

# TOPICAL REPORT

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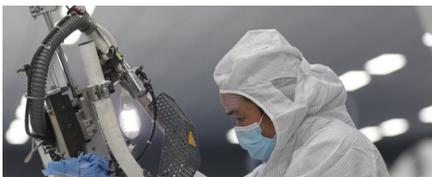
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### MANUFACTURING



#### Winning the Race for Survival: How New Manufacturing Technologies are Driving Business-Model Innovation

"As most manufacturing firms continue to realize their revenues through traditional channels, COVID-19 has created the need for rapid and radical innovation in both business and operating models. The future belongs to those who are able to manage uncertainty and innovate rapidly."

Source: WEFForum

#### A Second First Look For Manufacturing: 3-D Printing Finally Beats The Hype

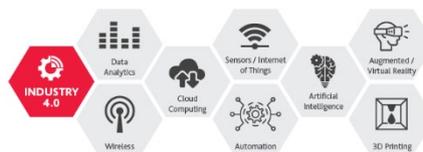
"The additive manufacturing response to supply chain disruption is seeing businesses increasingly able to continue their operations — if not as normal, then as close to normal as is currently possible. For critical need PPE, for example, 3-D printed parts are able to provide stop-gap supply while critical mass manufacturing efforts ramp up their production to the quantities required."

Source: Forbes

#### 10 Ways AI Is Improving Manufacturing In 2020

"Real-time monitoring provides many benefits, including troubleshooting production bottlenecks, tracking scrap rates, meeting customer delivery dates, and more. It's an

### INDUSTRY 4.0



#### The Digital Revolution And Implications Of Industry 4.0

"The purpose of this study is to investigate the impact of technology and digitization on brand business models and ultimately the overall marketing industry. Specific focus has been given to the web 4.0 paradigm. This research will also assess how brands now communicate to their consumers using digital innovations as well consumer responses. Ultimately this study aims to evaluate the effectiveness and compatibility of brands, social media, and technology in today's Fourth Industrial Revolution."

Source: The IIE

#### Role of Collaborative Robots in Industry 4.0 with Target on Education in Industrial Engineering

"The first part of this paper firstly theoretically presents first three industrial revolutions, main inventions and their impact on society and industry development. Then, Industry 4.0 is presented with focus on use of collaborative robots and their role is highlighted. Main part of the article focuses on the Laboratory of Industry 4.0 at University of West Bohemia, its key components, use in education and future plans."

Source: IEEE

### MANUFACTURING



#### How to drive agility and productivity in Manufacturing with Industry 4.0

"This 2020 global research study has been conducted to examine the extent to which manufacturers are leveraging Industry 4.0, whether that is: Embedding intelligence or smart devices in products; Connecting devices to supply chain and wider enterprise; Enhancing manufacturing process with digital connections"

Source: SAP

### DIGITAL FACTORY



#### Digital Factories 2020: Shaping the Future of Manufacturing

"Connected automation is already part of the factory landscape, using both wired Ethernet and legacy wireless systems. Until now, wireless hasn't been fast enough for operations needing instantaneous and precise machine movements. The potential of 5G, however, can conceivably replace expensive cable installations and free up machines from restrictive cabling, making factory layouts more flexible."

Source: PWC

excellent source of contextually relevant data that can be used for training machine learning models. Supervised and unsupervised machine learning algorithms can interpret multiple production shifts' real-time data in seconds and discover previously unknown processes, products, and workflow patterns."

Source: Forbes

### **Preparing for the next normal via digital manufacturing's scaling potential**

"Achieving digital at scale can give European manufacturing the resilience and flexibility it will need to speed its recovery after the coronavirus crisis—and beyond."

Source: Mckinsey

### **How COVID-19 Is Transforming Manufacturing**

"As the COVID-19 pandemic escalates, the advanced economies seem to be geared up for a manufacturing renaissance. But while this may reduce risks for large firms, it probably will not benefit very many advanced-economy workers, let alone the developing countries from which production is being shifted."

Source: Project Syndicate

## **DIGITAL FACTORIES**



### **Top 10 Digital Factories:**

#### **Samsung**

"After ranking in our Top 10 digital factories, we look at how Samsung is adopting smart manufacturing solutions in its factories in Korea and the US."

Source: Global Manufacturing

### **PwC: digital factories shaping the future of manufacturing**

"Digitalisation - a constant trend driving change within the manufacturing industry. The concept of a digital factory is challenging companies to implement innovative technology, and look for employees with different fundamental skills required in a traditional company."

Source: Global Manufacturing

### **A Window Inside A 5G Factory**

"Connected automation is already part of the factory landscape, using both wired Ethernet and legacy wireless systems. Until now, wireless hasn't been fast enough for operations needing instantaneous and precise machine movements. The potential of 5G, however, can conceivably replace expensive

### **Industry 5.0: Is the Manufacturing Industry on the cusp of a new revolution?**

"Looking forward to the fifth industrial revolution it is likely that there will be a paradigm change in how industry will evolve given the tools of industry 4.0; the internet of things, digitisation, blockchain, advanced materials, additive manufacture, artificial intelligence and robotics, drones, energy technology, biotechnology, neurotechnology and virtual and augmented reality"

Source: Proceedings of the International Symposium for Production Research 2019

### **Robotics and Automation as a Foundation of the Fourth Industrial Revolution - Industry 4.0**

"The foundation of Industry 4.0 is Robotics and Automation, Intelligent Sensors, Cloud computing, 3D Printing, RFID, etc. This paper analyzes the implementation of industrial and service robots in production processes, as well as the trend of innovations in the process of developing intelligent sensors."

Source: Grabchenko's International Conference on Advanced Manufacturing Processes

### **Creating a road map for industry 4.0 by using an integrated fuzzy multicriteria decision-making methodology**

". In this paper, this critical decision has been considered as a multicriteria decision-making (MCDM) problem under the uncertainty and vagueness environments. To increase the applicability of the uncertain data for the proposed methodology, intuitionistic fuzzy sets have been adopted. In other words, an integrated fuzzy MCDM methodology consists of interval-valued intuitionistic fuzzy analytic hierarchy process and interval-valued intuitionistic fuzzy technique for order performance by similarity to ideal solution has been suggested to prioritize of transition strategies for industry 4.0. According to proposed approach, "Training and continuing professional development" is determined as the most important strategy during the transition process, while "Technology" and "Equipment and Tools" are specified as the most crucial main and sub-criterion, respectively."

Source: Soft Computing

### **Dynamic capabilities and institutional theories for Industry 4.0 and digital supply chain**

cable installations and free up machines from restrictive cabling, making factory layouts more flexible."

Source: Forbes

## FUTURE FACTORIES



### Reshaping the factory of the future

"Learn how one of Europe's largest manufacturers of trucks and buses, Scania is driving the shift towards a sustainable transport system, creating a world of mobility that is better for business, society, and the environment. An essential part of this transition is taking place within the factories of Scania. At their Smart Factory Lab, Scania is exploring Industry 4.0 in general and how to use a private cellular network to potentially cut cables and streamline processes on the factory floor. The Lab has become a meeting place for different solution providers within smart manufacturing to jointly test their solutions in a real-life environment."

Source: ERICSSON

### The factory of the future full of autonomous robots is being built - BMW, NVIDIA share their progress

"As part of the company's Industry 4.0 strategy, BMW is developing AI-enhanced robots for material handling and transport to significantly reduce the time needed to build multiple models of custom-configured cars on the same production line."

Source: Diginomica

## SMART FACTORIES



### Oracle: a modern platform for smart connected factories

"As part of its solutions, Oracle provides a modern platform for manufacturers to collaboratively manage and improve their processes. By leveraging cloud, IoT, big data analytics, predictive intelligence and supply chain tools, Oracle's connected smart factory platform helps manufacturers to better predict and resolve maintenance requirements, correlate quality issues, reduce downtime and improve quality."

Source: Global Manufacturing

"This study explores the firm's orientation in adopting Industry 4.0 and digital supply chain. Institutional theory and dynamic capabilities view theory are used to explain the theoretical framework."

Source: Supply Chain Forum: An International Journal

### From Industry 4.0 to Robotics 4.0 - A Conceptual Framework for Collaborative and Intelligent Robotic Systems

"This work would like to re-visit the roles of collaborative and intelligent robotic system and its enabling technologies including ROS and ROS2, integrated drive system, robotic sensors, horizontal integration of a robotic network, human-robot friendly and natural interaction, and deep learnt robots."

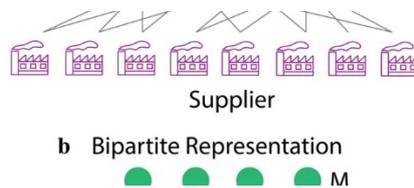
Source: Procedia Manufacturing

### Learning method design for engineering students to be prepared for Industry 4.0: a Kaizen approach

"Underdeveloped along with developing countries face enough crisis of human resources in high-tech industries. As a result, the amount of waste is higher along with less productivity. Highly qualified and smart employees are required as the term "Industry 4.0" introduces a lot of sophisticated and complex technologies that dominates productivity. But in those countries, to cope up with this terminology; neither the educational curriculum and method of teaching has been modified nor changed yet nor will be modified soon."

Source: Higher Education, Skills and Work-Based Learning

## SMART FACTORIES



### Designing an Information Security System in Smart Factories of the Industry 4.0

"Smart factory information security risks can be explained with program and technical means for the operator to control the cyber and physical configuration remotely and other components of the production infrastructure into a single digital space of the company. Measures are proposed to increase the information security level of the Industry 4.0 smart factory based on technical, organization and program solutions."

Source: IOP Conference Series: Materials Science and Engineering

## 'Smart' factories bring many benefits – but introduction is far from simple

"Smart factories could contribute \$2 trillion to the global economy over the next five years, according to the recently published Smart Factories @ Scale study from the Capgemini Research Institute."

Source: Institute of Mechanical Engineers

## INDUSTRY 4.0



## The State Of Industry 4.0 In 2020

"It was in 2011 at Hannover Messe that the German government first announced a new initiative to digitize manufacturing – an initiative known as Industry 4.0. Now, less than a decade later, the uptake of Industry 4.0 – not only in Germany and Europe, but around the world – has been impressive."

Source: Forbes

## What is the future for Industry 4.0 in the post Covid-19 paradigm?

"Industry 4.0 is not only as relevant as it was before the global Covid-19 emergency, it's actually far more relevant moving forward. John Robinson, Strategic Client Advisor, Digital Supply Chain at SAP, explains why."

Source: The Manufacturer

## Making the Move to Industry 4.0

"The fourth Industrial Revolution (Industry 4.0) is changing the way products are created by spreading digitized manufacturing/processing and automation. We have seen the benefits of automation over decades and are now adding enhanced data, machine learning and artificial intelligence to the mix. Today, autonomous systems are more interconnected, communicating, analyzing and interpreting data to let managers intelligently decide and act in other areas of the factory."

Source: Machine Design

## 10 ways 5G in manufacturing can boost Industry 4.0

"By enabling a switch from legacy systems to connected tech, 5G will fundamentally transform the manufacturing industry."

Source: 5GRadar

## Supporting the Design, Commissioning and Supervision of Smart Factory Components through their Digital Twin

"A key result of this work is the development of a set of virtual engineering tools and methodologies based on OPC UA and implemented using RobotStudio in order to accomplish the complete lifecycle support of an automated system, from the project and simulation phases, to the monitoring and supervision phases, suitable for integration in Industry 4.0 factories. Results are described for a test scenario with different devices."

Source: IEEE

## Supporting the Design, Commissioning and Supervision of Smart Factory Components through their Digital Twin

"In this paper we explore the use of the ABB RobotStudio software combined with the OPC UA standard with this vision in mind. Methodologies were defined to integrate both new generation and legacy equipment, as well as robot controllers and guidelines for equipment development. A key result of this work is the development of a set of virtual engineering tools and methodologies based on OPC UA and implemented using RobotStudio in order to accomplish the complete lifecycle support of an automated system, from the project and simulation phases, to the monitoring and supervision phases, suitable for integration in Industry 4.0 factories. Results are described for a test scenario with different devices."

Source: IEEE

## Real time localisation of mobile robots using odometer and an external sensor in smart factory

"In this study, we aim to introduce a method to solve the problem of localizing AGVs in an indoor environment. This problem exists in the real world as it is still not possible to acquire noise free measurements from an ordinary IMU sensor. This project is aimed at integrating the IMU and odometry readings in order to obtain a more accurate position of the AGV in a particular location."

Source: Nanyang Technological University

## Smart Factory. What Employees Will the Company Need in the Future?

"The purpose of the paper is to provide information about a research project aimed at supporting the

implementation of the Smart Factory concept (management system with support of digitization and robotization) in the production plant ALPS Electric CZ, Sebranice, regarding changes in working roles, working conditions, development of employees, changes in conditions for in-company communication and overall changes in corporate culture in ALPS Electric CZ, Sebranice. For research purposes, the research problem was formulated and six research questions were set."

Source: Univerzita Tomáše Bati ve Zlíně

### **A Study on the Factors Influencing on the Intention to Continuously Use a Smart Factory**

"This paper aims to investigate key factors having influence on the intention to continuously use a smart factory, the innovative IT device, on the basis of the technology acceptance model. This paper analyzed the influence of the leadership of CEO, organizational learning and perceived switching costs on the intention to continuously use a smart factory by the parameters of perceived ease of use and usefulness, the major belief valuables of the IT acceptance model."

Source: Journal of the Korea Industrial Information Systems Research

### **Factors Affecting Technology Acceptance of Smart Factory**

"In this study, based on the UTAUT (Unified Theory of Acceptance and Use of Technology), which has been proved through many years of research, I have studied the factors that influence the acceptance of smart factory technology. As a result of research, performance expectancy, social influence, and facilitating conditions of UTAUT model had a positive(+) effect on behavior intention."

Source: Journal of Information Technology Applications and Management

### **Analysis on Smart Factory in IoT Environment**

"This study deals with smart factory technologies related to the 5G era. In addition to the various interpretations of smart factories, this study examined the situation and progress of smart factories in major countries around the world and described solutions."

Source: Journal of The Korea Internet of Things Society

### **Quality Strategy for Building a Smart Factory in the Fourth Industrial Revolution**

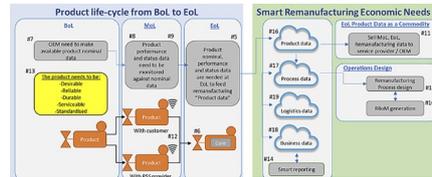
"This paper aims to propose a practical strategy for smart factories and a step-by-step quality strategy according to the maturity of smart factory construction."

## Trends in Smart Manufacturing: Role of Humans and Industrial Robots in Smart Factories

"This paper provides an overview of the role of humans and robots in smart factories, their connection to Industry 4.0, and which progress they make when it comes to related technologies."

Source: Robotics In Manufacturing

### MANUFACTURING



## Smart remanufacturing: a review and research framework

"Changes in product ownership models will affect the remanufacturing industry, with the growth of product-service-systems seen as an opportunity to re-circulate resources and create value. This is being supported by changes in society, user expectations and workforce attributes. Key to the success of remanufacturing in an I4.0 future is the uptake of existing and emerging digital technologies to shorten and strengthen links between product manufacturers, users and remanufacturers."

Source: Journal of Manufacturing Technology Management

## Digital Twin of Experimental Smart Manufacturing Assembly System for Industry 4.0 Concept

"This article deals with the creation of a digital twin for an experimental assembly system based on a belt conveyor system and an automatized line for quality production check. The point of interest is a Bowden holder assembly from a 3D printer, which consists of a stepper motor, plastic components, and some fastener parts. The assembly was positioned in a fixture with ultra high frequency (UHF) tags and internet of things (IoT) devices for identification of status and position."

Source: Sustainability

## Human-Computer-Machine Interaction for the Supervision of Flexible Manufacturing Systems: A Case Study

"In this paper, we propose a seamless Human-Computer-Machine Interaction (HCMI) architecture for supporting the supervision activity of the operator in the context of flexible

manufacturing systems. The suggested interaction is implemented and validated using a lab case study where we demonstrate how the proposed HCMI architecture, in line with the Industry 4.0 architectural design principles, enables 'close-to-realtime' supervision of the manufacturing system in its self-adaptation to production changes."

Source: Sustainability

### **The Practice Path of High Quality Intelligent Manufacturing in Taiwan**

"This paper provides several cases from semiconductor and hand tool industry in Taiwan to illustrate the breakthrough of modern industrial engineering (IE) in the introduction of intelligent manufacturing. This paper can provide some inspiration for enterprises that are transforming towards Industry 4.0."

Source: ICMSS 2020: Proceedings of the 2020 4th International Conference on Management Engineering, Software Engineering and Service Sciences

### **Application Of Industry 4.0 In Manufacturing**

"In current circumstance, all businesses are attempting to extend their arms everywhere throughout the globe to turn into a solid rival in manufacturing world. Industry 4.0 includes a wide arrangement of advances that gives a decent stage to development and imaginative arrangements. To actualize such condition, it requires the use of cutting-edge forecast devices that includes the transformation of information into data in a methodical procedure to clarify vulnerabilities. This innovation is a chance to change the economic standards of the business. As we probably are aware India is in its verge of advancement. It is critical to comprehend India's pushed towards "Make in India". In this way it is significant for an India to embrace industry 4.0 innovation and to get adjusted to the equivalent. This thus contributes in the advancement of Indian economy"

Source: EPRA International Journal of Multidisciplinary Research (IJMR)

### **A Strategic Roadmap for the Manufacturing Industry to Implement Industry 4.0**

"This study presents a systematic and content-centric literature review of Industry 4.0 enabling technologies, to highlight their impact on the manufacturing industry. It also provides a strategic roadmap for the implementation of Industry 4.0, based on lean six sigma approaches. The basis of the roadmap is the design for six sigma approach for the development of a new process chain,

followed by a continuous improvement plan."

Source: Designs

### **IoT architecture for advanced manufacturing technologies**

"The system works with a microcontroller, multiple RFID, SD module, Wi-Fi module and uses SPI protocol for operation and is capable of ensuring the quality of the process and the product. The developed architecture for RFID embedded solution for group technology is integrated with data analytics engine and machine learning module, thereby enabling real-time tracking of part quality and productivity"

Source: Materials Today

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