A STUDY ON IMPACT OF TECHNOLOGY IN MACHINE BUILDING AUTOMATION

-a study at Effica Automation Limited.

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A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that the Project report titled, **A STUDY ON IMPACT OF TECHNOLOGY IN MACHINE BUILDING AUTOMATION**, *a study at Effica Automation Limited* is the bonafide work of **Mr. J. DEEPAN CHAKRAVARTHY** who carried out the work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.
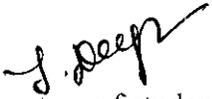
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ABSTRACT

In present scenario, technology has an important role in industries. Development of technologies led to innovation and creation of many new things for sophisticated life. Particularly, managing the technology and its development has the major part for development of industrial products or in machine building. This paper examines about the impact of technology in product development. And also to study and analyze the technology in machine building for which the parameters that are common for all the machines such as Production and Safety are chosen. For analyzing this paper, I have selected a case study that has been conducted in the Effica Automation Ltd, Coimbatore which is a Special purpose machine manufacturing Company with technologies such as robotics, visions, sensors etc. The case study analyzes the technology adopted for implementing the parameters in machine building. Based on this analysis, the success of technology Parameter implemented in the machine building is estimated. Hence the study could be concluded about the success of the technology implemented in machine Building.

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Last but not least I extend my heartfelt salutations to my **BELOVED PARENTS and the FRIENDS** who has always been an integral part in helping me through tough times and making my project a Herculean success.

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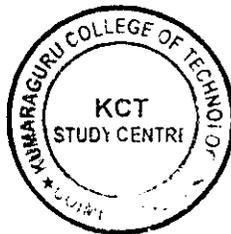
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effica
automation
■ ■ ■ ■ *Engineering Synergy*

06th August 2009

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College of Engineering, Coimbatore has successfully completed his
academic project ("A Study on Impact of Technology in Machine Building
Automation") in our Organization.

We appreciate his initiatives and wishing him all the best for all his future
endeavours.

With best wishes,

R. Srivatsan
Manager – HR & Admn

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1. CAN   CONTROLLER AREA NETWORK
2. PPE   PERSONAL PROTECTIVE EQUIPMENT
3. SPM   SPECIAL PURPOSE MACHINE
4. SRSWOR   SIMPLE RANDOM SAMPLING WITHOUT REPLACEMENT
5. SRSWR   SIMPLE RANDOM SAMPLING WITH REPLACEMENT
6. SRS   SIMPLE RANDOM SAMPLING
7. TFP   TOTAL FACTOR PRODUCTIVITY
8. HMI   HUMAN MACHINE INTERFACE

CHAPTER 1

CHAPTER 1- INTRODUCTION

1.1 RESEARCH BACKGROUND:

In this fast growing world scenario, to fulfill the people needs the production rate manufactured is not sufficient because of various drawbacks in the manufacturing industry such as safety, quality, accuracy, repeatability, lack of skilled labours.To overcome these drawbacks Automation field came in to existence .In particular the machine building automation started developing to fulfill most of these drawbacks and to compete with the production rate.

The Vital element in the machine building is Automation. Mainly the machine building Automation is used as a solution for Industrial needs. With the help of Automation, the production rate as expected to the fast growing world can be achieved. Automation generally means that, to reduce human intervention, errors etc. so as to increase the production, quality, repeatability by implementing a control system.

Developing a Machine with implementation of Automation, Requires of Major two criteria's namely Designing of the machine with sophistication and controlling the machine based on the designer's requirement. If both these criteria's is done in an effective

With this background on the machine Building Automation, I have made a study on impact of technology in machine building automation. For this study I have made a Case study in a Special purpose machine manufacturing company located at Coimbatore.

1.2 INTRODUCTION ABOUT COMPANY (EFFICA AUTOMATION LIMITED):

Vision: The vision of Effica Automation is to create a knowledge rich society with people who are dynamic in their mind, soul, and actions and are able to mould themselves into true professionals thereby creating wealth for them and to rejoice.

Mission: The mission of Effica Automation is to offer highly efficient products and services in Manufacturing, Assembly Automation, Vision Systems, & Material handling by using cutting-edge technologies and expert knowledge.

They are dedicated to improve themselves in order to become the leader of the industry by developing the expertise of our members and by concretizing our competencies in solutions and applications for our customers

Objectives:

The Primary Objective of Effica Automation is to create a niche for itself in the field of industrial automation by the year 2004 through innovative ideas and by integration of technologies from various fields of engineering. With automation emerging as a focus area for not just large integrated manufacturing industries but even for medium and small units. The Rs.4,000-crore Indian automation industry is hopeful of growing at 20-25 per cent per annum for the next few years and hence the automation industry is very "upbeat" about its growth prospects over the next few years.

Products and Services:

The Range of Product and Services include:

1. Manufacturing & Assembly

- Special Purpose machines
- Assembly Solutions

2. Material Handling

- Automated Palletizing Systems
- Transfer lines

3. Measurement & Quality

- Intelligent Sorting
- 100% Inspection
- Virtual Dissecting

4. Vision and Robotics

1.3 GENERAL SCENARIO OF INDUSTRY:

Technology is the relationship that society has, with its tools and crafts, and to what extent society can control its environment. And it's the practical application of knowledge especially in a particular area and a capability given by the practical application of knowledge The Technology refers to a collection of techniques. In this paper, it is the current state of humanity's knowledge of how to combine resources to produce desired products, to solve problems, fulfill needs, or satisfies wants; it includes technical methods, skills, processes, techniques, tools and raw materials. And also it refers to tools and machines that may be used to solve real-world problems.

A modern example is the rise of technology used in machine building, which has lessened manual work and increased the production, as a result, has helped in spawn of new subcultures. Not all technology enhances culture in a creative way; technology can also help facilitate political oppression and war via tools such as guns. As a cultural activity, technology predates both science and engineering, each of which formalizes some aspects of technological endeavor.

Technology in machine building industries plays an increasingly important role in the global economy and then daily experience .Developers strive to combine automated devices with technological tools to create complex system for rapidly expanding range of application in human activities. A new surge of growth will come through new technology (perhaps nanotech sensors, or wireless), production at the lowest cost for global distribution, and fast time-to-market (not impeded by standards committees and antiquated management conservatism).

The managers, innovators and visionaries who recognize the possibilities will become the new leaders of tomorrow. Since automation is a fragmented business, all the larger companies mostly a conglomeration of product and services; each product segment generates relatively small volume, but lumped together they form a sizeable business.

ABOUT PRODUCTION:

Production means the development and creation of goods and services using resources to stimulate exchange. It is the physical output of a manufacturing or service company. Production involves three processes – raw materials, work in process and finished goods. The way that businesses create products and services is known as the production process. There are three main parts to the production process as can be seen in the diagram below:

Inputs

Labour
Land
Machinery
Raw Materials

Transformation
Process

Outputs

Finished goods
Services
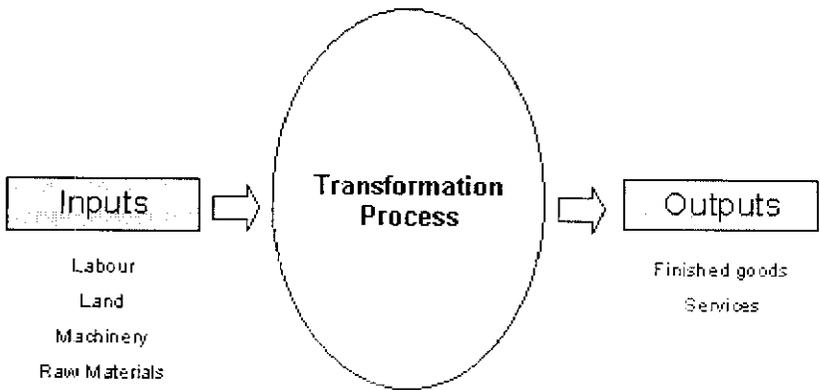
Dig 1.3.1 PRODUCTION

A firm must purchase all the necessary inputs and then transform them into the product (outputs) that it wishes to sell. For example a football shirt manufacturer must buy the fabric, pay someone for a design, invest in machinery, rent a factory and employ workers in order for the football shirts to be made and then sold.

How well-organized a firm is at undertaking this transformation process will determine its success. This is known as the productive efficiency of a firm and it will want to be as efficient as possible in transforming its inputs into outputs (i.e. using the minimum number of inputs as possible to achieve a set amount of output). This will reduce the cost per unit of production and allow the firm to sell at a lower price.

Ultimately, the objective of the production process is to create goods and services that meet the needs and wants of customers. The needs and wants of customers will be met if a business can produce the correct number of products, in the shortest possible time, to the best quality and all at a competitive price.

1.4 PROBLEM IDENTIFICATION:

Technology in automation industries plays an increasingly important role in the global economy and then daily experience. Developers strive to combine automated devices with technological tools to create complex system for rapidly expanding range of application in human activities. A new surge of growth will come through new technology (perhaps nanotech sensors, or wireless), production at the lowest cost for global distribution, and fast time-to-market (not impeded by standards committees and antiquated management conservatism). The managers, innovators and visionaries who recognize the possibilities will become the new leaders of tomorrow. Since automation is a fragmented business, all the larger companies mostly a conglomeration of product and services; each product segment generates relatively small volume, but lumped together they form a sizeable business.

In present scenario, technology has an important role in automation industries. Development of technologies led to innovation and creation of many new things for sophisticated life. Particularly, managing the technology and its development has the major part for development of industrial automation. The study aims at examining the impact of technology in machine building automation which influences the production in machine. For my case study, I have chosen Effica Automation Ltd, Coimbatore which is an Special purpose machine manufactures with technologies such as robotics, visions etc.

1.5 OBJECTIVE:

- The objective of this project is to study the impact of technology in machine building automation.
- The study focuses on, how the impact of technology influences the production rate.
- How much the production rate increases due to the impact of technology comparing to manual production.

1.6 OUTLINE OF THE PROJECT:

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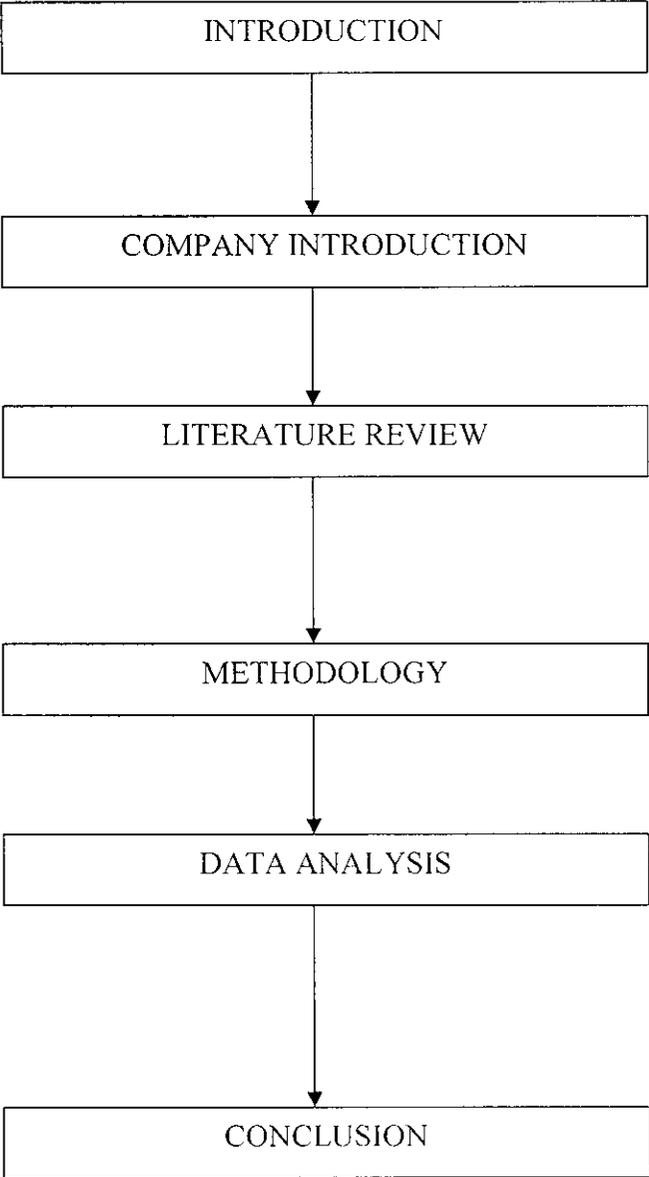
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CHAPTER 2- LITERATURE SURVEY:

2.1 REVIEW OF LITERATURE:

RESOURCE-SAVING TECHNOLOGIES IN MACHINE BUILDING, This paper is written by V. M. Makarov, A. Z. Kaganovich, and A. B. Bukhvalov.

In the context of rising raw material and energy shortage, search for new advanced technologies that would minimize consumption per unit engineering product is essential. It is known [1], for instance, that in a section rolling mill energy consumption (two-thirds as heat) averages 4000 MJ and 200 kWh per ton of the finished rolled stock (i.e., 20% of its cost).

The greater part (78%) of the expended heat energy goes for heating the metal before rolling and another 13% for heat treatment. It has been proved that capital and operational costs can be curtailed substantially by non-traditional production techniques, for instance by combining in a single technological system melting of electric steel, continuous casting, and subsequent hot-rolling of the obtained ingot [2]. Studies in recent decades have also proved combination of hot-rolling and subsequent heat treatment of the steel [3-6] to be beneficial. Thanks to utilization of the heat of rolling in the thermal hardening operation, heat treatment of a part and individual heating are unnecessary. Application of such non-traditional technologies as monitor able rolling and thermo mechanical hardening treatment saves heat energy substantially because of fewer heating operations and saves resources because of use of the metal in a super hard state.

In billet mills of machine-building enterprises resources and energy can be saved by raising the metal utilization factor employing such advanced practices as rolling of precise blanks of machine parts and by inducting unified (group) blanks. In this context, production of blanks of the type of revolving bodies, e.g., solid or hollow multidiameter shafts, rings, bushings, etc. ~ which are components of any machine or mechanism, is a pressing problem.

Let us examine the means of metal and energy saving in production of rolled blanks of the type of revolving bodies.

We shall estimate metal economy with reference to production of unified blanks from small lots of parts which are most representative in the order structure. We shall study the scope of energy saving in a case where operations of blank heating for hot rolling and heat treatment are combined with realization of thermo mechanical hardening.

1. Metal Saving in Production of Unified Blanks. We shall examine the real possibility of metal saving by virtue of enlargement of small lots of blanks and consequent attainment of a fuller load of high-efficiency equipment on the following example. Let us assume that a part of the product range is produced in parts rolling mills as precise blanks which hardly require mechanical treatment, while another part may be produced in two stages: first the unified blank is rolled and from it a whole group of parts is made by mechanical treatment of parts close in mass and the lot size. It will be seen that the mass of the parts, which are not fewer than 17 thousand, pieces in the lot, is 2450 tons. The total mass of the small-lot parts is roughly equal to one half of the total demand.

Use of unified blanks is justifiable if saving in the metallurgical production process exceeds the cost of additional mechanical treatment. Let us assume the equipment load to be 100% and compare the economic benefit of various technological alternatives: 1) rolling of precise

blanks, 2) rolling of unified blanks with additional mechanical treatment, and 3) traditional technique for making parts of the type of revolving bodies by turning from cylindrical ingots.

ABOUT SAFETY:

Machine safety has become an even more important machine design concern as it must provide responsible protection for operators and technicians in a manner that keeps the machines running to the fullest degree possible with intelligent use of light curtains, interlock switches, safety relays, safety modules, programmable safety controllers, and other essential machine safety devices to monitor, prevent, and react to machine upsets

In today's fast paced business world, maintaining a safe production environment is essential to protecting a company's bottom line, employee's health and safety, along with a company's reputation and assets. At the same time a company must continue to meet production, quality and delivery demands.

Whether you are installing new or modifying existing equipment or processes, or taking a proactive approach to workplace safety Can-Technologies will help you to meet your machine and process safety challenges.

The following provides a basic outline for the process of performing a safety management and risk reduction for a machine or system.

- Define Machine Limits (Use/Space/Time/Environmental/Interface)
- Define Tasks on/by machine
- Define Hazards associated with each task
- Conduct a Safety management based on each task and associated hazard in accordance with each applicable standard

- Develop and Implement Risk Reduction Strategies utilizing a hierarchical approach (Elimination/Substitution, Engineering Controls, Awareness, Training & Procedures, Personal Protective Equipment (PPE))
- Re-evaluation of risk.

Total factor productivity:

Theoretically, TFP is a relevant measure for technological change by measuring the real growth in production value, which cannot be explained by changes in the input of labor, capital and intermediate input.

TFP is the ratio of net output (pure output) to the sum of associated labor and capital input. Net output means total output minus intermediate goods and services purchased. TFP can be measured from different methods,

METHOD OF KENDRICK:

Kendrick presented the special way to measure the TFP:

$$TFP = \frac{Qt \text{ or } Vt}{\alpha Lt + \beta Kt}$$

Where,

Qt - output with constant value or the real value added.

K -Real capital

L- Number of persons or working hours of labors

α, β – are defined as portions of labor and capital in production or value added.

METHOD OF DUJEA:

Dujea represented the following method:

$$TFP = \frac{Qt \text{ or } Vt}{Lt \, \alpha + Kt \, \beta}$$

Where,

Qt - output with constant value or the real value added.

K -Real capital

L- Number of persons - working hours of labors

α, β – are defined as portions of labor and capital in production or value added.

In this approach $\alpha + \beta = 1$. So by measuring one of the elasticities, the other one can be calculated.

METHOD OF SOLOW:

Solow introduced the following way to analyze the total factor productivity,

$$TFPt = Qt - \alpha \, Lt - \beta \, Kt$$

According to the above equation, if labor and output stay constant. The output will be changed only by the Total factor productivity.

In order to direct the productivity analysis, Dujea model can be adopted,

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CHAPTER 3- METHODOLOGY:

3.1 TYPE OF PROJECT:

Research Project can be arranged in different types. As a consequence the project research adopted here is Explanatory research. As the technological impact on various machine, that affects the productivity rate has been explained with the suitable data, this research falls under the category of Explanatory research.

The goal of Explanatory research is to develop precise theory that can be used to empirical generalizations. An explanatory research goes beyond description and attempts to explain the reasons for the phenomenon that the descriptive study only observed. The researcher uses theory or at least hypotheses to account for the forces that caused a certain phenomenon occur. This type of research must be used when it is necessary to show one variable determine or affect on the value of other variables.

3.2 RESEARCH APPROACH:

In this project the approach adopted for analysis are Inductive and Quantitative approach.

As in the inductive approach the conclusions come from the particular fact. Although the literatures were reviewed and correlated and interrelated aspects were specified, the final conclusions have been concluded based on the results, which were found during the research and at the specific environment. (Effica Automation, SPM manufacturer). So the Approach used here is Inductive approach.

In this first phase, the quantitative data, which are related to the technological impact on productivity rate, have been collected from the Effica Automation, A Special purpose machine manufacturers. On the second phase, interview was conducted to the employees and experts of Effica Automation in order to evaluate the factors that produce impact of technology in machine building automation. Finally, information was analyzed as the numerical findings.

Since Quantitative research is a research strategy that emphasizes quantification in the collection and analysis of data. A qualitative research implies the search for the knowledge that will measure, describe and explain the phenomenon of our reality. Quantitative is about amount and how much or many of something. It is always formalize and well structured. Data in quantitative research are obtained from samples and observation seeking for relationship and patterns than can be expressed in numbers than words.

3.3 RESEARCH STRATEGY:

The research strategy should be chosen according to research questions in the particular situations. There are several different methods to perform the research. Case study, secondary data analysis and focus group are the most important

For this research project, case study is the most appropriate technique. At the first phase the Productivity rate of the machine due to the technological impact have been analyzed. Furthermore, in second phase, the impact of technology in machine building automation was analyzed by conducting the Interview through its employees and experts.

Case study is a method to gain information from a few situations that to researcher's problem area. This method concerns the intense investigation of problem solving situations in which problems are relevant to the research problem. The underlining concept is to select several targeted cases where an intensive analysis will identify the possible alternatives for solving the research questions on the basis of the existing solution applied in the case study.

3.4 SAMPLE SELECTION:

Sampling techniques provide a range of methods that facilitate to reduce the amount of data need to collect by considering only data from a sub-group rather than all possible cases or elements. At the time of conducting research, it is often impossible, impractical, or too expensive to collect data from all the potential units of analysis included in the research problem. A smaller number of units, a sample, are often chosen in order to represent the relevant attributes of the whole set of units, the population. Since the samples are not perfectly representative of the population from which they are drawn, the researcher cannot be confident that the conclusions will generalize the entire population.

The target population is the machines manufactured in the Effica Automation limited for the first phase and for the second phase the number of experts or employees to whom the interview is conducted.

According to first phase, huge number of data bases has to be created for every sample i.e., machines. Therefore 10 samples out of 30 samples taken have been selected by simple random sampling method by considering these constraints and limitations.

In the second phase analysis, interview was conducted among the employees and experts in the organization to know the impact of technology in machine building automation.

3.4.1 SAMPLING TECHNIQUE ADOPTED:

SIMPLE RANDOM SAMPLING:

In statistics, a simple random sample is a subset of individuals (a sample) chosen from a larger set (a population). Each individual is chosen randomly and entirely by chance, such that each individual has the same probability of being chosen at any stage during the sampling process, and each subset of k individuals has the same probability of being chosen for the sample as any other subset of k individuals. This process and technique is known as simple random sampling, and should not be confused with Random Sampling.

In small populations and often in large ones, such sampling is typically done "without replacement" ('SRSWOR'), i.e., one deliberately avoids choosing any member of the population more than once. Although simple random sampling can be conducted with replacement instead, this is less common and would normally be described more fully as simple random sampling with replacement ('SRSWR'). Sampling done without replacement is no longer independent, but still satisfies exchangeability, hence many results still hold. Further, for a small sample from a large population, sampling without replacement is approximately the same as sampling with replacement, since the odds of choosing the same sample twice is low.

An unbiased random selection of individuals is important so that in the long run, the sample represents the population. However, this does not guarantee that a particular sample is a perfect representation of the population. Simple random sampling merely allows one to draw externally valid conclusions about the entire population based on the sample.

Conceptually, simple random sampling is the simplest of the probability sampling techniques. It requires a complete sampling frame, which may not be available or feasible to construct for large populations. Even if a complete frame is available, more efficient approaches may be possible if other useful information is available about the units in the population.

Advantages are that it is free of classification error, and it requires minimum advance knowledge of the population other than the frame. Its simplicity also makes it relatively easy to interpret data collected via SRS

The methodology adopted for the analysis is Simple Random Sampling. Since, sample selected from a finite population will be selected, such that each possible sample combination has equal probability of being chosen. The simple random sampling without Replacement has been adopted, such that the sample units drawn will not be added to the next lot of selection.

The Population which has been selected is the Numbers of machines manufactured in Effica Automation Ltd., The Sample size which has been selected through simple random sampling is ten.

3.4.2 PROCESS OF SAMPLE SELECTION:

The sample has been drawn based on the Lottery method. Lottery method is the most popular and simplest method. In this method all the items of the population are numbered on separate slips of paper of same size, shape and colour. They are folded and mixed up in a container. The required numbers of slips are selected at random for the desire sample size.

Here 10 machines, out of 30 machines is selected .The names of the machine written on slips of paper would be mixed in a container and 10 machines will be selected randomly from the lot. The samples had been drawn based on the desired sample size.

Therefore the Outcome of the sampling would be the samples which will be used for the analysis of case study. Here in this sampling, the outcome will be the machines selected for analysis,

Number of Population (N): 30

Sample Size (n): 10

First sample Drawn: FLANGE ASSEMBLY MACHINE

Second sample Drawn: AUTOMATIC CONVEYING SYSTEM

Third Sample Drawn: AUTOMATIC PICK AND PLACE

Fourth Sample Drawn: DRILLING AND COUNTER BORING MACHINE.

Fifth Sample Drawn: AUTOMATIC PICK AND PLACE FOR BATTERIES.

Sixth Sample Drawn: 3 AXIS WELDING MACHINE.

Seventh Sample Drawn: AUTOMATIC SCREWING MACHINE.

Eighth Sample Drawn: AUTOMATIC FILLING AND PACKING MACHINE.

Ninth Sample Drawn: BOTTLE FILLING MACHINE.

Tenth Sample Drawn: AUTOMATIC CONDEM PACKING MACHINE.

3.5 CLASSIFICATION OF DATA:

The data collected can be classified as primary data versus secondary data. Primary data are gathered and generated for the project at hand, but secondary data were gathered for other purposes and now are used in the recent project. Usually the secondary data are found inside the company, libraries, research centers, internet and etc…

This work used both primary and secondary data.

3.5.1 DATA COLLECTION:

Different methods were used to gather information. The archival records and direct observation were used in the first phase. In the second phase, the Interview was conducted through the employees and experts to analyze the technological impact.

In the first part the factor of technology affecting the productivity of machine were tested in the current situation and the desirable situation independently. Second part asks the respondents to evaluate the current situation and the desirable situation of organization separately.

Archival data collection method include organizational records, charts and maps and survey data previous collected. Also the secondary data can be used in this kind of collection.

Direct observation involves observation of meeting, side walk activities; factory works classrooms and etc...Observational evidence is often useful in providing additional information about the topic studied.

There are different form of interview, such as open ended, focus interview and survey. Open ended interviews are performed in a conversational manner. The investigator can ask respondent for the facts of matter as well as for respondent's opinion about events. With the focused interview the main purpose is to confirm facts that already have been established and not ask questions of boarder nature and the respondents are interviewed in the short period of time such as an hour. In the survey the questions are more structured.

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CHAPTER 4-DATA ANALYSIS

EFFICA AUTOMATION LIMITED:

It is an organization which manufactures various special purpose machines according to the requirement of the customer needs. This organization employs various technologies to satisfy the customer needs. In recent years, to increase the productivity rate and to achieve the cycle time of the machine, safety of the machine and various other parameters, the technology have been implemented.

For this research, the production rate of the machine as the impact of technology has been analyzed. This analysis is carried out with the data observed, and statistical calculations have been carried out with "t-Test".

4.1 FIRST PHASE ANALYSIS:

In the first phase analysis, t-test has been adopted to analyze the production rate before and after implementing the technology.

4.1.1 t-TEST:

The Hypotheses is formulated with the relationship between the production before and after the implementation of technology.

NULL HYPOTHESES (H0): The manual production is less than the production after implementing the technology.

ALTERNATE HYPOTHESES (H1): The manual production is greater than the production after implementing the technology.

The degree of Freedom of t-Test can be calculated from the formula- (n1+n2-2). The level of significance used here is 5% (0.05). The outputs of the machine in manual production and production after implementing the technology have been observed. With the data observed the calculations for the t-test have been carried out which has been shown in the following table.

Here in this test n1=10, n2=10, Therefore DOF= (10+10-2) =18.

T-TEST CALCULATION TABLE

	Manual Production	Production after implementing Technology	Description
Machine 1	380	950	
Machine 2	552	1650	
Machine 3	413	1320	
Machine 4	500	1630	
Machine 5	380	1022	
Machine 6	420	1330	
Machine 7	300	1000	
Machine 8	380	970	
Machine 9	420	1250	
Machine 10	1000	4800	
Σx	4745	15922	Total (= sum of the 10 machine values)

$\bar{x}$	474.5	1592.2	Mean (= total / n)
Σx^2	2601273	37381084	Sum of the squares of each machine value
$(\Sigma x)^2$	22515025	253510084	Square of the total (Σx). It is **not** the same as Σx^2
$\dfrac{(\Sigma x)^2}{n}$	2251502.5	25351008.4	
Σd^2	349770.5	12030075.6	$\Sigma d^2 = \Sigma x^2 - \dfrac{(\Sigma x)^2}{n}$
σ^2	38863.3	1336675.06	$\sigma^2 = \Sigma d^2 / (n-1)$
$\sigma_d^2 = \dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}$	= 3886.3 + 133667.5 = 137553.8	σ_d^2 is the variance of the difference between the means	
σ_d	= 370.88		
$t = \dfrac{\bar{x}_1 - \bar{x}_2}{\sigma_d}$	= 1117.7/370.88= 3.0136		

Table 4.1.1- t –test calculations

From the above calculation, the calculated t value is less than the tabulated value (Refer Appendix-3) for 18 degrees of freedom with 0.05 significance level. This implies that, if the calculated value is less than the tabulated value, so the Null Hypotheses is accepted.

RESULT: The Null Hypotheses is accepted. Hence the production after implementing Technology is higher than that of the manual production.

From this test it is very clear that the impact of technology in production rate is significant and increasing.

4.2 ANALYSIS OF PRODUCTION RATE:

4.2.1 PRODCTION RATE OF MANUAL PRODUCTION VS AUTOMATIC PRODUCTION:

SAMPLE 1: FLANGE ASSEMBLY MACHINE

MANUAL PRODUCTION:

      The objective of the machine is to assemble the components used for submersible pump. In manual production, the components were assembled manually by the labors. The cycle time taken in the manual production is 1 minute and also the accuracy, safety was not assured in the manual production. The production rate was also relatively low in the manual production,

PRODUCTION ADOPTED WITH TECHNOLOGY:

      In automatic production, the assembly is totally automated without any human intervention. This machine is used for assembling only two types of model of pump. The models are SME-2/4 and SME-8.The raw material alone is loaded in to the slider & chute in sufficient intervals. The Ring and Flange Assembly Machine reduces the cycle time, accident and error when compared to manual operation.

pneumatic cylinders and stepper motor. The components to be assembled are 1.Suction ring, 2.Outer case of suction ring, 3.Inner case of suction ring and 4.Flange component. Initially the components are loaded in their respective loading station.

When the cycle operation is started, the Suction ring, Inner case of suction ring, Outer case of suction ring is fed one by one into the rings pressing station with the help of a pushing cylinder and PTFE assembly cylinders. Simultaneously the Flange components slides from the loading chutes due to gravity one by one using feed separation cylinders and it is held by Station 2 gripper. After the rings are pressed in the ring pressing station it is fed into the casing pressing station.

Then the flange component is placed on the casing pressing station only after the ring component is placed. Once the Ring and Flange component is placed in the Casing pressing station the components are pressed using hydro pneumatic cylinders and it is ejected from the casing Die. The ring and flange components can be loaded simultaneously. Thus finally the whole process of assembling the components is done automatically.

The machine has to assemble ring and flange component within 12 seconds. So the cycle time of the operation is 12 seconds. A shift of 8 hours will produce the Ring and flange assembled component. In manual production the number of labors will be more for this production and the component produced will also be less. But in the case of Automatic production, after implementing various technologies the production rate, efficiency, safety technology, cycle time , reliability all these parameters were achieved. This is explained with a pie chart and excel tool has been adopted for analyzing the data. The same procedure of analysis has been repeated with the other samples drawn. All the information regarding the rest of the samples is given in the Appendix-1.

For analyzing the increase in production rate when compared with manual production, cumulative analysis has been used as a tool, which is described as follows,

4.2.2 CUMMULATIVE ANALYSIS:

Cummulative Analysis has been used in my work for finding the increase in production rate. For implementing this analysis, the data has been observed directly from the production of the machine.

In Manual production, the output produced by the sample of machines, from the data collected is given below.

SAMPLES	OUTPUT PRODUCTION (IN NUMBERS)
MACHINE 1	380
MACHINE 2	552
MACHINE 3	413
MACHINE 4	500
MACHINE 5	380
MACHINE 6	420
MACHINE 7	300
MACHINE 8	380
MACHINE 9	420
MACHINE 10	1000

Table 4.2.2.1 Manual production

Similarly, the output produced by the sample of machines, in the particular shift observed is given below.

SAMPLES	OUTPUT PRODUCTION (IN NUMBERS)
MACHINE 1	950
MACHINE 2	1650
MACHINE 3	1320
MACHINE 4	1630
MACHINE 5	1022
MACHINE 6	1330
MACHINE 7	1000
MACHINE 8	970
MACHINE 9	1250
MACHINE 10	4800

Table 4.2.2.2 Automatic production

For analyzing the increase in production rate, I have adopted cumulative frequency to find the percentage increase in production rate by the comparison of the manual production and the production of machines adopted with technology, from the data tabulated above.

The cumulative Sum of output in manual production = 4745

The cumulative Sum of output in Automatic production = 15922

Cummulative Average in manual production= 474.5

Cummulative Average in Automatic production= 1592.2

Increase in production rate = 1592.2/474.5

$$= 3.36 \text{ times}$$

From the above calculation, it is clear that the Automatic production rate is more than that of the manual production. The Automatic production rate is 3.36 times more that of the manual production.

Following graph shows the production of component after implementing the automation technology and before implementing it.
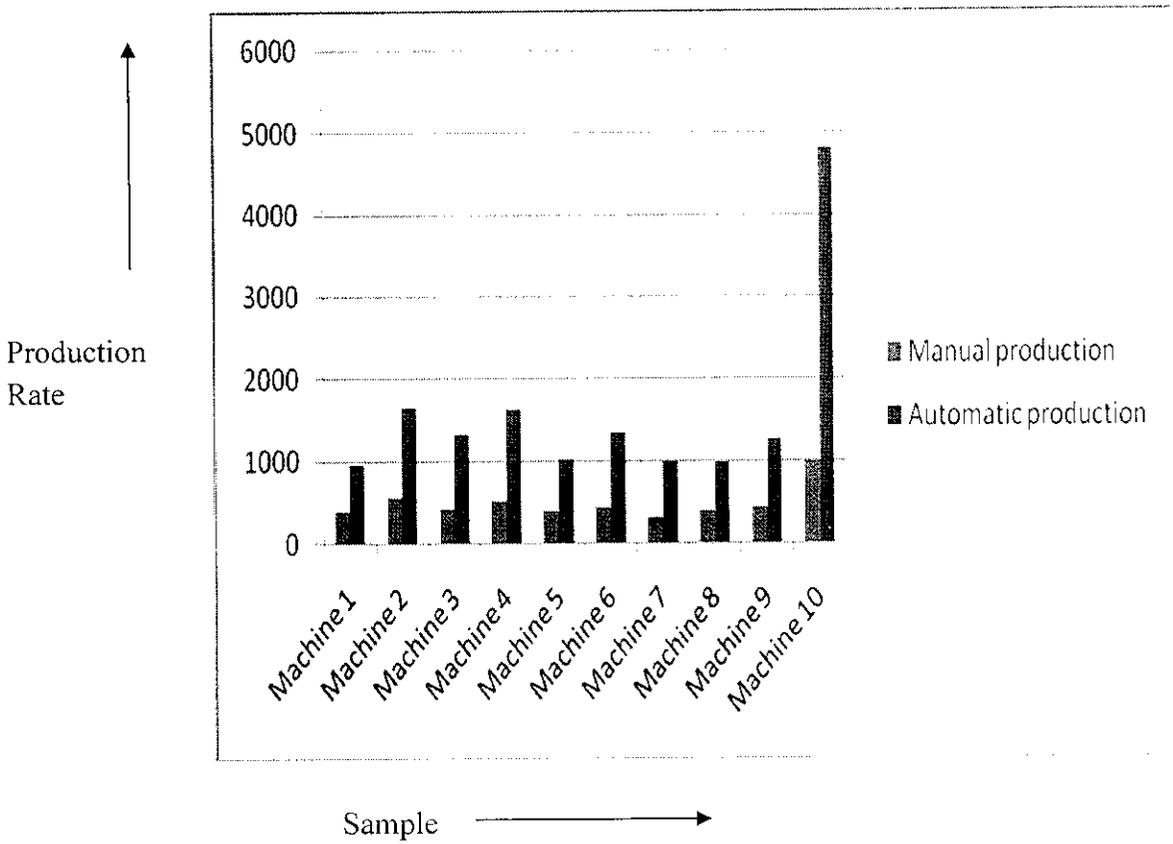
Dig 4.2 Sample versus production rate

The following table shows the production rate of components after implementing automation technology in a machine.

S.NO	CATEGORY	NUMBER OF COMPONENTS
1	SAMPLES	1000
2	NUMBER OF SUCCESSFUL COMPONENTS	986
5	NUMBER OF ERRORS OCCURRED	6
6	TIME REQUIRED (IN MINUTES)	480

Table 4.2.2.3 PRODUCTION RATE
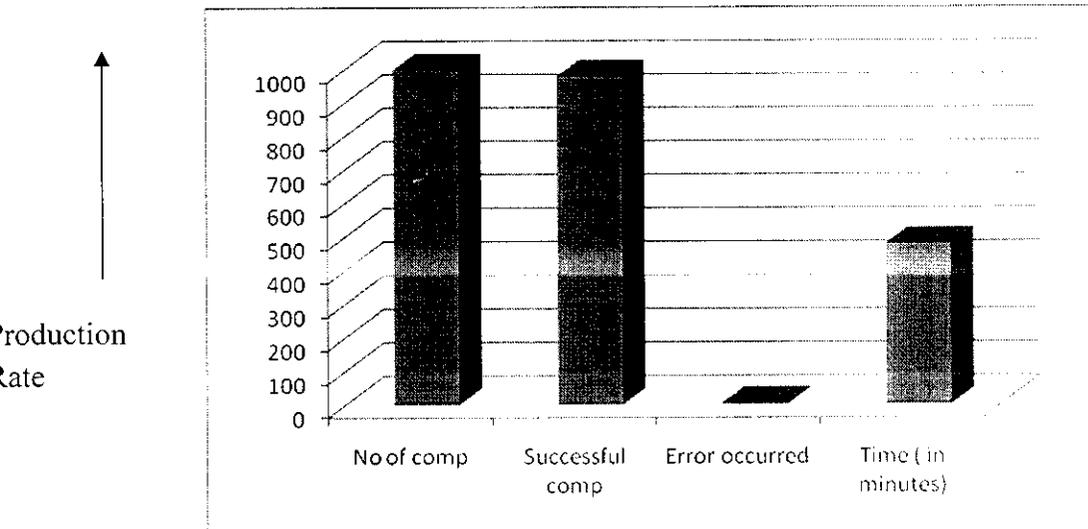
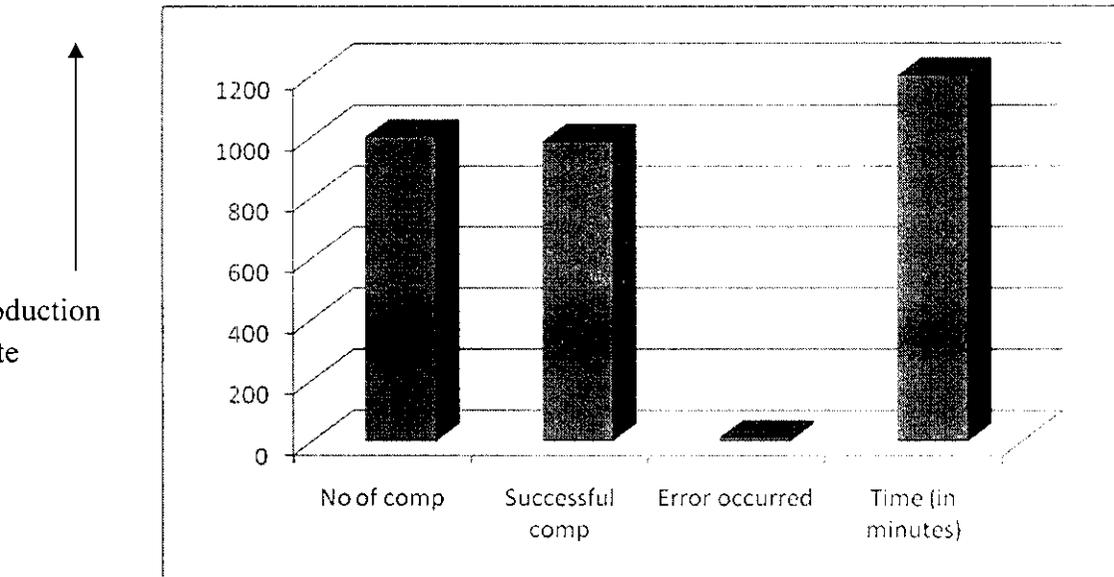
Dig 4.2.2.2 AUTOMATIC PRODUCTION

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Dig 4.2.2.3 MANUAL PRODUCTION

4.3 SECOND PHASE OF ANALYSIS:

4.3.1 INTERVIEW ANALYSIS:

After several meeting with my supervisors and limitation of time and some official barriers, 30 employees were interviewed and their datas were employed in the final analysis.

The following table gives the preliminary information of the respondents those who were interviewed. The questions formulated for the interview are open ended question. So directly from the respondent response, the data required were gathered. The details of the Respondents to whom the interview was conducted are given below.

S.NO	GENDER	DESIGNATION	EDUCATION	WORK EXPERIENCE
1	MALE	GENERAL MANAGER	ENGINEERING	10 YEARS
2	MALE	ASSISTANT GENERAL MANAGER	DIPLOMA	15 YEARS
3	MALE	MANAGER	DIPLOMA	21 YEARS
4	MALE	MANAGER	ENGINEERING	8 YEARS
5	FEMALE	SENIOR ENGINEER	ENGINEERING	5 YEARS
6	MALE	ENGINEER	ENGINEERING	3 YEARS
7	MALE	ENGINEER	ENGINEERING	3 YEARS
8	MALE	ENGINEER	ENGINEERING	3 YEARS
9	MALE	ENGINEER	ENGINEERING	2YEARS
10	MALE	ENGINEER	ENGINEERING	1YEARS

Table 4.3.1.1 RESPONDENTS OF INTERVIEW

S.NO	SAMPLE	SAFETY	ACCURACY	RELIABILITY
1	Ring and flange assembly	YES	YES	YES
2	Automatic conveying machine	YES	YES	YES
3	Automatic pick and place	YES	YES	YES
4	Drilling and counter boring machine	YES	YES	YES
5	Pick and place machine for batteries	YES	YES	YES
6	3 Axis welding machine	YES	YES	YES
7	Automatic screwing machine	YES	YES	YES
8	Automatic filling and packing machine	YES	YES	YES
9	Bottle filing machine	YES	YES	YES
10	Automatic condom packing machine	YES	YES	YES

Table 4.3.1.2 BRIEF DESCRIPTION OF ANSWERS FROM RESPONDENTS

CHAPTER-5

CHAPTER 5- CONCLUSION

5 .1 SUMMARY OF FINDINGS:

From the two phase of analysis, first phase analysis of direct observation in a plant showed the productivity rate after implementing the technological parameters has increased 3.36 times than the manual production. Hence the productivity rate has showed a positive result in machine building automation due to the impact of technology.

The second phase of analysis of interview questions through its employees, analyzed that the impact of technology in machine building automation had a greater advantage and had various benefits in terms of safety, accuracy, reliability etc…

5.2 CONCLUSION:

The research focused on the impact of technology in machine building automation, which was conducted in two phases. The first phase focused on the productivity rate of machine and the second phase analyzed about the technological parameters in machine building automation through interview. Before concluding it, I would like the present the data of finding of the research from which the conclusion of the research would

The first phase of analysis answered to the question of, "what is the relationship between the technology and the productivity rate." The answer for this question was analyzed through the direct observation of machine functioning before and after the implementation of technology.

It was analyzed with the help of t-test and cumulative frequency analysis. From the calculation, the graph showed that the production rate showed a positive result.

The second phase of analysis answered to the question of, "what was the impact of technology in machine building automation". The answer to this question was analyzed through the interview of the employees. The data obtained from the interview implied that the technology plays a vital role in machine building automation and it had a greater advantage in terms of safety, accuracy, reliability and which indirectly increases the profit of the organization.

From this summary of results of this research I would like to conclude the result of my research as, the Technology in machine building automation is must to satisfy the various parameters such as cycle time, productivity rate etc... with the technology adopted the customer needs can be satisfied. The findings of this research also implied that the productivity rate will be increased due to the technology adopted. The total factor productivity rate can also be easily calculated through Kendrick model of productivity. The interview conducted to the employees also implied that technological parameters had various benefits in the machine building automation but there were some implications found from the interview. But it could be concluded that the impact of technology in machine building automation had a greater advantage and it would be beneficiary to both the people as well as the organization.

5.3 IMPLICATIONS:

Top management of the organization plays a major role in implementing technology in machine building automation. The initial investment in adopting the technology depends on the organization decision to obtain its benefits. The major managerial implications are,

The management should train its employees according to the technology adopted. Therefore labors must be trained to adopt the technology.

The management should recognize the advantages of technology and should implement it and not sticking with the old conventional methods of machine building automation.

5.4 RECOMMENDATIONS OF FUTURE RESEARCH:

In present scenario, Automation is playing a vital role in day to day activities of a human life. So new advanced technologies in industry should be adopted, not only to satisfy the people needs, but also to increase the production rate to meet the increasing needs of people.

This research investigated the impact of technology in machine building automation, which mainly focused on the industrial need for the increase in productivity rate and various other parameters.

The future research can be conducted in the various other aspects of technology such as its investment capital of technology and its economic factors based on which the growth of the organization can be forecasted.

CHAPTER-6

CHAPTER 6- APPENDICES

6.1 APPENDIX-1

6.1.1 AUTOMATIC CONVEYING SYSTEM:

The objective of the Automatic conveying system is to convey the garnet filled bags from the filling station to stretch wrapping machine. This system is mainly designed with the help of various types of conveyors to transfer the garnet bags from the input filling stage to the packing stage. The stretch Wrapping machine is used for packing the bags and a Dispenser unit is used for dispensing the pallet to the packing station of bags.

Automatic conveying system is designed to transfer the garnet filled bags from the input filling stage of the bags from customer conveyor to the Stretch wrapping machine. The process of conveying is done with the help of the conveyors. The machine consists of conveyors such as Tilting conveyor, sizing conveyor, feeding conveyor, gravity conveyor, pallet conveyor, and in - feed conveyor. Initially the garnet filled bags from the customer conveyor will be fed into the Tilting station. In the Tilting station the bag will be tilted such that the Sealing side of the bag faces towards front side and then the bag will be conveyed into the sizing conveyor to size the bag equally. After sizing, the bag it will be conveyed into the Feeding conveyor which feeds the bag to gravity conveyor or to in - feed conveyor. Initially the Customer has to choose whether the bags are to be packed manually or automatically. If the manual packing is to be done then the customer has to select the Pushing

If the manual packing is to be done then the pushing cylinder will be activated and will push the bag in to the gravity conveyor. From the gravity conveyor the bag will be unloaded manually. If the packing is to be done automatically, then in-feed conveyor will be activated to convey the bag to the stretch wrapping machine. Robot will pick and place the bag from the in-feed conveyor to the Pallet. The Robot Functioning will be performed by ABB robotics. The pallet will be moved to the stretch wrapping machine with the help of pallet Dispensing conveyor.

A pallet dispenser unit is used to dispense the pallet one by one to the pallet conveyor for placing the bags on it. The Dispenser has three positions of movement namely Down, middle and up position, these positions movement are controlled by sensors. The design of pallet dispensing unit is typically like forklift which is having two arms to hold pallets and having forward and reverse movement to enter into the pallet.

6.1.2 AUTOMATIC PICK AND PLACE

The automatic pick and place machine is a kind of automation done for Cold Forging press. The machine is intelligent and automatically completes the pressing process in a highly precise and efficient method. The press is operated in its full cycle mode which utilizes its full efficiency; thereby the need of automation is here to improve the manufacturing method, safety and quality. By operating the full cycle mode, there is very less wear and tear in the press clutch system and the motor also works in its continuous duty. The machine is integrated with the press and the entire operation is controlled by an intelligent control system. Thus this system ensures operator safety, simple interface with the system so that anybody can get used with the system and ensures in increased in productivity, safe and

The objective of the project is to automate the pick and place operation for press and to operate the 400 Ton press in complete mode and in continuous mode. The manual feeding of the raw material and subsequent operation of the press is totally automated by the supplied machine and there is no need for manual intervention for the operation. The raw materials is alone is loaded into the stack of the machine for quite a sufficient intervals. The automatic pick and place is also indented to reduce the cycle time comparatively when the press is operated manually.

The machine is a simple kind of pick and place with two axis of operations. The axes of operation are controlled by pneumatic cylinder and a rack & pinion driven by servo motor. The components or raw materials are picked up from the stack and placed precisely in the die tool, and the forged component is ejected by the same pick& place. The operation of the press is controlled by the controller in the pick and place so that a single control may be there for the entire process. This also ensures the proper synchronized operation of the pick and place and the press. The operator needs to load the raw materials into the stack, run the press first and start the automation. The HMI interface is quite interactive to be easily handled and operated without need for much skill in operating the press. The components are separated by a feed separator arrangement by pneumatic cylinders.

6.1.3 COUNTER BORING AND DRILLING MACHINE

The objective of the project is to drill and counter bore of the slipper automatically. The drilling and boring is totally automated without any human intervention. This machine is used to drill and bore the slipper for various sizes. The size varies from 1 to

sufficient intervals. The Automatic Drilling and Counter Boring Machine reduce the cycle time, accident and error when compared to manual operation.

The operation of the drilling and boring machine is to drill and bore the slipper. The drilling and boring is accomplished with the help of pneumatic cylinders, stepper motor, servo motor and induction motor. The drilling and counter boring machine has four stations. They are

1) Loading station.
2) Sizing station.
3) Gripper
4) Drilling station.

The size of the component to be drill and bore varies from 1 to 12. A pair of component can drill and bore simultaneously (i.e. both the left and right slipper of all the size).Initially the operator is selected the size of the component in the mmi and the selected size component is loaded in the respective loading station. When the cycle operation is started, the sizing station moves according to the slipper size. Servo motor used to feed the slipper from loading station to drill station here the gripper ready to holder the slipper. Induction motor is used to rotate the needle which is used to drill and bore the slipper. Thus finally the whole process of drilling and boring the components is done automatically.

6.2 APPENDIX-2

INTERVIEW QUESTIONS:

Explain about the machine or the description of the machine?

What is the purpose of the machine?

What is the customer requirement?

What is the method customer used before to develop the product?

Is any new or complex technology is adopted to satisfy the customer requirement?

Explain about the safety of the machine?

What are the technologies adopted for the safety purpose?

Particularly in which areas, technology for safety is adopted and give its functionalities?

Why you have adopted these technologies for safety purpose?

Is this technology for safety affects the machine efficiency or the cycle time of the machine?

What is the cycle time of the machine?

What is the customer requirement regarding the cycle time?

What are the technologies adopted to achieve the customer requirement?

What about the outcome repeatability of the machine?

Is the full requirement of the customer is satisfied?

What will be the life time of the machine?

What is the reject rate of the machine outcome?

6.3 APPENDIX-3

T-TABLE

Degrees of Freedom	Probability, p			
	0.1	0.05	0.01	0.001
1	6.31	12.71	63.66	636.62
2	2.92	4.30	9.93	31.60
3	2.35	3.18	5.84	12.92
4	2.13	2.78	4.60	8.61
5	2.02	2.57	4.03	6.87
6	1.94	2.45	3.71	5.96
7	1.89	2.37	3.50	5.41
8	1.86	2.31	3.36	5.04
9	1.83	2.26	3.25	4.78
10	1.81	2.23	3.17	4.59
11	1.80	2.20	3.11	4.44
12	1.78	2.18	3.06	4.32
13	1.77	2.16	3.01	4.22
14	1.76	2.14	2.98	4.14
15	1.75	2.13	2.95	4.07
16	1.75	2.12	2.92	4.02
17	1.74	2.11	2.90	3.97
18	1.73	2.10	2.88	3.92
19	1.73	2.09	2.86	3.88
20	1.72	2.09	2.85	3.85
21	1.72	2.08	2.83	3.82
22	1.72	2.07	2.82	3.79

25	1.71	2.06	2.79	3.73
26	1.71	2.06	2.78	3.71
27	1.70	2.05	2.77	3.69
28	1.70	2.05	2.76	3.67
29	1.70	2.05	2.76	3.66
30	1.70	2.04	2.75	3.65
40	1.68	2.02	2.70	3.55
60	1.67	2.00	2.66	3.46
120	1.66	1.98	2.62	3.37
?	1.65	1.96	2.58	3.29

Table 6.3 t-Table

CHAPTER-7

CHAPTER 7- REFERENCES:

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