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AI NEED IN DIGITAL TRANSFORMATION IN INDIAN MANUFACTURING MANAGEMENT MAKING IT INTELLIGENT SMART FACTORY

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ABSTRACT

Growing technologies, with rising demand for process output in Indian factories drive automation processes that make high profits for the industry. This AI led digital transformation enables equipment self-configuration, predictive cap abilities, integration of connected devices with results from AI technology, manufacturing intelligence called "Smart Factory."

Keywords: Digital Transformation, Smart Devices, Sensors

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1. INTRODUCTION

Indian industry has changed rapidly due to digital automation, it is important to design Smart factory item, decentralizing, visualizing, real-time capacity, integration in vertical and horizontal areas, stock adaptation, company social significance, and manufacturing path [1,2]. In Figure.1.explains the digital innovation that brings "Intelligence" with smart devices, sensors, data and analytics to manufacturing[3].

Industry 1.0	1784	First Industrial Revolution	Steam engine (first machinery)
Industry 2.0	1870	Second Industrial Revolution	Electric Power (first production line)
Industry 3.0	1969	Third Industrial Revolution	Logic controller
Industry 4.0	2013	Fourth Industrial Revolution	German introduced industry 4.0

Figure 1: Industrial Growth.

Industry 4.0 (I- 4.0) concepts are: Smart production, digitalorscalabledevelopment,compatibility,design,decentralizing, virtualising, flexibility in real time, vertical and horizontal integration, stock differentiation, business social interest and company orientation [4].The advanced fast, adaptive, human-machine communication and scalable technologies[5,1,3]neededI-4.0definitionbringing [6] Small and Mid-sized enterprises (SMEs) towards the digital world by means of innovations Like Cyber- Physical Services (CPS), Big Data Analysis, Internet of Peoples (IoP), Cognitive and Cloud services, Additive Manufacturing, Blockchain, Cryptography, Increased Reality, Simulation, Enterprise Architecture and Integration (EA EI), Modeling, Semantic Automation and Business Robotics[7,2]. The Internet of Services and Information and Communications Technology (ICT) [2] are connected to the Internet of Things (IoT) which results Intelligent manufacturing called “smart factory”. I- 4.0 technology is self-optimisation, self-adaptation with centralized networks that digitize market development [8]. This is used to provide a better way to tackle complex [9] issues with efficiency and income improvements [10]. The Key measurement is developing, updating, analyzing, monitoring

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and continuous improvement of automated manufacturing systems, also known as the 'Intelligent or Smart Factory' [11]. It focuses primarily on integration process within and around enterprise boundaries, mainly on predictive maintenance and real time access to mobile. information[12].

2. DIGITAL TECHNOLOGY SMARTFACTORY NEEDS

The digital technologies linked IoT, which interacted with each other machines and automatically took better decisions [13]. Value and strategy focused on IoT domains, stakeholders and business models[14].

i) IoT

IoT in I-4.0 also known as Industrial IoT (IIoT), which addresses the networks in industry [15]. It involves the digital transformation of machinery's products/ goods, processes, and production including computer activity simulations (3D). This provides greater visibility and customer insights into manufacturing operations. System controls, middleware and medical devices are integrated, storage facilities for backend cloud services. [16].

i) a. IIoT

IIoT relies on smart machines for the efficient, routine and then human data collection and transmission. This report shows the tremendous potential for predictive maintenance, production initiatives, reliability of product energy quality and design optimisation. Consequently, IoS discusses value development through the materialization of the Product as Business model of a Service (PaaS). Now consumer product manufacturers are trying to create direct interaction with customers and improve their competitiveness through the provision of extra services and new sources of revenue [17], and the technology support required IoS. IIoT uses intelligent devices to efficiently, consistently and then humanly collect and distribute data. This reports shows the great potential for predictive maintenance, production projects, product energy quality efficiency and optimization of design. Therefore, IoS explores the production of profit by materializing the product-as-a-services business model (PaaS). Consumer goods producers are trying now, by offering secondary services and creating alternate source,flows of income[17], to build direct ties and to which enhance their leading position, and IoS offers the right technical infrastructure. In IoS technology, such as sensor-oriented devices, PaaS is enabling a business strategy that constantly feeds the provider's use of material and condition details and then can utilize the information of the users. purposes.[18].

ii) IoP

IoP relies on a socio-technical framework, which is not end customers applications but active elements in the internet [19]. The IoP network integrates as a software the social devices (SDs) and the PaaS. The precursory features of digital devices (smartphones, for example) coordinate communications with many other Wireless-connected devices, while PaaS offers personal devices the ability to implement their programs, such as online social and background profiles.[20,21].People put their lives online in human history, and show how they are of interest. Such data represent the social news and internet behaviors of people. Through gathering data and simulating them in the IoP system, businesses can predict new technologies that deliver results in real time. Cloud computing is a new innovation and is not having a common description. Its recent growth in hardware, virtualisation, delivery of internet services[22].

iii) Cloud Computing

Usage of cloud computing with software platform,Web- based interface and cloud communication enables con- nected resources to be incorporated [23]. It will in effect help to create the next generation of cloud development. [24].

iv) Big Data

Its new generation technology helps organizations to derive value by identify, store and analyze large amounts of a data. It helps organizations better assess the vast amount of knowledge they possess, forecast what would be likely to occur next, or what steps need to be taken to achieve successful or effective results [25]. Which understands fast observations and decision- making patterns, and retains competitiveness[26]).

v) Big Data Analytics

Big data analytics, in particular, would allow manufacturers can enhance the utilization and efficiency of resources, increase product customization, optimize digital maintenance, avoid failures, streamline production and distribution chain management more successfully [27].

vii) Cognitive Manufacturing

Cognitive service is used in IBM, example says that how big data analysis are generated [28].

vii) Blockchain

Blockchain is also known as Distributed Technology (DT), It is the basis of crypto-currency like Ethereum and Bitcoin, however his features go well beyonds. It is irreversible, accessible and defines faith, as it makes open, decentralized, safe, reliable, fast, public and private technologies [28]. The development of blockchain is important in I-4.0 because crypto-currency allow numerous digital devices to carry out transparent, stable, Simple and quick business transactions, completely automated in the IoT setting with no human assistance [29]. I- 4.0 develops systems for automation and blockchain which create trusted relationships among smart manufacturers, distributors and users. It brings machinery inside the smart factory into IIoT, CPS, and supply partners will allow. Augmented reality (AR) is an automation that enables the simulation of the graphics embedded in the real-time industries [30]. With growing advances in design and development, the [31] fault is widely used to define, schedule, track, diagnose recover. Output outcomes are assisted by manufacturers preparation, maintenance activities, quality control and product design[32].

viii) Automobile Industry

Growing on automation and robotics plays an sig- nificant part in the automotive industry. [33].Market demands for robots increased as a result of industrial automation.Its benefits include minimal throughput, low fault frequency, excellent quality, minimized excess and then use [34].

ix). Cyber Security

It is a major aspect of I- 4.0 providing organiza- tions with safe internet linking. The I- 4.0 will be challenged by its security and privacy concerns inside the environment [35], "manufacturing things" link through the supply chain [36] via

the internet. I- 4.0 puts together consumer relationships and can deliver orders to a partner immediately in real-time industries. Manufacturing materials should help the concept of a 'smart factory' by enhancing production speed, design, reductions in value chain, developing software and industrial scale growth [37]. Simulation and its techniques for system operations design, check and execute [38]. Simulation and modeling in smart factories would be critical to normal life for real-time data, which include computers, products and humans [39]. This stops manufacturers from making errors. Fabrication studies show greater simulation capacity in future development technologies. CPS is really a collection of revolutionary technology which enable the unique combination and virtual capability operations [16]. It is managed and Tracked using software-based algorithms and closely connected to items from their users through theinternet.

x) Semantic Technologies

I-4.0 Semantic technologies attain IoT [40], which links data and processes through IIoT. It offers tools that communicate by interfaces with each other, and prevents machinery from being combined by different manufacturers. In this case, the combination of semantic site with digital Web of Things (WoT) software will offer representation of information called Web Ontology Language[41].

2. I- 4.0 Principles

i) I-4.0-service Orientation

Service orientation in I- 4.0 applies mainly to the business model (Maas) of a networked logistics system for the production of products. Inter-connectivity among companies as well as the interface between Connected devices and cloud services has developed a new method of development to communicate its needs automatically. In this setting several manufacturing processes from different industries can combine complex tasks [42]. Products were distributed as a service in the other model (PaaS), here consumers are subscribed to the product and the cost on an industry-based basis. IoS technology enables this business model, which can be incorporated into the monitoring products. Smart technology is a new generation of devices that integrates with various types of sensors that communicate with industry and during their process cycles capture, store and transmit data. [43]. This stage of smart products will interact with manufacturing industry-related details, How is the past state and how much measures are required to reach the destination[16].

ii) smart Factory – Automated Devices

Smart factory is a connected system with smart machines and materials which automatically find the defect, timing and waste. Process efficiency is so needed in the current setting, industry automation and self-optimization are developed. It is dynamically integrated with the cps program, where resources are innovated as intelligent things [44]. It Will communicate with one another human resources via the [15] IoP, WoTand IIoT. I- 4.0 Interoperability can be described atvarious levels including organizational, semantic, systemic and technological interoperability [7]. I- 4.0's other design theory is modularity, which switches from linear to planning, static structures, and inflexible manufacturing. This may respond to requirements that involve whole output levels and manufacturing outputs [16,2]).

iii) Smart Technology – Intelligent Factory

The emergence of new developments in robotics, such as CPS, IoT, cloud computing, robotics and user-based additive

manufacturing products. This ex- plains why manufacturers not only meet consumers and address current requirements and expectations, but also IoP, visualization and Data analysis benefits to predict future business patterns and the needs of customers[7,15].

iv) Decen Tralization

Smart factory focused on decentralization such as Intelligent monitoring and auto-regulating mechanisms, which operates independently and makes its own decisions [16,23]). Industries take advantage of decen- tralization for generalised planning and implementation of multiple processes. Virtualization allows "digital twin" of the sensor information collected in prototype form from the modern world based on Virtualisation or simulation[45,46].

v) Digital Twin

A smart's digital twin allows the digital footprint of its past or current products across its production cycle, through product design. This provides a clearer understanding of the product's output at the point of purchase, but also helps businesses to analyze and develop the product [45,35,42]. I- 4.0 is typically Com- bined, actual-time and actual-world data in a range of measurements, including smart company, smart plant, products and business associates, real-time IoT apps [47,48. Real-time functionality includes data gathering and data interpretation, decision-making and security threats based on current findings[35,6].

vi) System Integration

System integration is the process of one device, offering a service for the company. It is focused on I-4.0 that smart items and other smart processes need to incorporate production systems and technologies. Its vertical and horizontal integration to link all information and functions across industry [20].Responsibility in the business world includes such fields as labor and environmental regulations. The fourth industrial growth, robotics and automation of manufacturing would significantly impact work prospects in corporate industries. It is also regarded as a job creator. It focuses more on employment while believes that automation often creates more jobs than before, so I- 4.0 also creates new job opportunities, particularly in computer engineering, computer science and mathematics. I- 4.0'sgoal is to improve future skills in education [49].The effects shift the division of work [16] between humans and machines. From the I-4.0 organization reports, Human Resource Management (HRM) evaluates abil- ities for the workforce and recognizes the abilities of existing workers, and describes the expertise currently missing in the business [50,51,52]. But, the current workers don't live in a digitized warehouse, they are well-trained about the rules, conditions and workplace of the organization. The I-4.0 transition involves complete automation and procedures, the benefit of this change is to take one's own decision to be educated by experts and adapt them to the new technology and changes that are rising. Intelligent technology is characterized byintegration, automation, visibility, strategic thinking and flexibility, that targets traditional production into a completely automated and scalable process [12]. Moving towards future systems development begins with IIoT to create relations between the factory and horizontal or vertical integration of devices, databases, operations, and monitoring systems [23,16]. The smart ERP, with data mining, makes digital twin, reflecting an entire system, past and present actions[45]. Figure 2. Describes the I-4.0 plan describes the fourth innovation, which affects the supply chain, which focuses primarily on the development of digitalized processes [15].I-4.0Incorporatesdigitaltwinoperationswiththe development of a supply

network [45] based on the IT value chain. Its goal is first to improve the connectivity of the supply chain to achieve coordination between the value chain [2] The advantage of WoT and blockchain.

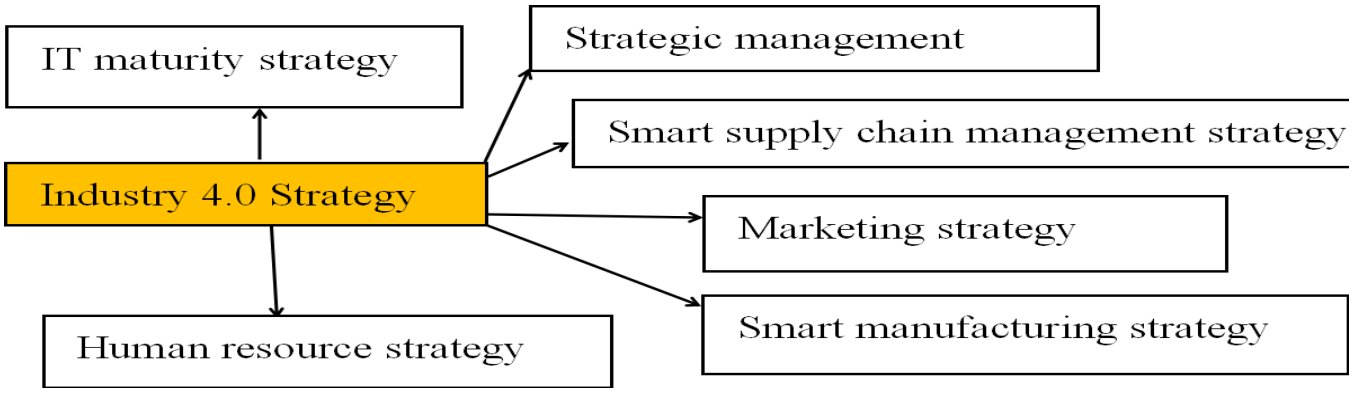

Figure2: I- 4.0 Strategy.

Eliminates information, data integrity and protection across various channels inside the [28] supply chain. A supply network participants should incorporate the information management, products, operations, financing, and manufacturing of expertise that supports the I- 4.0 transformation. The production of smart network and smart value chain, enables operations and processes to be Integrated along with Partners and Clients. This integration in effect offers internal and external supply chain systems[2].

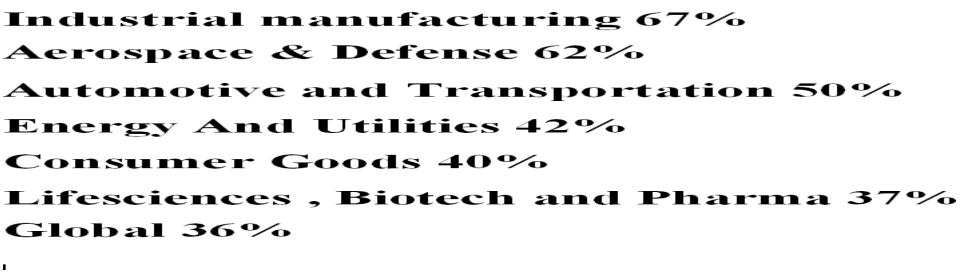

Figure 6: Smart Factory - Uses in Industries.

3. SMART FACTORY MAJOR ROLE IN INDIANMANUFACTURING

The digital innovation drives new IoT-connected technologies along with developments in AI and machine automation in an advanced manufacturing method called Smart Fabrication [53,54]. Industrial equipment that interacts automatically with users and other devices, with- out human interference. Innovation [55,56] emerges from real-time contact between industry and citizens. So, we're developing a new modern digital production process called modern factory.[57].

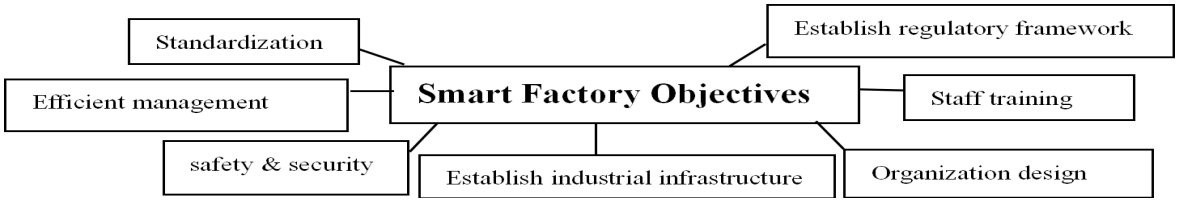

Figure 3: Smart Factory Objectives.

It is a connected, adaptive and scalable manufacturing device Which uses a continuous knowledge stream from Related activities and program development processes to change and adapt to new demands.figure.4. Explains the maturity

model which improves smart factory production [1]. Implementation of Smart Factories and Creativity in Processes. Intelligent manufacturing will drive a new industrial transition as per Data analysts[21].In an interconnected system, Intelligent Factory is a network of devices, sensors and robots working with each other to manufacture cars and batteries more effectively, so that manufacturing processes turn their services via smart factory automation. Indian production drives transition in the manufacture of all goods that are of great assistance to our everyday lives [58]. Explains, the percentage of smart factory use in Indian industry.

LEVELs	MATURITY MODEL	EXPLANATION
Level 1	connected technologies	add complexity to implementing smart factories.
Level 2	structured data gathering and data sharing	create models for structured data gathering and sharing.
Level 3	real- time process analytics & optimization	focus benefits from the data and the system.
Level 4	smart, predictable manufacturing	implementation of smart factories.

Figure 4: Smart Factory Maturity Model.

Figure 5: Smart Factory Notions.

4. INDIAN SMART FACTORY - CASE STUDIES

For that demands, the companies put automated machinery in favor of humans to produce a product. Figure.5. Explains the notion of smart factory cycle in industry. Many of India's big digital transformation-driven industries, Figure.7. Explains the smart factory focused industry case study they follow:

The figure.7. S.No with following citations of the case study. 1 [59,39],2 [60,61,62,63], 3 [64,65], 4[66], 5 [59], 6[67,68], 7 [69], 8[70], 9 [71,72,], 10 [73,74], 11 [75], 12 [76,77],13 [78], 14 [79], 15 [80,81]

S.No	Manufacturing Products	Explanation
1	Shoe	Manufacturing of shoes.
2	Government policy	Economy performance technological system and find government policies.
3	Herbal products	Automated herbal products reviews and explains the herbal plant purposes.
4	Plasma Research	Plasma-Assisted waste-to-energy (WTE) process.
5	Railway coaches	Manufacturing of Railway coaches.
6	Sugar factory	Automated sugar factory.
7	Salesperson alignment	Automated salesperson.
8	Building control	Automated building control management.
9	Sub- station automation	Manufacturing sub- stations automatically.
10	Textile	Automated clothes manufacturing
11	Energy management	Automated energy management
12	Drug packing	Reconfigurable drug- packing
13	Cloud- CNC application	Implementation on cloud based CNC application that validates machines.
14	Fortune	SME's based techniques used
15	Water management	Smart water management

Figure 7: Smart Factory - Case Study in India

CONCLUSIONS

Artificial Intelligence (AI) is a catalyst in Digital Transformation for Indian Manufacturing making it more intelligence smart factory.

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