

IMPACT OF AUTOMATION SYSTEM IN INDUSTRIES : SPECIAL REFERENCE TO AUTOMOBILE MANUFACTURING UNITS

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Abstract –

In today's globalization, Industrial Automation System is become very important technology for all sectors such as production, marketing, human resource management, material management, financial management and information technology. Automation system provides set of machines that controlled by computers to handle the industrial process. The main advantage of Automation System is to reduce the waste material, to reduce errors occurs in dimensions, to increase safety, profitability & reliability. This research paper is focused on impact of Automation System in Industries. Industrial Automation System in an integration of Machine Vision & Design, Electronics Components, Programmable Logic Controller, Databases, Sensors, User Interfaces and Programming Languages.

This Research Paper describes how Manufacturing Industry Owner will be benefited if they invest in Industrial Automation. There are many reasons of investing the money in Industrial Automation such as Decrease Worker Exhaustion and Struggle or WorkRigorous Operation, Avoid Products or Materials from Being Scratched or Demolished, Prevent Non-conforming Product from Distribution, Increase Effectiveness, assemble Improved Data, boosts measurements, Formulate the Accurate Process Developments and save the money.

Keywords ; Automation system, Distributed Control System, Robotics, Zigbee , IoT

Introduction:

Author B.R. Mehta Y. & Jaganmohan Reddy have described the important and role of automation in manufacturing Industry in eBook entitled "Industrial Process Automation Systems". They have elaborated the applications of Distributed Control System in Automation

System. The book also having deep information about Batch Automation System and its role in Automation. The important of Programmable Automation Controller in also described by the authors. In this book author also elaborated that how automation system is more powerful in Manufacturing Industries and different technology are used to run automation system.¹

The Author Frank Lamb, book “Industrial Automation: Hands on Hardcover” described that the role of Automation in manufacturing industries. Author has focused that how hardware and software perform very important role in automation and how programmable languages controls to automotive machines. Author also emphasis the application of process management in automation and its impact on quality of product.²

Introduction to Industrial Automation by Stamatis Manesis, George Nikolakopoulos, and this book focused on basic introduction of industrial automation. In this book he has described the elements of Automation such as PLC (Programmable Logic Controller), Hardware Devices such as Robotics, Software requirement i.e. programming languages to control the automation system.³

In book “Automation and Robotic” by Dr.Miltiadis has described how Robotic perform important role in assembly line to optimize the heavy work and produce the high quality product. In this book the author also focused the role of Software Engineering Technology and Data Communication Models help to make automation too smoothly.⁴

In this research paper authors described that application of Remote Control System in automation which help to increase the productivity and efficiency of operations in manufacturing Industry. The research paper also elaborated the Zigbee technology which is used for wireless communication in Industrial Automation. Zigbee technology specifically builds for control and sensor networks. ⁵

A Real Time System is one important part of the automation which is used to complete particular operation in scheduled time in Automation System. It can be any information processing system which is used to generate input within finite time. Authors Vicent Rutagangibwa & Babu Krishnamurthy, “Survey on The Implementation of Real Time Systems for Industrial Automation Applications” explained methods and implementation of Real Time Systems in Automation which helps to execute Event-Triggered operations, Service Oriented tasks, Mathematical methods & Object Oriented programming execution.⁶

There are many advantages of Automation such as decreasing of operating costs, worker safety, increase productivity, reduce outsourcing, optimal space utilization, easy integration and so on.

Authors explained in his research paper in deep how Automation perform very important role in industry entitled “Increasing Productivity & Quality of products by Implementations of Automation in manufacturing sectors”.⁷

In Automation System IoT(Internet of Things) perform predominant role as this technology allow us to control the automation system using WiFi , Bluetooth concept of Smart Phone. Now in digital world most of the circuits are available with Microcontroller Arduino Uno , Raspberry Pi, GSM modem, Android applications and sensors through that we can manage the Automation System properly and effectively.

Author Sahana H S, explained the role of IoT in Automation system in his research Article entitled “Office Automation System Using Internet of Things”.⁸

Objective Of The Study

- To visit Automobile Manufacturing Units.
- To prepare the questionnaires for the research paper
- To collect the data from the various Automobile Manufacturing Units
- To analyze the data and formulate it in the form of table and graph to check the hypothesis.
- To make the Conclusion, recommendation on the basis of survey

Hypothesis

- Automation System increase the Productivity of Manufacturing Industries
- Automation System Controls the Quality of Product in Manufacturing Industries

Data Collection and Interpretation

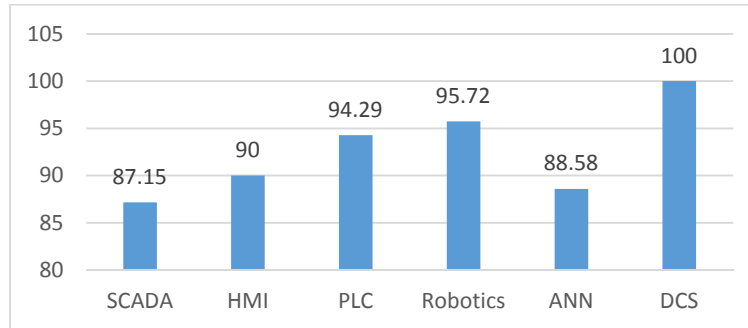
The data for the Research Paper is collected from 70 Automobile Manufacturing Units from Maharashtra. During data collection it has been found that all Automobile Units have installed Automation System to perform industrial functions properly. All automobile units are using following Automation System Tools in the in the Manufacturing unit.

a) Automation Tools used in Automobile Units

Table No-1

Automation System Tools Implemented in Automobile Units

Automation Tool	No. of Units Answered	%
Supervisory Control and Data Acquisition (SCADA)	61	87.15
Human Machine Interface (HMI)	63	90.00
Programmable Logic Controller (PLC)	66	94.29
Robotics	67	95.72
Artificial Neural Network (ANN)	62	88.58
Distributed Control System (DCS)	70	100



From above table and graph, it has been observed that 61((87.15%) units out of 70 have installed SCADA automation system as it controls all tools& techniques which are used for Automation System. 63 units(90%) are using the HMI to control industrial automation tools and equipment. Total 66 units (94.29%) have revealed that PLC is also important tool of Automation System to manage multiple inputs and outputs. It has been also observed that 67units(95.72%) have installed Robotics as a part of Automation System to perform complex job efficiently. Processing the information is big task of industrial unit and ANN is a tool through that it can be achieved 62 units(88.58%) have stated that ANN is used as a part of Automation System. Distributed Control System is main tool of Automation system to monitor the whole network of industrial unit. 100 units from surveyed sample have been stated that DCS is one important part of Automation System.

b) Reasons of Automation System used in Automobile Units

Almost all surveyed Automobile Units have installed Automation System as it having many reasons

Table No-2
Automation System Tools Implemented in Automobile Units

Name of IT Tools/Techniques	No. of Units Answered	%
Improve production Quality	70	100
Decrease material cost	68	97.14
Reduce the labour cost	65	92.85
Reduce the waste of material	63	90
Better floor space utilization	18	25.71

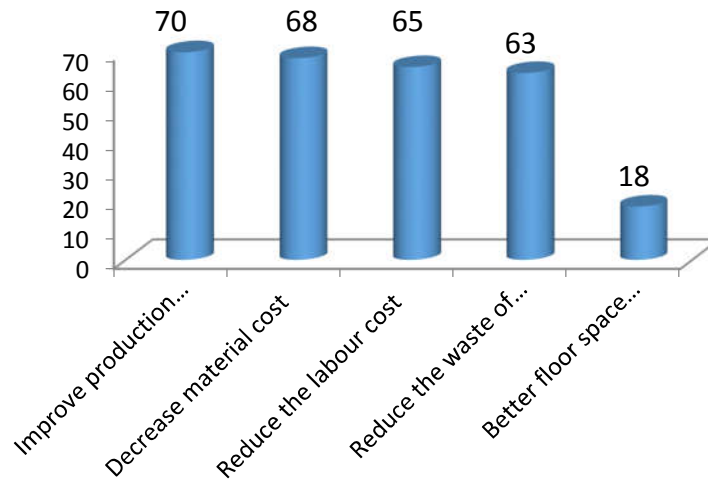


Figure No. 33

Analysis and Interpretation :

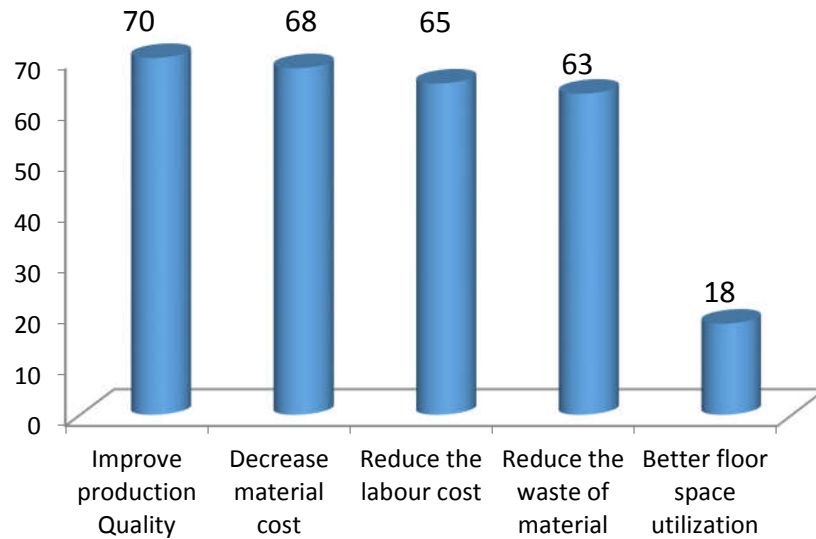
In data given above, it has been observed that the using the IT Tools, the Automobile units have improved the production Quality, decreased material cost, reduced the labour cost, and waste of material . Mostly all industries have implemented IT Tools in the organizations. Out of **70**Automobiles, units all units are using IT Tools to Improve Production Quality , **68 i.e. 97%**units have replied that automation decreases the cost of material. Around **56 units i.e. 92%** have stated that it reduces the labour cost. There **are 63 units i.e. 90%** who have replied that IT tools helped in reduction of waste and **18(25%)** automobile units replied that there is possibility of Better floor space utilization.

Majority of the units i.e. more than **92%**have agreed that automation improved the quality, decreased material cost , reduce the labour cost and reduce the waste.

Table No-4
Reason of Applications of IT Tools

Total Units :-70

Name of IT Tools/Techniques	No. of Units Answered	%
Improve production Quality	70	100
Decrease material cost	68	97.14
Reduce the labour cost	65	92.85
Reduce the waste of material	63	90
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Majority of the units i.e. more than **92%**have agreed that automation improved the quality, decreased material cost , reduce the labour cost and reduce the waste.

Hypothesis- I

Ho	:	Productivity of the product not increase due to implementation of the IT Tools and Techniques i.e. H0=75
H1	:	Productivity of the product increase due to implementation of the IT Tools and Techniques i.e. H0≠75

Productivity of Manufacturing Industries using Automation System

Total Units : 70

Degree of Response	Total Industries Surveyed
Yes	66
No	04
Total	70

Calculated Values From Table

\bar{P} - Actual Observations	:	66/70 =0.943
P- Expected percentile of Hypothesis Assumption	:	0.75
N=total Number of Observations	:	70
Q=P-1	:	1-0.75=0.25

Put these value in Formula

$$Z = \frac{\bar{P} - P}{\sqrt{PQ/n}}$$

$$Z = 0.943 - 0.75 / \sqrt{0.75 * 0.25 / 70} \quad Z = 3.78$$

Degree of freedom = n-1, 70-1 i.e. 69

P-value value of 69 with 5% significance level is 0.0000 which is less than calculated value. Therefore null hypothesis is rejected and alternative hypothesis is accepted.

Hence it is concluded that Productivity of the product increase due to implementation of the IT Tools and Techniques

Hypothesis- II

Ho	:	Quality of the product is independent on IT Tools and Techniques i.e. H0=75
H1	:	Quality of the product is dependent on IT Tools and Techniques i.e. H0≠75

Quality Control by Automation System

Total Units : 70

Degree of Response	Total Industries Surveyed
Yes	64
No	06
Total	70

Calculated Values From Table

\bar{P} - Actual Observations	:	$\frac{64}{70} = 0.914$
P- Expected percentile of Hypothesis Assumption	:	75%= 0.75
N=total Number of Observations	:	70
Q=P-1	:	1-0.75= 0.25

Put these value in Formula

$$Z = \frac{\bar{P} - P}{\sqrt{PQ/n}}$$

$$Z = 0.914 - 0.75 / \sqrt{0.75 * 0.25 / 70}$$

$$Z = 3.21$$

Degree of freedom = n-1, 70-1 i.e. 69

P-value value of 69 with 5% significance level is 0.0000 which is less than calculated value. Therefore null hypothesis is rejected and alternative hypothesis is accepted.

Hence it is concluded that Quality of the product is dependent on IT Tools and Techniques .

Conclusions:

- Automation System provides excellent quality of Product.
- Automation System reduce the wastage of Production Material
- It Transport heavy material from one place to another which helps to provide the security to workers.
- Very Complex works such vehicle color spraying and PCB soldering can be done effectively by Automation System.
- Due to Automation System Less errors occurs and hence repeating of work is reducing which affect on labor cost directly.

- Adaptability of Automation system is less than human being as machines are implement with software and hardware and it works on predefined program only.

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