ITMAM Reports

Report No. 1

ITMAM Consultancy

Fourth Industrial Revolution (Industry 4.0) Report

1-4

- Industry
- Technologies

Table of Content

Title of the first report 1-4

The Fourth Industrial Revolution (Origin and Future)

Title of the second report 2-4

The impact of Emerging Technologies Adoption in Industrial and Logistics Sector

Title of the third report 3-4

An analytical study on the Fourth Industrial Revolution (facts and opportunities)

Title of the fourth report 4-4

Study of the readiness of the industrial sector for the fourth industrial revolution

Industry 4.0 Overview

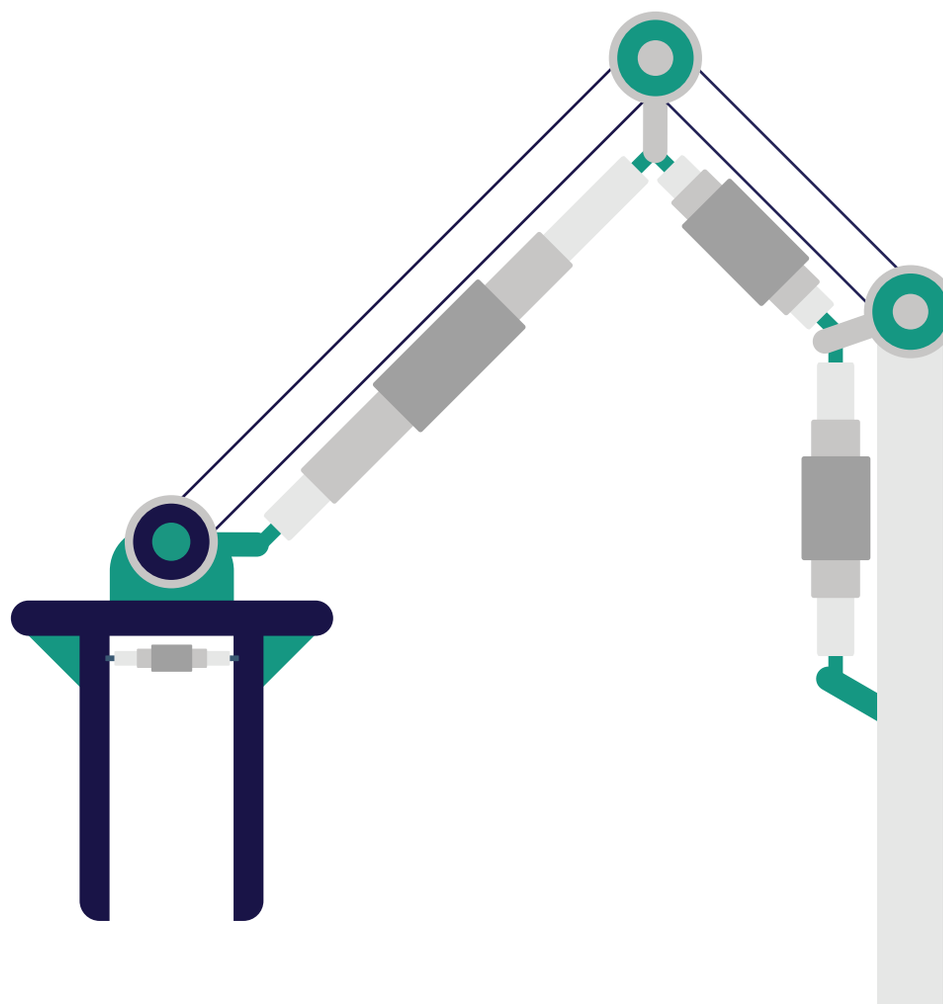
We are on the verge of a technological revolution that will radically alter our way of life, work, and communication, marking a new era of human development propelled by the convergence of innovations from the First, Second, and Third Industrial Revolutions.

Fourth Industrial Revolution "Industry 4.0" embodies a technological transformation that profoundly affects cultures and economies worldwide, characterized by its efforts to merge material, technological, and biological domains in a manner that generates both vast prospects for advancement and potential hazards stemming from its accelerated nature and far-reaching implications.[1] [2]

What Is Industry 4.0?

The term “Fourth Industrial Revolution” (or “Industry 4.0”) first appeared in the German High-Tech Strategy (HTS) Program back in **2011**, but achieved global recognition and widespread use following its adoption by the World Economic Forum (WEF) in **2016**.

The Fourth Industrial Revolution refers to the new industrial wave that builds upon Industry **4.0** , characterized by its harnessing of cutting-edge technologies such as robotics, simulation, the Internet of Things, cloud computing, and others.[3] [4] [5]



Industry 4.0 is digitally transforming and integrating processes together:

Vertically:

This revolution manifests in the transformation of traditional products and services into digital counterparts, the creation of entirely new digital products, and the revamping of manufacturing processes.

Horizontally:

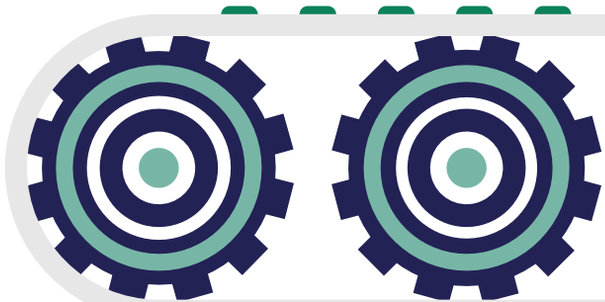
The impact of the Fourth Industrial Revolution extends beyond internal operations, encompassing suppliers, customers, and partners across the entire value chain. This holistic approach facilitates the development of integrated solutions within a unified digital ecosystem. [6]

The Industry 4.0 global market value amounted to

114.55
USD billion
in **2021**

And is expected to reach

377.30
USD billion
by **2029** (at a CAGR of **19.4%**)[7]



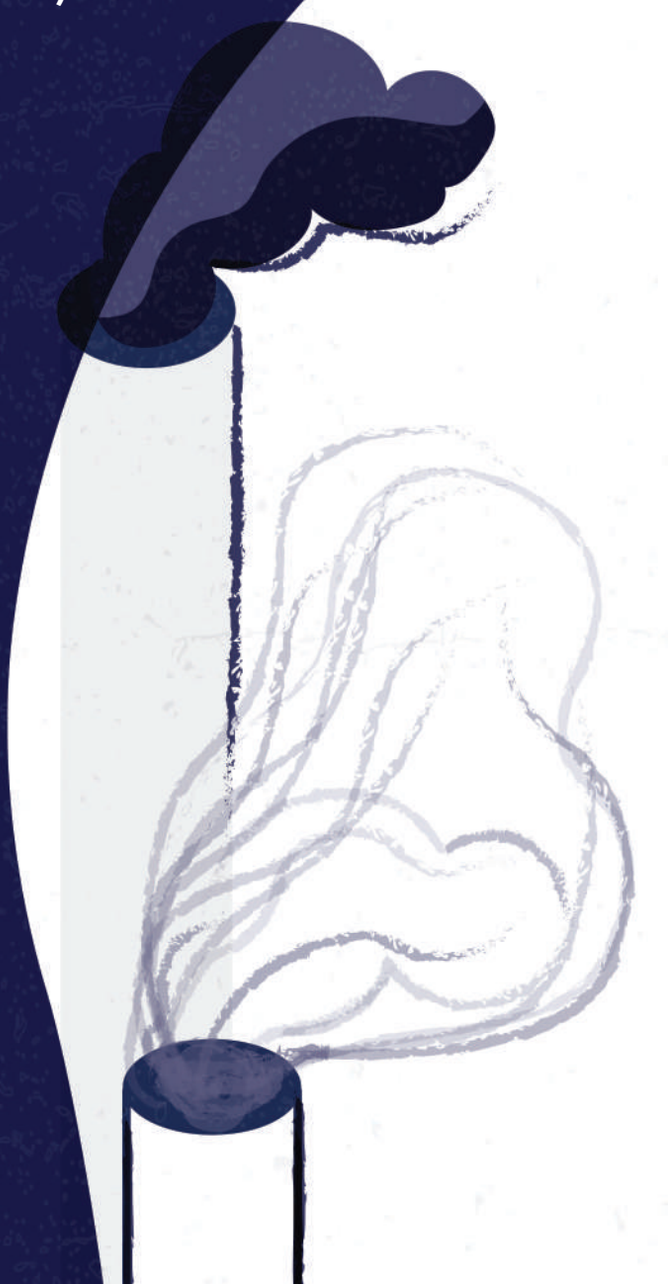
From Steam to Sensors: The Industrial Revolutions across History

First Industrial Revolution (Industry 1.0) In the late 1700s[8]

- Utilizing steam and water for production rather than relying on human resources and animals.
- Employing machinery and equipment, rather than relying on manual production, to manufacture goods.

Second Industrial Revolution (Industry 2.0) In the late 1800s

- Developing production lines, and using oil, gas and electrical energy.
- Inventing the telephone and telegraph.
- Relying on mass production, and automating some manufacturing processes.

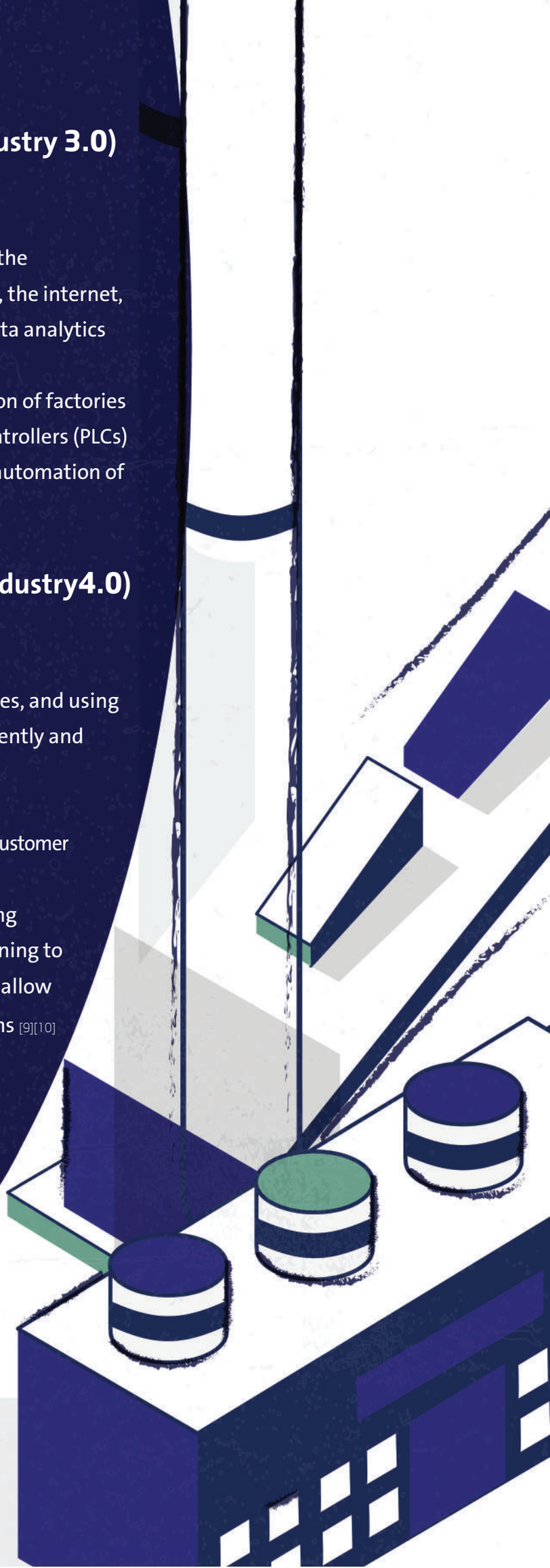


Third Industrial Revolution (Industry 3.0) In the late 1900s

- A defining feature of this revolution is the integration of cutting-edge computers, the internet, advanced telecommunications, and data analytics into manufacturing processes.
- Embarking on the digital transformation of factories by integrating programmable logic controllers (PLCs) into machines and equipment for the automation of certain processes and data collection.

Fourth Industrial Revolution (Industry4.0) Current era

- Employing smart machines and factories, and using data to help produce goods more efficiently and productively.
- Using mass customization to increase flexibility across factories and better meet customer demands
- Collecting and analyzing data, and using artificial intelligence and machine learning to achieve information transparency and allow smart factories to make better decisions [9][10]



Key Industry 4.0 Technologies

Cloud Computing:

Cloud computing fosters integration across supply chains, production, sales, distribution, and other services. It also facilitates the processing and analysis of large volumes of stored data in a more efficient and effective manner, while reducing startup costs for small and medium-sized enterprises.

Artificial Intelligence and Machine Learning:

Artificial intelligence and machine learning allow full utilization of the volume of information generated across factories, and can enhance predictability and automate processes, resulting in higher operating efficiency.

Additive Manufacturing:

Additive manufacturing, also known as 3D printing, refers to the use of special printers to form and create 3D objects by adding successive layers one on top of the other. Additive manufacturing is a specialized approach that contrasts with subtractive manufacturing, which involves using dies to cut out and remove material from a solid block.

Internet of Things:

The Internet of Things is used as a key component of smart factories to equip and provide machinery and equipment with sensors and a distinctive Internet Protocol (IP), allowing them to connect to other devices and exchange large amounts of valuable data for collection and analysis purposes.

Key Industry 4.0 Technologies

Big Data Analytics:

The utilization of cutting-edge technologies to analyze the immense volume of data gathered from production machinery sensors facilitates the discovery of patterns and the anticipation of maintenance and repair requirements. Moreover, big data analytics underpins production efficiency evaluation, data comprehension, improved forecasting, and automated production control.

Digital Twin:

This technology allows the creation of digital twins, representing a virtual replica of processes, production lines, factories, and supply chains. Digital twins can be used to increase productivity and improve workflow by simulating the production process. For instance, digital twins may help in testing possible changes occurring to the manufacturing process to find ways to reduce downtime.

Virtual Reality (VR) and Augmented Reality (AR):

Virtual reality uses virtual environments, while augmented reality integrates virtual elements into the existing real-world environment, both to provide useful knowledge and information to improve operations, increase safety, and reduce costs. [11]

Industry 4.0 Areas of Application

While Industry 4.0 originated in the industry sector, its principles and technologies can be applied to a wide range of other fields.
The Industry 4.0 areas of application include the following: [12]

Industry

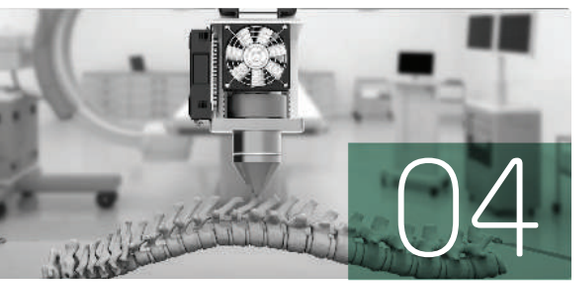
Harnessing augmented reality (AR) to provide information and enhance the working environment for operators engaged in complex tasks, and employing automated guided vehicles (AGVs) for the transportation of materials between locations.

Agriculture

Using drones to control and monitor agricultural lands, and utilizing artificial intelligence to analyze agricultural factors, such as temperature, to improve planning, and witnessing the emergence of vertical farming.

Wholesale and retail trade

Utilizing big data to gain insights into consumer behavior, cloud computing to facilitate seamless data sharing, robotics to streamline in-store inventory management and delivery services, and augmented reality for virtual product testing.



Healthcare

Employing additive manufacturing to create 3D objects that are similar to human cells and organs, and using artificial intelligence to speed up the issuance of medical reports.

Finance

Witnessing the emergence of blockchain-driven cryptocurrency and fintech sector integrating technology into financial services, and exploiting the Internet of Things and big data to provide basic banking services

Industry 4.0 Advantages

The adoption and application of Industry 4.0 technologies have many advantages, focusing on reducing costs, increasing efficiency and productivity, enhancing safety, improving accuracy, and reducing downtime. According to a study carried out in this regard, the following advantages are expected to be achieved upon adoption of the Industry 4.0 technologies: [13]

15 - 20%
Reduced inventory holding costs

15 - 30%
Increased staff productivity

30 - 50%
Reduced equipment downtime

85%
Improved forecast accuracy

Industry 4.0 Advantages

The advantages of Industry 4.0 technologies adoption are evident across many use cases, most notably in:

Improving production [14]

Challenge

Manufacturers' inability to accurately track items throughout the production process and the difficulty and time-consuming nature of implementing changes to production processes.

Solution

Ericsson has successfully implemented Digital Twin technology, which provides a clear digital representation of the current state of the production environment, enabling the planning of future scenarios ("what-if scenarios") by simulating operations and identifying the best ways to improve them without making any changes to the real environment.

Key Findings

Improved production flow	Decreased rework rate	Reduced downtime
60%	6%	3%

SIEMENS

Ensuring integration between team members and design processes [15]

Challenge

The widespread use of diverse software programs by product designers, combined with the lack of universal access to updated data among team members, generates a significant number of workflow errors, causing substantial time and effort to be squandered.

Solution

Leveraging the Teamcenter simulation system to manage data, facilitate team collaboration, and integrate diverse software applications and employing digital twins to optimize and automate operations.

Key Findings

Reduced duration of initial evaluation cycle of products

50%

Reduced time required to identify design options (in early stages)

6%

Providing asset performance management solutions [16]

Challenge

Asset management faces challenges in ensuring safe and efficient operations and achieving long-term production and profitability goals.

Solution

A suite of software and services designed to enhance asset performance, increase operational efficiency, and optimize maintenance through digital twin data analysis and process automation.

Key Findings

Reduced environment, health and safety (EHS) incidents

3 - 40%

Increased asset availability

2 - 6%

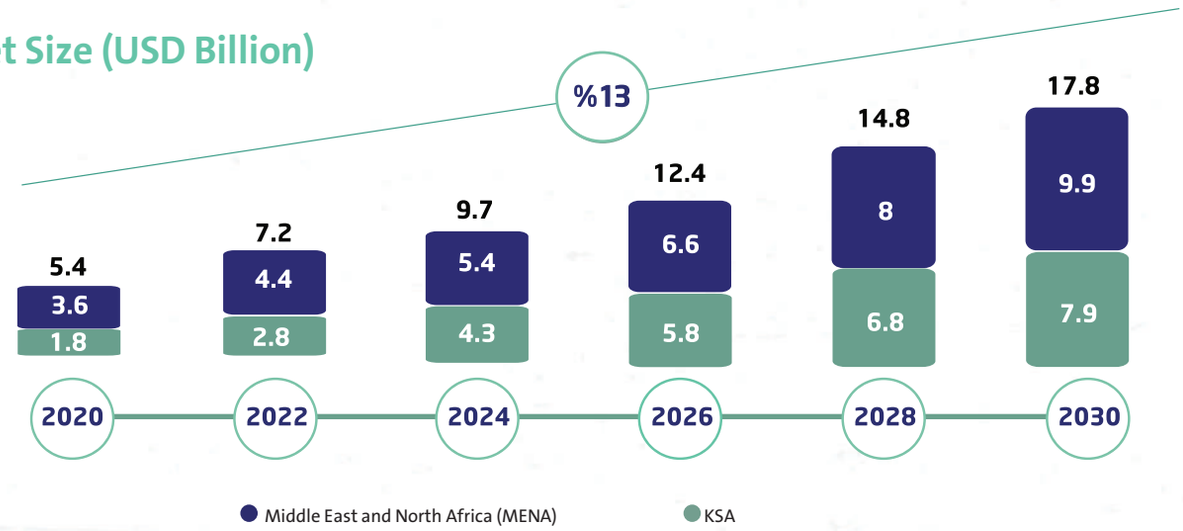
Reduced inventory cost

5 - 10%

Current Status of Industry 4.0 in Saudi Arabia

In an era shifting towards a more advanced future, the Kingdom of Saudi Arabia is keeping pace with all recent Industry 4.0-led developments taking place worldwide in view of the need to break away from traditional practices.

Market Size (USD Billion)



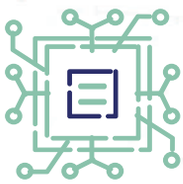
The compound annual growth rate (CAGR) is approximately **13%** in the Middle East and KSA. [17]

The size of the Industry 4.0 market in KSA was approximately valued at USD **1.8** billion in **2020**, and is expected to reach USD **7.9** billion in **2030**.

453

USD billion

Allocated as a financial subsidy to support various mining, industrial, logistics, and energy projects.



28

USD billion

Allocated by the Saudi Industrial Development Fund (SIDF) to support Industry4.0 projects.

2.5

USD billion

Allocated as a government subsidy to support building the digital infrastructure.

800

USD million

Allocated by a specialized program to fund the transformation of **100** factories and adoption of Industry 4.0 technologies.

Current Status of Industry 4.0 in KSA

The growing demand for Industry 4.0 is led by several key drivers, the most prominent of which are the following:

Saudi Arabia is the largest technology market in the MENA region.

The Industry 4.0 ecosystem relies heavily on companies and service providers from outside KSA.

Due to the growing need to reduce costs through process optimization, manufacturers are increasing their spending on emerging technologies and digital transformation solutions.

The Saudi Vision **2030** aims at increasing the share of non-oil revenues in GDP, requiring industrial companies to enhance and improve their operations through digital transformation.

Many stakeholders are coming into play to take part in the Industry 4.0 in KSA, the most prominent of which are the following:

وزارة الصناعة والثروة المعدنية
Ministry of Industry and Mineral Resources

برنامج تطوير الصناعة الوطنية والخدمات اللوجستية

وزارة الاتصالات وتقنية المعلومات
MINISTRY OF COMMUNICATIONS AND INFORMATION TECHNOLOGY

وزارة الاستثمار
Ministry of Investment

هيئة المحتوى المحلي والمشتريات الحكومية
Local Content & Government Procurement Authority

CST
هيئة الاتصالات والفضاء والتقنية
Communications, Space & Technology Commission

SDAIA
الهيئة السعودية للبيانات والذكاء الاصطناعي
Saudi Data & AI Authority

وزارة التجارة
Ministry of Commerce

KACST
مدينة الملك عبدالعزيز للعلوم والتقنية

مدن
MODON

SIDF
صندوق التنمية الصناعية السعودي

Key Efforts to Promote Industry 4.0 Adoption in KSA

In light of the Saudi Vision **2030**, KSA has paid great attention to keeping pace with the Industry 4.0 realm and its applications as a key focus area of the National Industrial Development and Logistics Program.

Current trends aim to focus on achieving the goal of promoting the digital economy to thrive in the Industry 4.0, by:

Creating an adequate legislative environment by establishing the necessary legal frameworks to expand the scope of application of the Industry 4.0 technologies in line with the development of the Program sectors.

Developing the Industry 4.0 technologies ecosystem, as well as expanding existing value chains and developing new ones.

Developing the telecommunication and digitization technologies infrastructure as a key enabler for the growth and expansion of Industry 4.0 applications across various sectors.

Key Achievements

01 **Launching the National Digital Transformation Strategy:**

The Digital Transformation Unit launched the National Digital Transformation Strategy, focusing on priority sectors, including Industry 4.0.

02 **Assessing100 factories:**

The Saudi Authority for Industrial Cities and Technology Zones "MODON" assessed **100** factories, and provided a roadmap for Industry 4.0 technologies adoption.

03 **Raising the awareness of 1,421 enterprises:**

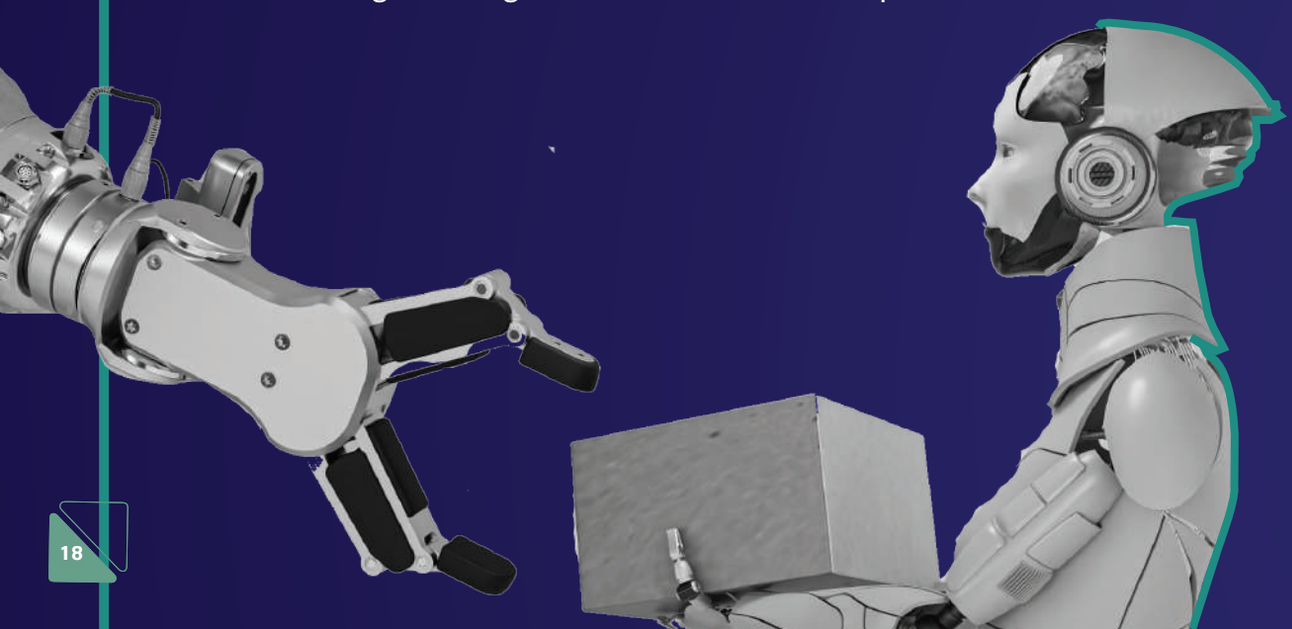
Raising awareness among **1421** establishments about the significance of fundamental and advanced technologies, motivating **37** establishments to adopt Industry 4.0 technologies.

04 **Establishing the Innovation Center for Industry 4.0:**

The King Abdulaziz City for Science and Technology (KACST) established the Innovation Center for Industry 4.0 to provide a number of Industry 4.0 technologies and capacity-building solutions [18].

05 **Adopting the Smart Industry Readiness Index (SIRI):**

SIRI was adopted to measure the digital readiness of the National Industrial Development and Logistics Program sectors-affiliated enterprises.



References

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