Industry 4.0

For Economic Developers

Terms to Know

Sources:

https://packiot.com/glossary-of-digital-transformation-in-manufacturing-40-terms-you-must-know/
https://logicaladvantage.com/19-terms-know-industry-4-0/
https://www.fcc.gov/5g-faqs

3D Simulation: Products, materials or even processes that can be simulated in 3D: so that it is possible to analyze actual data and thus improve the models before implementation.

5G Technology: 5G stands for the fifth generation of mobile communications. 5G technology provides consumers faster data rates with lower latency, or delays, in transmitting data. It also promises more capacity for a more efficient network and energy savings. It enhances existing networks and broaden uses like telemedicine and virtual reality.

Administration Shell: A popular rising Industry 4.0 term, an administrative shell describes the process of automating generic admin tasks. (Related terms: *administration system*)

Advanced Manufacturing: The combination of automation in industry, with advances in computing, connectivity, and IT. Advanced manufacturing enables production to be much faster, more flexible and integrated. In addition, it can be managed remotely and in real-time.

Advanced Robotics: The technology that makes it possible to use robots in industry and services, such as manufacturing, maintenance, cleaning, and other functions. Their usage in factories creates a more agile, productive, competitive and safe market. Industrial robots usually perform repetitive tasks that require precision.

Algorithm: A sequence of mathematical instructions and rules that a computer uses to calculate an answer.

Artificial Intelligence (AI): Artificial Intelligence enables machines to learn patterns and make decisions for themselves. In industry, it allows a large increase in production at a much lower cost, making plants more competitive and efficient.

Augmented Reality (AR): Augmented reality (AR) is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory.

Automation: Describes the use of digital systems to control equipment and machinery within a factory.

Autonomous: These are technologies that can work on their own, without human intervention. Robots, drones and even cars can be autonomous. They automate functions using artificial intelligence and can interact with other machines, objects, and people, in an intelligent way.

Big Data: It corresponds to the huge volume of data constantly collected, processed and analyzed by software/models. They can be used to predict patterns, detect errors, and understand the consumption profile of customers. It is based on this data that the Internet of Things, Artificial Intelligence, Deep Learning, and many other Industry 4.0 technologies work. Get more info on Big Data.

Blockchain: A blockchain is a growing list of records, called blocks, which are linked using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data. By design, a blockchain is resistant to data modification. It is “an open, distributed ledger that can record transactions between two parties efficiently, and in a verifiable and permanent way”.

Business Intelligence: Business intelligence is taking data and transforming it into action and extracting feasible insights from it. It comprises the strategies and technologies used by businesse for the data analysis of business information. BI technologies provide historical, current, and predictive views of business operations

Cloud Computing: Cloud computing is the delivery of computing services—including servers, storage, databases, networking, software, analytics, and intelligence—over the Internet ("the cloud") for faster innovation, flexible resources, and economies of scale. In regard to Industry 4.0, cloud computing plays a central role in where–and how–data is be stored.

Cloud Robotics: As mentioned under *cloud computing*, communication between the physical and digital worlds will be controlled in the cloud. And with cloud robotics, communication can be more easily managed between robots used in mobile applications. (Related term: *robofactory*)

Collaborative Robots: A type of machine that, unlike traditional ones, can work alongside humans without any safety risk. They perform numerous functions and are very adaptable, changing activity or working capacity according to the demand of the moment.

Cyber Physical Production Systems: In a cyber-physical system, also known as a CPS, physical and digital entities are connected, monitored and managed with computer programming and algorithms. (Related term: *CPS platform*)

Cyber-Resilience: This is a "new" term, and only used in specific contexts of modern business challenges. At its simplest, being cyber-resilient means taking measures to prevent and protect against the criminal or unauthorized use of electronic data.

Data Monetization: Refers to how a business is using data for financial benefit. Internal or indirect methods include using data to make measurable business performance improvements and inform decisions (Risk mitigation and fraud detection, customer targeting, value-add services, product or service customization, data syndication to customers).

Data Science: This is an academic/professional field that comprises several components for data analysis and interpretation through mathematics, statistics and information technology. A data scientist not only collects and analyzes inputs, but also interprets and relates the facts to the context in which they are inserted.

Deep Learning: Deep learning is part of a broader family of machine learning methods based on artificial neural networks with representation learning. Learning can be supervised, semi-supervised or unsupervised.

Digital footprint: Whenever one uses the Internet, or even a cell phone, a digital footprint is the mark left behind. (Related terms: *digital shadow*, *digital risk*)

Digital Supply Chain: An environment where processes are web-based. To successfully implement Industry 4.0 concepts, businesses will need to integrate a digital supply chain into their processes. Greater connectivity allows greater sharing of manufacturing processes, production control and scheduling.

Digital Twin (or digital model): A virtual model of a process, product or service. This pairing of the virtual and physical worlds allows analysis of data and monitoring of systems to head off problems before they even occur, prevent downtime, develop new opportunities and even plan for the future by using simulations. A digital twin is associated with an object that actually exists.

Edge Computing: Edge computing is where processing takes place at (or near) the physical location of the user or data source. With the closest processing, users benefit from faster and more reliable services, while enterprises take advantage of the flexibility of hybrid cloud computing. Edge computing is one way a company can use and distribute a pool of resources across a large number of locations.

Edge Ggateway: An edge gateway serves as a network entry point for devices typically talking to cloud services. They also often provide network translation between networks that use different protocols. (Related term: *entry device*)

ERP: Enterprise Resource Planning and refers to software and systems used to plan and manage all the core supply chain, manufacturing, services, financial and processes of an organization.

Fog Computing: Extending cloud computing to the edge of an enterprise's network, reducing the amount of data transferred to the cloud for processing and analysis, improving security. This creates efficiencies and has opportunities for companies concerned with compliance issues.

Human-Machine-Interface (HMI): HMI is the space where interactions between humans and machines take place. Applications within Industry 4.0 center around machine control achieving new levels of safety and efficiency.

Industrial Software: These are programs that help in the collection, manipulation, and evaluation of digital data from industry. With industrial software, the connected machines take all the data to a single system.

Industry 4.0: Industry 4.0 is the subset of the fourth industrial revolution that concerns the industry. The fourth industrial revolution encompasses areas that are not normally classified as an industry, such as smart cities, for instance. Although the terms "industry 4.0" and "fourth industrial revolution" are often used interchangeably, "industry 4.0" factories have machines which are augmented with wireless connectivity and sensors, connected to a system that can visualize the entire production line and make decisions on its own. In essence, industry 4.0 is the trend towards automation and data exchange in manufacturing technologies and processes which include cyber-physical systems (CPS), the internet of things (IoT), industrial internet of things (IIoT), cloud computing, cognitive computing, and artificial intelligence. According to PwC, the concept of Industry 4.0 should be based on three different pillars: digitalization and integration of vertical and horizontal value chains, digitalization of products and services, and digital business models and the consequent access of the consumer.

Innovation: The provision of better solutions that meet new requirements, or new and existing market needs. Innovation takes place through the development of more-effective products, processes, services, technologies, or business models.

Internet of Things (IoT): A network of web-enabled machines or other connected devices that are capable of collecting, exchanging, and acting on data in real-time, including sensors, RFID tags, and IP addresses for the networked interconnection of everyday objects.

Interoperability: A computer system or software's capacity to communicate and exchange data with other machines and software systems.

Intrapreneur: Self-motivated, proactive, and action-oriented people (employees) who take the initiative to pursue an innovative product or service.

Intrapreneurship: A system and culture that allows an employee to act like an entrepreneur within a company or other organization. Allows employees to use their entrepreneurial skills for the benefit of both the company and the employee.

Lights Out Environment: Lights out manufacturing is a methodology, rather than a specific process, referring to fully automated factories that run 'lights out' and require no human presence on-site, hence, they can run with the lights off. A fully automatic factory is one where raw materials enter and finished products leave with little or no human intervention.

Machine-to-Machine Communication (M2M): When networked devices can exchange information and perform actions without the manual intervention of humans. The technology that underpins the Internet of Things.

Machine Vision System (MVS): A type of technology that is a combination of hardware and software that provides operational guidance (inspect, evaluate and identify) to devices in the execution of their functions based on the capture and processing of images. Used for quality control, defect detection, part selection, etc.

Manufacturing Execution System (MES): A production system that allows real-time management. The system records and links operational data (from machines and personal deployment), and is usually connected to the organization's additional automation systems. MES operates at the operational management level and creates a link between the corporate and operational management levels.

Open Data: Open data is data that is available for public use without restrictions.

Open Systems Interconnection (OSI): This is a model that describes how different components in a network communicate with each other. OSI divides communication into 7 layers, called stations. All stations are recorded in a protocol so that they can receive the necessary information from the inner layer and thus function effectively.

Overall Equipment Effectiveness (OEE): The evaluation of how effectively equipment is working in a manufacturing environment.

Platform: A system comprising a hardware device together with an operating system that an application, program or process can run upon.

Predictive Maintenance: The capacity to predict the productivity and maintenance needs of machines within a smart factory. Predictive maintenance also has potential is for machine manufacturers to have data coming back to them after their products are installed in the customer's factories. By better understanding how a product is used and being able to detect defects (and ideally, remote maintenance) leads to better future design and improved customer relationships.

Process Integration: Digital sharing with outside suppliers and internally (vertical and horizontal).

Production Analytics (software): A production analysis software is a platform that helps to visualize real time the data of machines, lines and factories. In addition to live tracking, it also analyzes historical data and makes predictions based on inputs collected from sensors.

Provisioning: This term refers to the process of enrolling, or implementing, a device into a system.

RAMI 4.0 (Reference Architecture Model Industry 4.0): RAMI 4.0 is a three-dimensional structural model that presents the levels and participants of Industry 4.0 in a way that is easy to understand. In this model, the processes are divided into smaller units and it is possible to visualize the structure hierarchy of a modern plant. The functions, processes and data are integrated, allowing a description of the product life cycle. RAMI 4.0 enables the exchange information securely and develop the manufacturing process.

Software as a Service (SaaS): SaaS is a form of software distribution and marketing. In the SaaS model, the software supplier is responsible for all the necessary structures to make the system available (servers, connectivity, information security care), and the client uses the software via Internet, paying a fee for the service.

SCADA (Supervisory Control and Data Acquisition): This is an application rather than a specific technology. A control system in which peripheral devices are used to the interface, in addition to computers and other networks.

Smart Factory: Factories that are monitored by artificially intelligent machines that oversee the manufacturing process, reducing the manpower traditionally required on the factory floor. The data provided by the connected elements brings huge opportunities for businesses to better understand their process, potential flaws and, ultimately, to implement considerable efficiencies.

Smart Manufacturing: Smart manufacturing is used to describe an environment in which computers are in charge of decision-making. In a smart manufacturing environment, physical and digital are connected and communicate with one another to improve production. (Related terms: *smart factory*, *smart production, smart data*)

Smart Sensor (or IIoT Sensor): A device that collects a specific type of data from a physical environment (outside or inside). It takes that information and uses computing resources that are built into the sensor to perform a programmed function on the data it is collecting. It then passes that data on via a networked connection.

Value-added: One of the most popular words to describe the potential outcomes of Industry 4.0, value-added refers to the savings these integrated processes are expected to bring. (Related terms: *value-added system*, *value-added chain*, *value-added process*)

Virtual Reality (VR): A computer-generated simulation of a three-dimensional image that can be interacted with in a seemingly real or physical way by a person using special electronic equipment. In the manufacturing environment it can allow for rapid visualization, prototyping and simulation.