# latest Automation Technology & its impact on today's Indian Industries A study

Nikhil Mohanrao Ekotkhane[1], Pravin Ambadas Sapane[2], and Yogesh Ashok Paliwal[3], Sumangal M. Vidwans[4]
[1,2,3]*Assistant Professor, R V Parankar College of Engineering,*
[4]*Scholers In Mechanical Engineering*

***Abstract*—We are in the middle of an advanced industrial revolution, which allows complex machinery and processes to be managed much more effectively and affordably than ever before. Hence, by reducing the need for human labor in redundant and dangerous processes. The role of industrial automation in the Indian economy is allowing businesses to focus on critical operations, energy usage, and safety. Because of a number of technological changes that are affecting our industries, there is an urgent requirement for high-end, precise products that can only be met by high levels of productivity. Engineering systems, automated manufacturing, and industrial automation all play a role here. Industry 4.0 and automation, are presently taking shape thanks to technologies such as AI, 5G, advanced automation, advanced sensing, and many others. These are significantly altering how various industries operate and how their processes are carried out. Moreover, the role of industrial automation in the Indian economy is to emphasize efficiency and optimization. All while significantly reducing the possibility of errors. Whereas, in a manual process where the margin of error can reach up to 10% when humans carry out the work, an automated platform can mitigate it significantly.**

## I. INTRODUCTION

In today's Indian Manufacturing industries, the word 'Automation' is often referred to as the adequate use of the equipment to automate production processes or systems. To achieve higher efficiency as well as production output and at the same time reduce production cost is the end goal of the adaptation of automation in industries.

The main concept of automation is to replace human involvement in production processes with highly efficient machines based on the latest technology. This is carried out by the use of electro-mechanical systems which are programmable as per the type of required processes. Automation is not always beneficial to every manufacturer if desirable technology is not implemented and proper execution is not done.

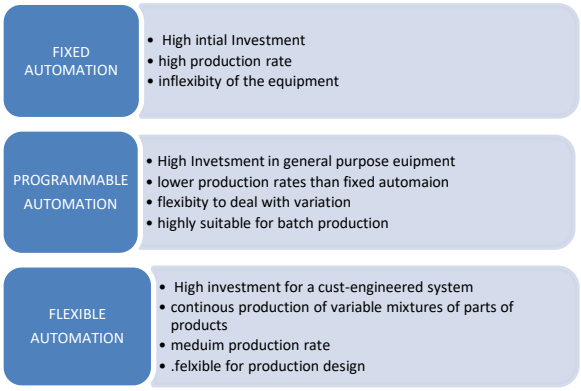
The companies may find benefit by adopting one of the following types of automation technology-

a). fixed Automation

b). programmed automation.

c). Flexible automation.

Three basic Category of Automation




(A)Fixed automation – A system in which sequence of processes or assembly operations in fixed by configuring the equipments accordingly is termed as fixed automation. In this type of automation each operation sequence is simple, involves plain rotational or linear motion, or combination of both. The integration and coordination of many such operations into one piece of equipment that makes the complete system complex. In fixed automation products are produced in very large quantities and at very high production rate. The high initial cost of equipment which are involved in this type of automation, can be spread over a very large number of units, which makes the unit cost attractive compare to alternative methods of production. Following is some of the typical features of fixed automation –

- Production rate is high
- Initial investment is high for custom engineered equipment.
- Relatively inflexible in accommodating product variety.

(b)Programmable Automation – In programmable automation, production equipment is designed with the capability to change the sequence of operations to accommodate different product configurations. The sequence of operations can be controlled by a program, which are the set of instructions coded so that they can be read and interpreted by the system. New programs can be prepared and entered into the equipment to produce new products. This type of automation production system is used in low and medium volume production. The production is carried out in batches. To produce each new batch of a different products, the system must be reprogrammed with the set of machine instructions that correspond to the new product. Following are some of the features of programmable automation –

- Most suitable for batch type production.
- Investment is high in general purpose equipment.
- Lower production rates than fixed automation.
- Flexibility to deal with variations and change in product configuration.

Examples of programmable automation include numerically controlled (NC) machine tools, industrial robots, and programmable logic controllers.

(C)Flexible automation – It is the extension of programmable automation system. Flexible automation system is capable of producing variety of parts/products with virtually no time lost for changeovers from one part style to the next. Also, there is no lost production time while reprogramming the system and altering the physical setup (tooling, fixtures, machine settings). The system can produce various combinations and schedules of parts or products instead of requiring that they be made in batches. This characteristic makes flexible automation possible is that the difference between parts processed by the system are not significant. It may be a case of soft variety, so that amount of changeover required between styles in minimal. The features of the flexible automation system can be summarized as below –

- Continuous production of variable mixtures of products
- High investment for a custom engineered system
- Medium production rates
- Flexibility to deal with product design variations

Examples of flexible automation are the flexible manufacturing systems for performing machine operations that date back to the late 1960s.

Importance of Computer Integrated Manufacturing and Industrial Automation - The aim of Automation of the manufacturing support systems is to reduce the amount of manual and clerical effort in product design, manufacturing planning and control, and other different business functions of the firm. Nearly all modern manufacturing support systems are implemented using computer systems. Computer technology is used to effectively implement automation of the manufacturing systems in the factory as well. The term *computer— integrated manufacturing* (CIM) denotes the pervasive use of computer systems to design the products, plan the production, control the operations, and perform the various business—related functions needed in a manufacturing firm. True CIM involves integrating all of these functions in one system that operates throughout the enterprise. Other terms are used to identify specific elements of the CIM system. For example, *computer aided design* (CAD) denotes the use of computer systems to support the product design function. *Computer aided manufacturing* (CAM) denotes the use of computer systems to perform functions related to manufacturing engineering, such as process planning and numerical control part programming. Some computer systems perform both CAD and CAM, and so the term *CAD/CAM* is used to indicate the integration of the two into one system. Computer—integrated manufacturing includes CAD/CAM, but it also includes the firm's business functions that are related to manufacturing.

Let us attempt to define the relationship between automation and CIM (Computer Integrated Manufacturing) by developing a conceptual model of manufacturing. In a manufacturing firm, the physical production activities that take place in the factory can be distinguished from the information—processing activities, such as product design and production planning, that usually occur in an office environment. The physical activities include all of the processing, assembly, material handling, and inspection

operations that are performed on the product in the factory. These operations come in direct contact with the product during manufacture. Raw materials flow into one end of the factory and finished products flow out the other end. The physical activities take place inside the factory. The information—processing activities form a ring that surrounds the factory, providing the data and knowledge required to successfully produce the product. These information—processing activities are accomplished to implement the four basic manufacturing support functions identified earlier:

(1) business functions,
(2) product design,
(3) manufacturing planning, and
(4) manufacturing control.

These four functions form a cycle of events that must accompany the physical production activities but do not directly touch the product. The industrial automation in implemented at all the different levels of industries with varying strategies to get desired results. Following figure focuses on different equipments and mechanisms that are employed at different levels in industries to use the automation-

The industrial automation helps in achieving many targets, which not only increases the production speed and reduces the wastes but also contributes in more profit generation. Following is some of the important benefits of automation-

1)It improves productivity – The overall productivity of the plant gets improved by adoption of automation techniques, as it reduced the waste generation in the form of scarp during any manufacturing processes. It is fully machine/equipment-based systems, hence there is no issues of fatigue etc.

2) It allows specific task to be performed – Automation helps in performing specific task or set of tasks without disturbing the sequence of other processes that are carried out in same system.

3) It cuts down time – Since automation is requiring lesser human intervention. Apart from that, implementing virtual and augmented reality, coupled with automation, is helping in increasing productivity in business models and facilitating learning. The time for information processing is decreased due to Automation 4.0. Moreover, for the storage and management of data generated by processes, the platform has a sizable capacity.

4)It reduces errors – The chances of errors are totally eliminated as complete process is fully automated and no human involvement is there, thus it helps in achieving error free processes.

5)It helps to overcome with labor related issues – Some countries always have labor strikes and all such issues, which can be resolved with the help of automated equipments and machines, but at the same time it is also responsible for the less human job creation.

6)It performs dangerous jobs – The automation can be employed at those tasks, generally which may be considered as risky from human point of view, the automated equipment performs all such risky tasks very effectively and efficiently. Thus, it improves manufacturing environment safer.

7)Cost-Efficiency: Since automation is requiring lesser human intervention. It is reducing production costs. Apart from that, implementing virtual and augmented reality, coupled with automation, is helping in increasing productivity in business models and facilitating learning.

8)Competitive Advantages: consequently, due to the nature of industrial automation technology, production is continuous and operational 24*7. As a result, it is providing competitive advantages in terms of increased productivity, capacity, and process quality. While reducing task errors and the cost of downtime.

9)Flexibility and Scalability: On the other hand, a human operator is requiring training because the industrial sector is dynamic and the tasks are constantly changing. Since they can be tightly programmed in a constrained amount of time and are reconfigurable.

10)Maximized security: Machines may be given risky and dangerous tasks by the production line that are posing a significant risk to the workers. With collaborative robots, the robot & humans will be sharing a common workspace.

11)Monitored Control: The automated processes are monitored, controlled, and recorded. These will be generating the big data that helps to identify patterns, improve operations, and implement changes to prevent future task errors.

Presently, there are huge demand towards the adaptation of latest techniques in every field which helps in getting work done more effectively and efficiently with less or no waste generation as well as

which helps to gain some competitive edge with other players. A research data shows that following are the countries which are implementing automation technology more into businesses of different sectors.

## II. CONCLUSION

The role of industrial automation in the Indian industrial sector is embracing Industry 4.0 at a reasonable pace and has observed exceptional growth as a result of recent automation advances. Furthermore, Industry 5.0 is a more recent trend that is emphasizing immediate customer service, personalization, and the integration of humans and cobots (collaborative robots) to be proactive in the new industrial automation model, as well as embracing new technological advancements. Hence, we may conclude by hoping that this is the correct way to move further as the future is very bright for those which adopted the proper automation techniques in their manufacturing/service industries, because the future time is the time of technology

## REFERENCES

[1] Prakash,A. (2015). "India's Asian Dilemma: How Best to Grow Robotics Industry?" Robotics Business Review, October,2015.

[2] Hubert Dubois, Marie-Agnès Peraldi-Frati, and Fadoi Lakhal. A Model for Requirements Traceability in a Heterogeneous Model-Based Design Process: Application to Automotive Embedded Systems. In 15th IEEE International Conference on Engineering of Complex Computer Systems, ICECCS 2010, Oxford, United Kingdom, 22-26 March 2010, pages 233–242, 2010.

[3] Martin Glinz. On Non-Functional Requirements. In 15th IEEE International Requirements Engineering Conference, RE 2007, October 15-19th, 2007, New Delhi, India, pages 21–26, 2007.

[4] Eric Herzog and Asmus Pandikow. SysML - an Assessment. In Proceedings of the 15th INCOSE International Symposium, 2005.

[5] Shrivatava, R. (2015) Structural Change and Non-Standard Forms of Employment in India, Conditions of Work and Employment series no. 68 (Geneva: ILO), https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/--travail/document/publication/wcms_450077.pdf (assessed September 2018)

[6] Marcos Vinicius Linhares, Alexandre Jose da Silva, and Romulo Silva de Oliveira. Empirical Evaluation of SysML through the Modeling of an Industrial Automation Unit. In Proceedings of 11th IEEE International Conference on Emerging Technologies and Factory Automation, 2006.

[7] Standing, G. (2021) A Model Driven Approach for Requirements Engineering of Industrial Automation Systems. MPifG discussion papers, no. 211/3/5

[8] Kapoor, R. and Krishnapriya, P. (2017) Informality in the Formal Sector: Evidence from Indian Manufacturing, International Growth Centre, Working Paper F-35316-INC-