LAKIC Aleksandra

L0

**Source: Google Scholars**

Applications of AI in Intelligent Manufacturing

KEYWORDS: Big Data, Intelligent Manufacturing, new business models, new means, new forms, resources/capacities layer, **ubiquitous network layer**, **service platform**, **intelligent cloud service application layer**, **security management**, **standard specification system**, **intelligent manufacturing technology system, evaluation, global development of intelligent manufacturing, research, China, US, Germany**

Artificial Intelligence is becoming more and more a reality and its use can be a serios game changer, especially when it comes its potential to improve business functioning across industries. The development of AI technologies and its applications has rapidly evolved in the course of the last couple of decades, thanks to the emergence of Big Data, Internet and the information community among other factors.
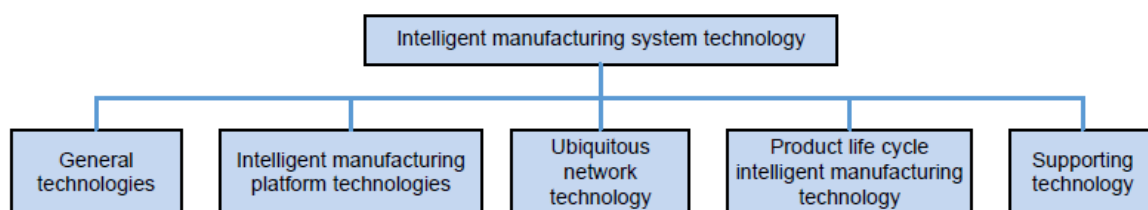
Consequently, the application of AI in manufacturing has provoked the appearance of a new framework – **intelligent manufacturing** - that is integrated with the whole system and lifecycle of product development that enables **new business models**, **new means** and **new forms** (refer to the figure below), that improvs real-time quality predictions in manufacturing and allowing the high quality, high-efficiency and cost-effective processes to take place.
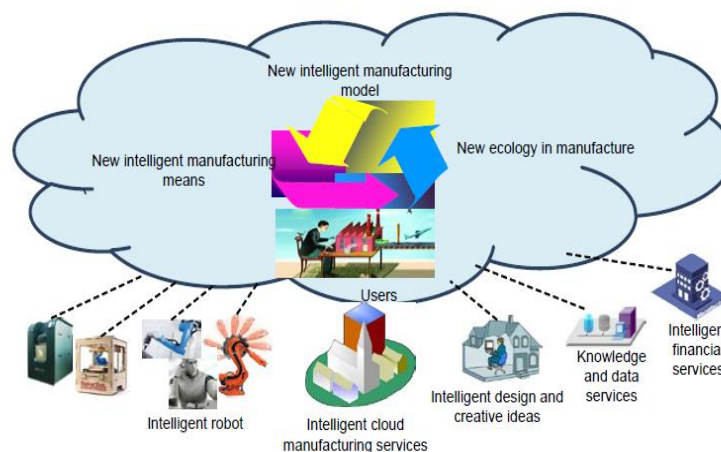
The **intelligent manufacturing system** is based on an **architecture** that encompasses a **resources/capacities layer**, a **ubiquitous network layer**, a **service platform**, an **intelligent cloud service application layer** and a **security management** and **standard specification system**, that integrates human, machine, goods, environment and information, providing on-demand services.

1. **The resources/capabilities layer** combines both **hard** (machine tools, robots, machining centers, etc,) and **soft manufacturing resources** (models, big data, software...) and **manufacturing capacities** of demonstration, design, production, simulation, etc.

2. **The ubiquitous network layer** that englobes both physical and virtual components that help manage communication and sensing.

3. **The service platform layer** consists of a virtual intelligent resources/capacity, a core intelligent support function and an intelligent user interface (UI) layer.

4. **The intelligent cloud service application layer** highlights the role of the human/organization.

5. **Security management and standard specification system** ensures user identification and data security.

The **intelligent manufacturing technology system** is comprised of sets of various technologies, which can be divided in five principal categories, as shown on the picture below:

The application of AI in intelligent manufacturing can be **evaluated** based on three factors, that are **application technology**, **industry** and **application effect**. In regard to the **application technology**, the level and capacity of infrastructure construction, single applications, synergy applications, and business development should be taken in consideration. In terms of the **industry evaluation**, intelligent products, intelligently connected products, intelligent industrial software and the development of hardware

supporting intelligent design, production, management, commissioning and security should be assessed. The **application effects** evaluation should focus on changes in competitiveness and social-economic benefits to measure the direct or indirect impact of the intelligent manufacturing system on capability enhancement and economic benefits.

When it comes to the **global development of intelligent manufacturing**, the **US** and **Germany** are leaders in making innovative and strategic plans, such as the '**Advanced Manufacturing Partnership Plan**' (2011) and '**Industrial Internet**' (2012) (with focus on equipment, people and data for smarter decision-making) in the US, and the '**Industry 4.0 Plan**' (2013) (with focus on intelligent factories and production, utilizing cyber-physical systems for real-time data monitoring and analysis) in Germany. **China** has also emerged as one of the leaders in this domain, as it is undergoing through a shift form low-end to high-end manufacturing with its plans like **'Made in China 2025'** and the '**13th Five-Year Plan**', with focus on innovation, quality and sustainability. However, China faces some challenges that hopes to overcome by implementing the '**Intelligent Manufacturing Development Plan**'.

In order to be able to fully integrate the AI 2.0 into the entire life cycle of processes in manufacturing, more research must be conducted, especially in the domain of key application technologies, such as Big Data, Internet of Things and intelligent resources, while also delving into intelligent manufacturing system platform technology.