

INDUSTRIAL AUTOMATION: A COST EFFECTIVE APPROACH IN DEVELOPING COUNTRIES

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ABSTRACT

Industrial automation is a means of simplifying production jobs and for providing speed with accuracy for work elements involved. In broader technical terms, industries automation can be stated on a system that consists of relating coordinating, integrating machines, mechanisms, devices and control to the extent that partial or complete processing of production inputs is accomplished automatically without the assistance of intervention of human being.

Industrial automation may be categorized into two i.e. full automation and cost effective automation. Full automation may be considered as a system of complex equipments that automatically processes production inputs i.e. raw material to finished products that utilizing machinery those are specifically designed for the purposes. Full automation is generally associated with mass production, the use of computerized controls and expensive equipment. In low cost automation selected manual operations are to be converted in to automatic operations. The investments normally involved in low cost automation are nominal.

This paper attempts to make an in depth investigations on the topic Industries automation that plays a vivacious role in the modern age although the concept of automation is well known. The success of automation depends upon key factors like quality of equipment, management and skill of workers and environmental facility available to the systems. Authors concentrate more on the aspects of cost effective automation in this paper, as full automation is not reachable by every low and medium scale industries.

Key Words: *Industrial, Automation, Developing Countries, Cost, Prospects*

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INTRODUCTION

Technology has made available to us the devices that can see better, hear better, sense better and measure better than human operators. These devices and mechanisms are more reliable, more powerful, more precise, more consistent and fully predictable. Unlike human workers, they do not complain for over work, better productivity or require a regular increase in cost. There are several reasons why manufacturing concerns hesitate to plunge in to fully automated processes that are as follows:

- Limitations in financial resources.
- Demand for the product may be unpredictable or of insufficient volume to justify the application of man production techniques.
- General resistance by labour to radical changes and their resistance in accepting anything that will pose a threat to their work even for the reasons of increased productivity.

Reasons for cost effective automation are:

- (1) The existence of market for products where large producers cannot compete with small-scale manufacturers.
- (2) The demand for the product exceeds productivity of small-scale producers but is not large enough to justify plant expansion. i.e. adding another production line.
- (3) Ease of operation directly increases productivity that results workers satisfaction and better treatment of tools.
- (4) Change in less abrupt, the process of adaptation less destructive and resistance corresponding weaker.

It is apparent that both management and labour have strong reservations with respect to full automation. Hence, in order to obtain as much benefit from technological advancement as possible and still avoid problems that are likely to arise in the implementation full automation, a compromise can be resorted to the application of cost effective automation.

LITERATURE REVIEW

Agus and Hajinoor(2012) have addressed the key relationships between lean production, product quality performance and business performance within the Malaysian manufacturing industry, where relatively few studies are available. In addition, relationships between constructs are analyzed through structural equation modeling (SEM) that measures not only magnitude but also the causal direction of the relationships. Rajgor and Pitroda (2013) explained the applications and

activities of robotics and automation in construction industry started in the early 90s aiming to optimize equipment operations, improve safety, enhance perception of workspace and furthermore, ensure quality environment for building occupants. The main is to convince to incorporate robotic systems when managing modern buildings. Tommila et al. (2001) described that in an industrial plant, physical process systems consist of machines and process equipment. They are individual devices or larger subsystems of their own which lead to a whole-parts hierarchy. Process systems can be in different operational states, such as 'maintenance', 'starting up' or 'operating'. In each state, they provide a set of capabilities that can be combined to perform the various stages of the process. In the course of control system design, control tasks identified in co-operation with users and other engineering disciplines are allocated to the control system and human operators. The automated parts should form a structured set of control activities corresponding to the physical equipment and processing tasks.

Objectives

- Cost effective industrial automation in developing countries
- Low inventory cost and space management

Methodology

Computerized production planning management approach is used to optimize the cost including material resource planning, inventory management, maintenance management, process and production planning. It indicates the If and But of the system for the production and operations which reduces the cost of production as a basis of cost effective industrial automation.

Challenges encountered by automation

- **Internal Problems:** Most of the organizations resist change and it gets very difficult for the executive/employee to digest the fact that after the change in the entire system it will become difficult for them to work. Executive/employee must understand that after the reengineering the system is going to work as it was designed.
- **Technological Problem:** It may be possible that at the present level the organization might not be in the condition to enhance the companies. It should be noted that the entire Reengineering team should develop and implement only those ideas which may be possible at the same level of the organization.
- **Changing Mental attitude:** It might be easy for the organization to change completely but it is very difficult to change sometime the mentality of the people. The organization

should develop first some awareness programs before giving the full throttle to the Process.

Characteristics of Cost Effective Automation (CEA)

Automating as many phases of operation as possible reevaluates several plants more effectively by replacing old equipment and processes. Most of the changes made consist of the replacement by machines or by human activities.

Application of CEA does not generally require the replacement of existing machines. Certain activities in the process can be made automatic by installing simple devices and mechanisms in the system or the machine itself. The major characteristics of CEA can be enumerated as follows:

- Existing equipment is used and improvements are built around it.
- The design and operation of devices are simple and hence no training of plant personnel required.
- Automating devices are reusable.
- The devices are flexible in operation.
- Standard components are used, which are commercially available at reasonable costs.
- The corresponding investment in the improvements is not expensive as replacing the system with an automatic machine.

Competition that need for greater output, higher product quality and rising labour costs are major motivations for manufacturers to turn to L.C.A to improve their operations.

Criteria for adopting Cost Effective Automation

It will be preferable to perform the search in the areas of potential improvement in stages to conserve time and effort where CEA is applicable. One criterion to determine which areas should be studied and improved is return of investment i.e. what improvement will yield the highest returns?

Another criterion could be emergency decision i.e. what improvements must be accomplished first? Tables of priority can therefore be established from a rough estimate of the magnitude of the benefits to be derived and the urgency of the needed improvements would be highlighted.

The first stage in search for improvement i.e. cost reduction would be made in the following areas:

- The product: value analysis of the product may be taken care.

- Unit production costs: Analysis of unit production cost considering the entire factors that influencing it.
- Plant operation: manufacturing cycle time, type of process, product demand, bottlenecks, accidents, etc. are to be considered.

The second stage in search for improvement requires a closer look for more details analysis of the various tasks involved in the production process. This search can be best accomplished by the application of such industrial techniques as:

- Methods improvement: alternate methods may be noted down and suitable method may be adopted.
- Arrangement of the workplace: It plays a vital role for optimum result. Workplace may be allocated on the basis of types and complexity of the job to be performed.

Prospects of low cost automation

Technological innovation and fully automated production processes have created a significant gap in the application of technology between developed and developing countries. This gap can be bridged by developing countries through the use of low cost automation to increase their productivity and provide margins export.

Centers of modern technology are normally characterized by high labour costs and enormous expenditures for research and development. These two factors makes it uneconomical for large enterprises to embark on small production runs or retrains from taking full advantage of current automation technology. Being rich in capital resources the optimum strategy for firms in developing countries will be to obtain all possible benefits for as long as last incremental investment necessary. An analysis of relationship between gains in productivity and required investment will reveal that the “Lawof diminishing returns” is an almost perfect description of this relationship. It is apparent that the optimal strategy for a firm or an economy with limited resources is to maximize return on investment. This concept justifies the adoption of selective or partial automation more appropriately called low cost automation.

In general, the technology involved in the design and operations of CEA application are not usually original inventions but simply adaptation and combination existing automatic equipment and mechanisms the level of creativeness will not have to be of a very high order. Success in adoption and implementation of CEA depends more heavily on awareness of the relevant technology and a strong desire to obtain potential improvements.

In short, CEA is geared to the needs of small-scale industries, the job operations and the small programming entrepreneurs. Although, any company can benefit from CEA, it is struggling and developing companies that will derive the greatest advantage from CEA systems.

Limitations of Cost Effective Automation

- Only Low cost allowed.
- Most of the time, manual labour is not eliminated.
- Modifications for LCA are not easy to conceive.
- Aesthetic sense is not always possible.
- In handling areas, where the job is located, fixed or moved, the feel to choose right device is very important.
- Sometimes, it is slower than manual work i.e. even though the fatigue is saved cycle-time has increased.
- If the improvements are not exploited immediately, the additional expenditure may go high.

CONCLUSION

In a developing country like India, where industrialization taking place rapidly, one of the biggest problem that country is facing the maximum utilization of available resources in competitive market that the burning area of 9th five year plan is productivity improvements. It is observed that most of our industries are operating not even as 50% productivity of an equivalent to the Japanese company with the same manpower. We cannot always blame the workers for their low output. At the sometime we cannot imagine of using highly automated machines operating at high cost of production, required high skill of manpower and the complexity of the working system that are too costly proposal. Hence, it may not be advisable because of lack of knowledge, high technology and its availability in the country. The path that can be conveniently chosen is that of maximizing the efficiency of available sources of production that can be conveniently done with the help of CEA. The equipment and ideas used are most convenient to adopt in any small to large-scale industries.

The future of cost effective automation is definitely very bright. Some of the leading companies have tempted the development of entirely new range of standard products with the application of CEA, which are very conveniently used with existing facilities.

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