by integrating and using data from design, production, and product use; digitizing manufacturing operations to improve product, process, and enterprise performance, and tools for modeling and advanced analytics, throughout the product life cycle. [*Source: Manufacturing USA*

Edge Computing

The "edge" is where the physical world meets the digital world. In IoT terms, the edge is where a sensor's or machine's data in voltage or current is turned into the ones and zeros that a computer needs to process it. Edge computing means filtering or processing that data directly in devices like programmable automation controllers (PACs) located at the edge, so that intermediary gateways and software are not required. Processing data before it is sent to the cloud reduces traffic on networks and the Internet by reducing the amount of data sent. It also increases efficiency, security, and compliance. [*Source: OPTO22*]

Fog Computing

Similar to edge computing, fog computing takes the analogy of the cloud and brings it down closer to the physical world: fog. Typically fog computing is using computing power in a fog node or IoT gateway to filter or process data and then send only the required data to the cloud. [*Source: OPTO22*]

Industrial Ecosystems

Economic specialization and complexity depend on a large network of company relationships with customers, subcontractors, suppliers and with relevant organizations in the innovation system. As there is the risk that this network might have loopholes or gaps due to relocation processes, fast technological development or other factors, the systemic approach should ensure that its ecosystems are complete and contain no obstacle to company growth and development. [*Source: SPRI - Basque business development agency]*

Industry 4.0

This is one name by which advanced manufacturing is known, due to the pioneering initiative adopted in Germany in this field. The name evokes the idea that the fundamental technologies entailed make up a fourth industrial revolution based on the technical integration of cyber-physical systems into manufacturing and logistics and on the use of the Internet in industrial processes. This revolution was preceded by a first one based on water and steam power, a second one caused by the electric power that facilitated the division of labour and mass production, and a third one linked to information technologies and the resulting automation of industrial processes. [*Source: SPRI - Basque business development agency]*

Internet of Things (IoT)

The IoT consists of physical objects which can communicate with each other via internet. The connection is made via integrated microchips which allow a unique identifier of the device in

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the network. An example: Appropriately equipped printers can order printer cartridges automatically once the ink level reaches a critical value. This communication can be understand using the example of the "smarthome" where several or all household devices are interconnected, the fridge independently reports used food via the smartphone or the user can switch on the heating using the tablet before he comes home. [*Source: LBBW*]

Lean Manufacturing

A manufacturing practice that aims to reduce wasted time, effort or other resources in the production process. [*Source: Manufacturing USA*]

Machine to Machine (M2M)

M2M denotes the largely automated communication between devices, such as machines, automatic machines, vehicles and measuring units. Exchange takes place via internet or mobile phone and is used in medical engineering, facility management or in automated production. M2M is used for remote maintenance and monitoring of machines, the use of automatic machines such as mobile pay terminals or mobile transfer of consumer data. M2M brings together information and communication technology. [*Source: LBBW*]

Machine Learning (automatic learning)

Its objective is to develop techniques and methods enabling machines to learn, simulating one of the principal human capacities. Machine Learning is mainly supported by computing and artificial intelligence techniques. Machines are capable of predicting what will happen based on the analysis of large data volumes, learning from them to finally be capable of making predictions. These machines will gradually improve their predictions over time as they learn. [*Source: SPRI - Basque business development agency*]

Radio Frequency Identification (RFID)

RFID devices are chips which communicate with a reading device using an electromagnet field. Like a barcode or a magnetic strip, the chips contain information which can be obtained using a scanner. This information can also be recorded over large distances. Chips are often used in storage as objects marked in such a way can be localized at any time. [*Source: LBBW*]

RIS3

This is how Europe has christened the new European Innovation Strategy: Research and Innovation Smart Specialisation Strategy. This Strategy seeks to make each country or region specialize, focus and assign resources to strengthen those areas in which it has the greatest potential. [*Source: SPRI - Basque business development agency*]

Servitization

This consists of new ways of conceiving the relationships between users and providers of assets, based more on the provision of service than the delivery of physical goods as such. These relationships require partnership and cooperation between the parties involved, and sharing the risks and benefits of using the assets provided. It also involves new ways of conceiving the payment and collection models that regulate financial relationships between

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users and providers of assets (for example, via pay per use, depending on the capacity that a provider makes available to a user or on performance-based contracts. [*Source: SPRI - Basque business development agency*]

Smart Factory

A Smart Factory is a production facility in which the production processes are optimized automatically and managed via network machines. Individual tools contain – for example using RFID chips – information that can be read by other machines. One of the advantages of Smart Factories is that they can manufacture small lot sizes efficiently or even on a specially customized basis. [*Source: LBBW*]

Smartizacion

Smartization consists of providing intelligence or increased capabilities to a physical product or process through the incorporation of data processing capabilities and interaction with the environment, whether with other productive devices or with Internet. [*Source: SPRI - Basque business development agency*]

Smart Manufacturing

Aims to reduce manufacturing costs from the perspective of real-time energy management, energy productivity, and process energy efficiency. Initiatives will create a networked data driven process platform that combines innovative modeling and simulation and advanced sensing and control. Integrates efficiency intelligence in real-time across an entire production operation with primary emphasis on minimizing energy and material use; particularly relevant for energy-intensive manufacturing sectors. [*Source: Manufacturing USA*]

Virtual reality

Virtual reality allows the user to fully enter a simulated environment that seems real but is actually computer generated. [*Source: SPRI - Basque business development agency*]

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