Automation Strategies in Operational Management

Dr. Ranganathan Kumar
Associate Professor,
Master In Business Administration (General Management), Presidency University, Bangalore, India,
Email Id:drsenthilkumar@presidencyuniversity.in

ABSTRACT:

An automation strategy is a framework that offers businesses a comprehensive and integrated approach to process automation. Automation strategies that measure scope, reliability, and impact define the terms robotic process automation RPA and business process automation BPA.Operational management automation techniques use technology and systems to simplify and improve company operations. The importance of automation tactics in raising operational effectiveness, cutting costs, and raising overall organisational performance is examined in this paper. It looks at various automation methods, tools, and the effects they have on various facets of operational management.

KEYWORDS:

Automation Strategies, Operational Management, Process Optimization, Efficiency Improvement, Cost Reduction, Technology Integration.

I. INTRODUCTION

Several basic tactics may be used to boost productivity in manufacturing operations technology. The first technique is the employment of specialised equipment intended to execute a single activity as efficiently as feasible. This is similar to the notion of labour specialisation, which has been used to increase labour productivity.Production takes place as a series of operations. Complicated components may need dozens, if not hundreds, of processing steps. The integrated operations method entails decreasing the number of independent manufacturing machines or workstations through which the component must be routed. This is achieved by conducting many operations on a single machine, minimising the number of separate machines required. Since each machine has a setup, this method may save time throughout the setup process. Material handling effort and downtime are both decreased.

A natural extension of the combined operations approach is to conduct the activities that are integrated at one workstation at the same time. In effect, two or more manufacturing or assembly activities are done on the same workpart at the same time, lowering overall processing time.Another technique is to unite numerous workstations into a single integrated mechanism by transferring components between stations using automated work handling equipment.As a result, the number of various machines through which the product must be scheduled is reduced. With several workstations, various components may be processed at the same time, improving the system's total output.This method aims to maximise equipment utilisation in job shop and medium volume circumstances by utilising the same equipment for a range of goods.It entails the use of flexible automation ideas. The primary goals are to minimise setup and programming time for the production unit. This usually means shorter production lead times and less workinprocess.

Enhanced material handling and storage systems.The use of automated material handling and storage processes provides a tremendous chance to reduce nonproductive time. Reduced task and shorter production lead times were common advantages.Traditionally, quality control is conducted after the procedure. This implies that any subpar product has already been manufactured by the time it is examined. Integrating inspection into the production process allows for process changes to be made while the product is being manufactured. This lowers scrap and brings the overall quality of the product closer to the designer's nominal criteria.This comprises a broad variety of control techniques designed to increase the efficiency of the specific process and related equipment. Individual process times may be lowered and product quality can be enhanced with this method.Unlike the previous approach, which was concerned with controlling specific manufacturing processes, this strategy is concerned with controlling computer networking inside the factory at the plant level.Computer integrated manufacturing (CIM) Extending the preceding model by integrating factory operations with engineering design and many of the firm's other business activities. CIM in the workplace entails considerable usage of computer programmes, computer online databases, and computer networking.

Automated Flow Lines

An automated flow line is made up of numerous machines or workstations that are connected by work handling devices that transmit components between the stations. Work pieces are transferred automatically, and workstations perform their specific duties automatically. The flow line may be represented graphically as illustrated in Figure. 1 . A raw workpart enters one end of the line, and the processing processes are carried out sequentially as the part goes from station to station. Buffer zones may be added to the flow line, either at a single point or between each workstation. Inspection stations may also be included in the line to automatically conduct intermediate tests on the quality of the workparts. Manual stations may also be placed along the flow line to conduct procedures that are difficult or expensive to automate[1], [2].

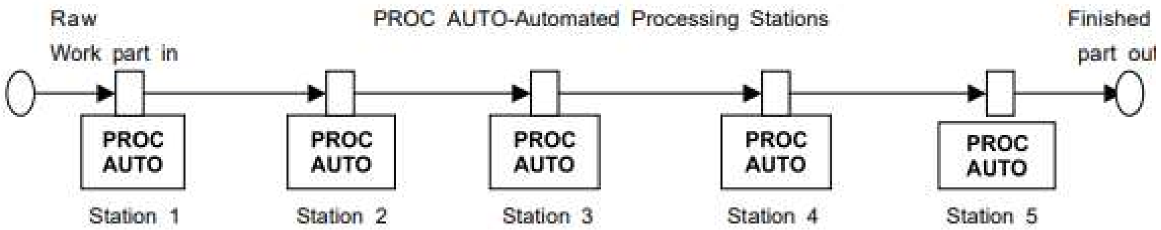

Figure 1: Represent the Configuration of an automated flow line [Fastvoice media.De].

Automatic flow lines are often the most suitable way of production in circumstances of reasonably constant product life; strong product demand, which necessitates high production rates; and if the alternative way of manufacturing would bill a high labour content.Flow line automation is used to accomplish the following goals:

1. Decrease labour expenses.
2. Boost production rates.
3. Reduce workinprocess.
4. Minimize distances travelled between operations.
5. Achieve operation specialization.
6. Achieve operation integration.

II. DISCUSSION

Inline Type

The inline layout consists of a series of workstations arranged in a moreorless straight line. Workflow may take a few 90° turns for workpiece reorientation, factory layout constraints, or other reasons and still count as a straightline arrangement. A rectangular form, for example, is a popular workflow pattern that allows the same operator to load the initial workpiece and unload the end workpiece[3], [4].

Rotary Type

The workpieces in the rotary design are indexed around a large table or dial. The workstations are immovable and often situated around the dial's rim. The pieces spin on the revolving table and are registered or positioned at each station for processing or assembly. This sort of equipment is also known as an indexing machine or dial index machine, depending on the arrangement.The application determines which of the two setups to use. Rotary machines are often restricted to smaller workpieces and fewer stations. The rotational arrangement is not flexible in its design. The rotating arrangement often uses less expensive equipment and consumes less industrial floor area. Inline designs are preferred for bigger work items and may support a greater number of workstations. Inline machines may be developed with builtin storage to mitigate the impact of work stoppages at particular stations and other abnormalities.

Automated Guided Vehicles Systems

An automated or automatic guided vehicle system AGVS is a materials handling system that employs selfpropelled vehicles that work autonomously and are directed along predetermined tracks in the floor. The cars are powered by onboard batteries that enable them to run for many hours 8 to 16 hours is usual before needing to be recharged. The paths are often defined using wires implanted in the floor or reflecting paint on the floor surface. Sensors on the cars follow guide wires or paint to provide guidance.

Types of AGVS

The following are the several kinds of Automatic Guided Vehicles Systems AGVS:

1. Driverless Trains: They are made up of a towing vehicle the AGV that pulls one or more trailers together to create a train. It was the first form of AGVS introduced and is still widely used today. It is beneficial in situations where big weights must be transported over long distances in warehouses or factories, with intermediate pickup and dropoff stations along the way.

2. AGVS Pallet Trucks: These trucks are used to transport palletized cargo along predefined routes. In most cases, the vehicle is backed onto the laden pallet by a human worker who controls the truck and utilises its forks to gently lift the cargo. The person who leads the truck to the guiding route then programmes its destination, and the vehicle automatically drives to the unloading location. The forklift AGV is a relatively recent addition to the pallet truck family. This vehicle's prongs can travel significantly vertically to access cargo on shelves.

3. AGVS Unit Load Carriers: These AGVS are used to transport unit loads from one station to another. They are often outfitted with motorised rollers, moving belts, automated lift platforms, or other systems for automatic loading and unloading. The lightload AGV is a compact vehicle with a relatively limited load capacity. It does not need the same wide aisle as a traditional AGV. Lightload guided vehicles are intended to transport tiny cargoes through smallscale industrial units. The AGVS assembly line is intended to transport a partly finished subassembly through a series of assembly workstations to complete the product.AGVS technology is still in its early stages, and the industry is always trying to create new systems in response to new application needs. A novel and growing AGVS concept includes mounting a robotic manipulator on an automated guided vehicle to offer a mobile robot capable of executing difficult handling duties at multiple places within a plant[5].

Applications of Automated Guided Vehicle Systems

Automatic guided vehicle systems are increasingly being employed in a wide range of applications. Its applications are classified into the following categories:

1. Driverless Train Operations: These applications need the transportation of huge amounts of cargo over relatively long distances. Moves inside a huge warehouse or manufacturing facility, for example, or between buildings in a vast storage depot. This becomes an effective handling approach for trains consisting of 5 to 10 trailers.

2. Storage/Distribution Systems: In these applications, unit load vehicles and pallet trucks are often employed. These storage and distribution activities include the moving of commodities from or to designated places in unit loads sometimes individual things are transported. The applications often connect the AGVS to another automated handling or storage system, such as a distribution center's automated storage/retrieval system AS/RS. The AGVS transports incoming unit loads from the receiving dock to the AS/RS, who stores them. The AS/RS then removes individual pallet loads or products from storage and transfers them to trucks for transportation to the shipping dock. When the rates of incoming and leaving loads are balanced, this mode of operation allows the AGVS vehicles to carry loads in both directions, boosting the handling system's efficiency.

3. Assemblyline Operations: AGV systems are increasingly being employed in assemblyline applications. The production rate in these applications is rather modest, and the manufacturing line produces a wide range of distinct models. Components are kitted and put on the truck between workstations for the assembly procedures that will be done on the partly finished product at the next station. The workstations are often organised in parallel arrangements to increase the line's versatility. The AGVS employed in these production lines are unit load carry and lightload guided vehicles.

4. Flexible Manufacturing Systems: AGVS technology is also used in flexible manufacturing systems FMS. The guided vehicles are employed as the materials handling system in the FMS in this application. The trucks transport work from the staging area where work is often physically put on pallet fittings to the individual workstations in the system. Work is also moved between stations in the production system by the vehicles. The work is transported from the vehicle platform to the work area of the station for processing at a workstation.

After that station's processing is finished, a vehicle returns to pick up the work and move it to the next region. AGV systems provide versatility to the FMS operation by providing a diverse material handling system.For example, combining roborts and automation combined, production may be completed without the need of human labour unmanned from raw materials to final goods.Nonmanufacturing and nonwarehousing applications of automated guided vehicle systems include mail delivery in office buildings and hospital material handling activities. Meal trays, bedding, medicinal and laboratory supplies, and other goods are transported between departments by hospital guided vehicles. These applications often need vehicle mobility between various levels of the hospital, which is accomplished via the use of elevators.

Automated Storage/Retrieval Systems

The Materials Handling Institute defines an automated storage/retrieval system AS/RS as a combination of equipment and controls that handles, stores, and retrieves commodities with precision, accuracy, and speed under a set degree of automation.AS/R systems are designed specifically for each application and vary in complexity from tiny automated systems managed manually to extremely large computercontrolled systems completely integrated with manufacturing and warehousing operations.The AS/RS is made up of a series of storage aisles that are served by one or more storage/retrieval S/R machines, generally one per aisle. Storage racks are installed in the aisles to contain the things to be kept. The S/R machines are used to supply goods to and retrieve materials from storage racks. The AS/RS has one or more input stations where items are delivered for storage and picked up from the system.In the language of AS/RS systems, the input/output stations are sometimes referred to as pickup and deposit P&D stations. The P&D stations may be operated manually or connected to an automated handling system, such as a conveyor system or AGVS.

Types of AS/RS

There are many main types of automated storage/retrieval systems. These include:

1. AS/RS for Unit Loads: Typically, this is a big automated system intended to handle unit loads stored on pallets or other conventional containers. The system is computercontrolled, and the S/R machines are automated and built to handle container loads. The general AS/RS unit load system is used.

2. Minilab AS/RS: This storage system is meant to handle tiny loads individual components or supplies housed in the storage system's bins or drawers. The S/R machine is meant to collect the bin and transfer it to a P&D station at the end of the aisle, where individual products may be removed from the bins. The bin or drawer is then restored to its original system placement. Minilab AS/RS systems are typically smaller than unit load AS/RS systems and are commonly enclosed for the security of the objects held.

3. AS/RS Onboard: The AS/RS onboard system is an alternate method to the issue of storing and retrieving individual things in the system. Unlike the minilab system, which transports the full bin to the endofaisle pick station, the manonboard method allows individual products to be selected directly from their storage locations. This provides a chance to lower the system's transaction time.

4. Automated Item Retrieval System: These systems are also intended for retrieving individual items or small unit loads, such as product cases, in a distribution warehouse. Items are kept in singlefile lanes rather than bins or drawers in this approach. When an item is ready to be picked up, it is moved from its lane onto a conveyor and delivered to the pickup station. The supply of goods in each lane is often supplied from the back of the retrieval system, allowing for item flowthrough and first in first out FIFO inventory management.

5. Deeplane AS/RS: A deeplane AS/RS is a high density unit load storage system that is useful when huge amounts of material must be stored but the number of distinct kinds of material is limited. The deeplane system stores up to ten or more loads in a single rack, one load behind the next, rather than storing each unit load such that it may be reached directly from the aisle. Each rack is built with 'flowthrough' in mind, with input on one side and output on the other. Loads are selected from one side of the rack system by a unique S/R type machine built for retrieval, and loads are entered by another special machine on the entry side of the rack system.

International Quality Standards

Every country has its own set of quality standards. For example, the American National Standards Institute ANSI and the American Society for Quality Control ASQC have collaborated to publish the Q90 series of quality specifications. Nonetheless, it isBecause of increased global trade and global supply chains, it is critical to establish global quality standards. The International Institution for Standardization ISO was founded to address the need for global quality standards. ISO began operations on February 23, 1947. ISO is constantly working to establish standards for products, processes, information systems, and the environment in relation to all types of organisations and activities. ISO has created a comprehensive system for certifying that companies from all over the world have voluntarily met the standards and are ISO certified. The ISO 9000 quality series and ISO 14000 are the most wellknown ISO standards environmental series[6]–[8].ISO's work programme includes standards for traditional activities like agriculture and construction, as well as mechanical engineering, medical devices, and the most recent information technology developments.

Screw thread standardisation aids in the quick assembly of chairs, children's bicycles, and aircraft. Try to solve the repair and maintenance issues that a lack of standardisation would cause. Standards establish common components and international agreement on terminology, making technology transfer easier. International trade would be slower and more expensive if goods container dimensions were not standardised. Life would be more complicated and expensive without the standardisation of telephone and banking cards. A lack of standardisation may even have an impact on the quality of life: for the disabled, for example, when they are denied access to consumer productspublic transportation and buildings—due to nonstandardized dimensions of wheelchairs and entrances. Standardized traffic symbols provide danger warnings regardless of the language used. Consensus on material grades provides a common reference for suppliers and clients in business dealings. Agreement on a sufficient number of product variations to meet the majority of current applications enables efficiencies of scale with cost benefits for both producers and consumers[9]–[11].

III. CONCLUSION

For operational management to increase effectiveness, save costs, and boost performance, automation solutions are essential. Organisations may improve productivity, simplify processes, and develop superior decisionmaking skills by adopting automation technologies like RPA, AI, and machine learning. Process optimisation, data analytics, workflow automation, and scalability are made possible by automation, which enhances organisational success overall. For businesses to remain competitive, adjust to changing market dynamics, and achieve operational excellence, they must embrace automation in operational management.

REFERENCES

[1] W. A. Olson and N. B. Sarter, Automation management strategies: Pilot preferences and operational experiences, *Int. J. Aviat. Psychol.*, 2000, doi: 10.1207/S15327108IJAP1004_2.

[2] A. Tuomi, I. P. Tussyadiah, and J. Stienmetz, Applications and Implications of Service Robots in Hospitality, *Cornell Hosp. Q.*, 2021, doi: 10.1177/1938965520923961.

[3] K. Terdpaopong, A. Puapradit, and U. Malisuwan, The effect of lean on the operational performance of mediumsized Thai manufacturing companies, *Uncertain Supply Chain Manag.*, 2021, doi: 10.5267/j.uscm.2021.5.005.

[4] H. Kir and N. Erdogan, A knowledgeintensive adaptive business process management framework, *Inf. Syst.*, 2021, doi: 10.1016/j.is.2020.101639.

[5] B. B. Ashagre, G. Fu, and D. Butler, Automation and realtime control of urban wastewater systems: A review of the move towards sustainability, *J. Water Supply Res. Technol. AQUA*, 2020, doi: 10.2166/aqua.2020.074.

[6] G. Paiva, R. Agra, and G. de Tomi, Application challenges for information and automation technologies in an underground mine in Brazil, *Rev. Esc. Minas*, 2017, doi: 10.1590/037044672015700117.

[7] G. Lin, M. Pritoni, Y. Chen, and J. Granderson, Development and implementation of faultcorrection algorithms in fault detection and diagnostics tools, *Energies*, 2020, doi: 10.3390/en13102598.

[8] C. Sentouh, A. T. Nguyen, M. A. Benloucif, and J. C. Popieul, DriverAutomation Cooperation Oriented Approach for Shared Control of Lane Keeping Assist Systems, *IEEE Trans. Control Syst. Technol.*, 2019, doi: 10.1109/TCST.2018.2842211.

[9] K. Winter, O. Cats, K. Martens, and B. van Arem, Relocating shared automated vehicles under parking constraints: assessing the impact of different strategies for onstreet parking, *Transportation Amst.*, 2021, doi: 10.1007/s1111602010116w.

[10] A. Tezel and Z. Aziz, From conventional to it based visual management: A conceptual discussion for lean construction, *J. Inf. Technol. Constr.*, 2017.

[11] C. Mincu, Digital operational strategies for municipal solid waste treatment, *Qual. Access to Success*, 2014.