

P-3632



**A LAYOUT DESIGN TO INCREASE THE EFFICIENCY OF OPERATION AT
DECCAN PUMPS PRIVATE LIMITED, COIMBATORE
TAMIL NADU**

By

S.BALAMURUGAN

Reg. No. 1020400009

Under the guidance of

R.VINAYAGASUNDARAM

Associate Professor

A PROJECT REPORT

Submitted

In partial fulfillment of the requirements
for the award of the degree
of

MASTER OF BUSINESS ADMINISTRATION

Department of Management Studies

Kumaraguru College of Technology

(An autonomous institution affiliated to Anna University, Coimbatore)

Coimbatore - 641 049

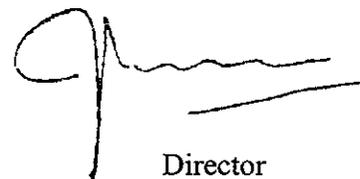
November, 2011



BONAFIDE CERTIFICATE

Certified that this project report titled "A LAYOUT DESIGN TO INCREASE THE EFFICIENCY OF OPERATIONAT DECCAN PUMPS PRIVATE LIMITED" is the bonafide work of **Mr. S.Balamurugan, 10MBA09** who carried out the project 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.


Faculty Guide
(R. Vinayagasundaram)
Associate Professor
KCTBS


Director
Dr.Vijila Kennedy
KCTBS

Submitted for the Project Viva-Voce examination held on _____

18/11/11


Internal Examiner


External Examiner

Date: 06.08.2011

PROJECT COMPLETION CERTIFICATE

This is to certify that Mr. **S. BALAMURUGAN** (Roll.No.:10MBA09), student of KCT Business School, Coimbatore has completed a project titled "**A LAYOUT DESIGN TO INCREASE THE EFFICIENCY OF OPERATION AT DECCAN PUMPSET PRIVATE LTD**" in our organization for the period from 27/06/2011 to 06/08/2011.

During this period his conduct and performance was good.

For **DECCAN INDUSTRIES**



M.Senthil Kumar
Manager

ACKNOWLEDGEMENT

I express my sincere gratitude to our beloved chairman **Arutchelvar Dr. N.Mahalingam and Management** for the prime guiding spirit of Kumaraguru College of Technology.

I wish to express deep sense of obligation to **Mr. R.Vinayagasundaram**, Associate professor, KCT Business School, for his guidance and his moral support throughout the project from its inception to completion and made my project real success

I am greatly indebted to thank **Mr. C.Ganeshmoorthy**, Project Co-ordinator and all other faculty members of KCT Business School for their kind support.

I thank **Mr. Senthilkumar**, Production Manager- Deccan pumps for his valuable guidance and motivation to complete the project successfully.

TABLE OF CONTENTS

Sl. No	TITLE	Pg.No
CHAPTER 1: INTRODUCTION		
	1.1 Introduction to the study	1
	1.2 Industry Profile	2
	1.3 Organization Profile	10
	1.4 Objectives of the study	15
	1.5 Statement of the problem	16
	1.6 Scope of the study	17
CHAPTER 2: REVIEW OF LITERATURE		
	2.1 Review of literature	18
CHAPTER 3: RESEARCH METHODOLOGY		
	3.1 Data and sources of data	22
	3.2 Statistical tools used	22
CHAPTER 4: ANALYSIS & INTERPRETATION		
	4.1 Assembly section	30
	4.2 Machine Shop	31
	4.3 Cost benefit analysis	32
CHAPTER 5: FINDINGS, SUGGESTIONS AND CONCLUSION		
	5.1 Findings	35
	5.2 Suggestions	35
	5.3 Conclusion	35

LIST OF TABLES

TABLE NO.	TITLE	PAGE NO.
4.1	Actual Time and Change Time of Assembly section	30
4.2	Actual Time and Change Time of Machine Shop	31
4.4	Comparision cost for production of 100 pumps in Existing & Proposed layout	32

LIST OF CHART

CHART NO	TITLE	PAGE NO
4.4	Comparision cost for production of 100 pumps in existing and proposed layout	33

ABSTARCT

The basic principles governing plant layout are more or less same . As far as small business is concerned , it requires a smaller area or space and can be located in any kind of building as long as the space is available and it is convenient. Plant layout problem is an area of arranging facilities such as equipment , department , section , etc. inside the plant or work place. It is one of the most critical strategic decisions.Plant layout is generally a onetime activity as it is very difficult to frequently rearrange the facilities. To reduce the timing for production and increase the productivity and also the efficiency system that meets requirements of quantity and quality in the most economical way. The systematic direction of the processes that transform inputs into finished goods & services. to minimize cost of production

CHAPTER-1

INTRODUCTION

1.1 INTRODUCTION TO THE STUDY:

A Plant layout study is an engineering study used to analyze different physical configuration for an industrial plant and modern industrial manufacturing plants involve a complex mix of functions and operations. Various techniques exist , but general areas of concern are space , material handling , communications , utilities , buildings etc and layout facilitates the arrangements of machines , equipment and other physical facilities in a planned manner within the factory premises . An entrepreneur must possess an expertise to lay down a proper layout for new or existing plants. It differs from plant to plant , from location and from industry to industry . But the basic principles governing plant layout are more or less same . As far as small business is concerned , it requires a smaller area or space and can be located in any kind of building as long as the space is available and it is convenient.

1.2 INDUSTRY PROFILE:

Growth of Pump Industry

Although some pumps were used in 19th century, the real growth of Pump Industry took place in 20th century:

- 1905: Multistage Centrifugal Pumps were developed.
- 1929: Considerable light was thrown on the vexing problem of pressure pulsations in large hydraulic turbines & pumps.
- 1932: Proper understanding of the origin and nature of pressure pulsation & the accompanying, vibratory, structural, mechanical response.
- 1955: Dependence of cavitation erosion on liquid was established. This led to an understanding of why high-energy pumps are more likely to suffer from this damaging phenomenon.
- 1956: How the thermodynamic vaporization properties of the pump liquid could lead to reduction of cavitation activity at high temperatures at the same NPSH (Net Positive Suction Head) (Liquid pressure head in excess of vapour pressure head).
- 1994: How cavitation can cause profound instabilities in pump & inducer operation.
- 1990-2000: It is found that sometimes obscure fluid phenomena can produce mechanical instability in rotodynamic pumps.

Drivers of pump development

1. **Industrial Revolution:** Pump industry had been fuelled by the massive demands of the industrial revolution that built our modern society.
2. **Post World War II Expansion:** In order to satisfy the pent-up demand that had gone unfulfilled in war years. Here the emphasis was on large, multistage electric utility boiler feed water pumps & oil-field injection & pipeline pumps.
3. **Energy Crisis:** Energy crisis all over world led to lot of research & development work for developing energy efficient pumps & systems.
4. **Environmental Challenges:** Curbing emissions was the paramount concern. This influence has led to better sealing of pumps including sealless, magnetically coupled chemical pumps. The ultimate product in this regard could be 'integral motor pump'.
5. **Globalization:** The fluid engineering & other technical challenges are assumed to be solvable by the MNC who emphasize quality, productivity & faster delivery of the product in order to battle global market share. The apparently mature pump product has a lot of room for improvement. The technical improvements will continue to be necessary to maintain global competitiveness.

The applications of pumps

Transportation: It is a prime function.

- **Circulation:** For homogenizing the temperature and/or composition of fluid.
- **Mixing:** Two or more streams can be connected at the suction of pump & mixing can be achieved.
- **Injecting:** High pressure can be developed by using pump and fluid can be

- Metering: Pumps can be used as metering device.
- Pressure Reducing Device: Rotary pumps can be used for reducing the pressure in polymers.
- Agitator Pump: Submersible pump keep the solids in suspension & prevent setting.
- Vacuum Generation: Liquid ring vacuum pumps are well known. Dry vacuum pumps are also developed.
- Reactor: When two liquids are to be reacted with very small residence time then pump can be used.
- Cavitation Reactor: When one liquid and another in vapor form are to be reacted, the principle of cavitation can be used.

Indian pump industry at present met the pump requirements of 95% of applications.

Some Recent Developments in Pumps

- One supplier has developed dry industrial vacuum pump. They use claw technology with a built in roots mechanism & facilitate high speed evacuation down to an ultimate vacuum of 0.05 mbar. Peak pump capacity is 560 cubic m/hr. Despite high pumping capacity, manufacturer claims less energy consumption.
- Another has developed vertical dual-screw dry running vacuum pump. It has an electric drive control integral with pump unit & can also be remotely controlled. It meets the stringent electrical, mechanical & instrumentational safety standards of legislation. (Received award in 40th International Mech. Engg. Exhibition at BRNO in Czech Republic).

- One foreign supplier has developed ultra high pressure plunger pumps (Pressure : 2500 bar & flow 15 to 20 lit/min., Temp. : 50°C) can be used for
 1. Sensitive paint stripping from metal and concrete surfaces.
 2. Surface preparation prior to painting & coating.
 3. Cutting of metals, concrete, reinforced material.

Computational Fluid Dynamic studies are carried out by Cranfield University for:

1. Flow prediction in pumps
 2. Three dimensional transonic flow simulation using a time marching scheme.
 3. Erosion studies during cavitation.
- **“SMART PUMPS”**: Depending on the changes in suction conditions and /or changes in the discharge requirement the pump should act accordingly by using “SMART SENSORS” which will be based on optical fibers.
 - **High Efficiency Small Circulation Pumps**: The conventional efficiency of small pumps is of the order of 5 to 10%. When these pumps are used as part of solar-auxiliary system, the efficiency of pump plays a vital role. The efficiencies of the pump have improved dramatically (+80%) using permanent magnet motors & hydraulically optimized impellers.
 - One supplier has developed mechanical seal (for oil service at 660°F & water at 320°F) where cooling is achieved by using extended surfaces (fins), thus cooling water requirement is eliminated.
 - Enterprise Asset Management (EAM) software applications reduce energy consumption & improve pump reliability by automatic monitoring of process pumps.
 - Abroad, favorable experience of variable speed drive for power conservation in high HP equipment has led to development of micro drives.

The challenges ahead:

- Stabilizing the head characteristics of large, high specific – speed mixed flow pumps by using CFD (Computational Fluid Dynamics) techniques.
- Predicting the performance curves of pump using CFD.
- Eliminating vibrations & off-design pressure & flow fluctuations.
- Finding solutions to both rotor & structure related vibrations using FEA (Finite Element Analysis).
- Performance & life of pump is drastically affected due to cavitation. Improved blade shapes reduces / eliminates cavitation damage.
- Develop highly reliable pump such that no standby pump is required.

Role of pump user

- Now-a-days pumps are purchased based on life cycle cost analysis. Hence, user will have to keep a track record of all the pumps for expenditure on utilities consumption, spare parts consumption, maintenance etc. and give feedback to consultants and manufacturers.
- For any technical problem, the user should contact consultant if they do not get satisfactory services from manufacturer and also address the problem to Pump Manufacturer's Association.
- The user should replace old inefficient pumps with efficient pumps. This will save national energy to a great extent. Use of variable speed drives wherever possible can be implemented.

- Wherever possible use 50% spare capacity instead of 100% spare capacity. For example instead of 200m³/hr. capacity (1 working + 1 standby) use 100m³/hr. capacity (2 working + 1 standby) pumps.
- Ensure preventive maintenance of all pumps.

Role of Technical Consultant

- A technical consultant is a very important link between pump user & manufacturer. He is responsible for selecting suitable type of pump for the given application.
- Consultant should ensure that material of construction of all fluid-contact parts are suitable for given application.
- Consultant should ensure proper equipment layout, upstream and downstream line sizing, strainers etc.
- Consultant should participate in seminar / workshops & share their experiences with user & manufacturers.

The role of Pump Manufacturers

- Manufacturers to ensure that maximum possible indigenous pumps are locally available & thus avoid import of pumps. Thus save on foreign exchange. Depending on feasibility study import substitute as well as export market can be explored. For example, Ceramic pumps, High performance alloys, High precision gear pump for spinning m/c. in manmade fiber industry, peristaltic pumps, magnetic drive pumps etc.
- Pumps consume about 30% total power. Pump is an item which will consume more energy throughout its life if it is not energy efficient. Hence, it is necessary to improve on energy efficiency of the pump. Even for small Kw rating it is essential to

have high energy efficiency because in future, we will likely to use solar energy where pump efficiency plays vital role.

- In Germany, 20% increase in energy efficiency by 2005 is made mandatory. In Netherlands, 33% improvement in energy efficiency compared to 1995 to be achieved by 2020.
- In European industry 15-20% of energy saving potential is widely accepted through implementation of new technologies which are commonly available but not widely applied at present. What about India?
- In India, in 15% of the cases, motor selection is by consultant where as more than 45% of the cases motor selection is by manufacturers. Hence by selecting energy efficient motors & variable speed drive, pump manufacturers can contribute to energy saving.
- There is demand from user that manufacturer should take the responsibility for optimization of material selection. Here manufacturers should focus on application of new materials of construction. E.g. Ceramic coating.
- Manufacturers should arrange training programs for user & consulting engineers.
- Manufacturers to ensure “PASS”. (Prompt After Sales Service)
- IPMA (Indian Pump Manufacturers Association) should

1. arrange more national / international seminars / exhibitions for further business developments.
2. submit their recommendations about export / import policies, excise, custom duties policies etc. to Govt. of India at least once in a year.
3. take a lead role in setting up of laboratory facility required for pump manufacturers.

1.3 ORGANISATION PROFILE

ABOUT THE INDUSTRY

For more than three decades now, the name Deccan has been synonymous with Revolutionizing India's traditional pump manufacturing industry. In this time, they have dedicated their mission to making water, the earth's most precious resource, easily accessible to millions of farmers across the country. Their unique product innovation improvisations such as Vertical - Open well Submersible Pump sets Mini Submersible Pump sets (Sub Sevak) have been silent contributors to the green revolution that reinvented India's story of prosperity. Today, their capabilities have taken them beyond India's shores, to over 37 countries worldwide. With a steady year on year growth rate of 23% and facilities to manufacture more than 100,000 pump sets a year, they are today among Asia's leading pump companies. **DECCAN INDUSTRIES** was started in the year 1981 with the first exclusive production line for submersible pump sets in the country. Bore well submersible pumps, Open well submersible pumps, Jet pumps and Centrifugal pumps are the major product groups. With an annual production of 100 thousand units, Deccan is one of India's leading pump manufacturers. Deccan innovative pumps have been widely recognized in the market and the company is the largest producer of vertical open well pumps in the country. The group with 3 manufacturing units and 1 technology centre with 140 thousand square feet of built up area and 220 thousand square feet of open space aims to consolidate and expand the continued development of pumping solutions. Strategically positioned at Coimbatore, the pump city of Asia, Deccan' pump sets cater to the needs of Indian market besides being exported to many middle east countries with NEMA / DIN standards.

Late. Sri. K.K. Veluchamy born in an agricultural family, at his age of 13 dreamt of finding a better way to bring water to the fields, than having farmers depend on hard manual and animal labour. His dream led him to pursue engineering and delve into the finer aspects of design and manufacture of submersible motors. In 1981, he realized that dream and founded Deccan Industries, an exclusive production line for submersible pumps along with his cousin Mr. P. Arumugam. Today, the Deccan Group has grown to encompass many entities, from a dedicated research institute to education institutions.

P-3632

Management

Many minds have worked alongside the founder to create that solid foundation on which the Deccan Group of Industries exists. They bring with them diverse skill sets that have helped them grow, sustain that growth and constantly reinvent ourselves to meet growing market needs. Mr. P. Arumugam, a graduate of Mathematics is the fellow founder of Deccan Group and is the key driving force behind their operations strategy. He heads the Finance, Purchase, Production Planning and Development divisions and is involved in devising the roadmap for Deccan. His management skills have helped us build a core team that works to deliver his strategic plans. He is committed to ensuring that the group sustains its benchmarks of quality Mr. K.V. Karthik following an engineering degree from MIT (Pune) pursued higher learning at Sheffield University, (U.K) joined his father and uncle and has since been working at all levels of the group. He was able to hone his engineering skills and also develop an understanding of rapidly evolving technologies from around the world. Mr.K.V.Karthik spearhead research initiatives works in close coordination with the research team in areas of new product developments and has been responsible for several product improvisations. His global exposure has helped him gain several insights into global marketing strategies. He currently heads the sales and marketing and research divisions at the group. His enthusiasm and high energy levels are a constant source of inspiration for team Deccan.

The core management team is ably supported by a group of professionals, each responsible for a particular area of operation. Along with an able team, they work to constantly to elevate their standards in pump and allied light engineering manufacture.

QUALITY POLICY

As a leading pump manufacturer and a company known for its unique product innovation and improvisation, Deccan combines the best technology with fresh ways of thinking and continues to develop better pump sets, systems, services and standards for the future. For Deccan, being number one means “being the best in terms of quality and reliability”. The strategy is that if quality and performance continue to improve, volume and revenues will automatically follow and that is what it has always been in the past and will also be in the future.

At Deccan, they constantly strive to improvise on the nuances of production and when 30 years of small improvements accumulate, they have become a revolution.

They see them as creators of a highly specialized industry. With more challenges taking place in the fluid management industry, they are on the path to reinvent their capabilities in terms of increasing their product range and innovating customized products for specific purposes. They see themselves playing an increasing and responsible role in water conservation and recyclability.

The Deccan Group of Companies is renowned for its several enterprising efforts in diverse ventures. But like a true corporate citizen, it has responsibly discharged its duties beyond business as well. The group companies include

Deccan Industries (Unit 1)

Deccan Industries (Unit I) is the flagship company of the group and is engaged in the manufacture of 3", 4", 6", 8",10" and 12" submersible pumps for bore holes.

Deccan Industries (Unit 2)

The Unit II of Deccan Industries is reputed to be among the largest of its kind in India. It is Primarily involved in the manufacture of Vertical and Horizontal type open well submersible pump sets.

Deccan Industries (Unit 3)

This unit is equipped with infrastructure to manufacture a variety of pump sets, such as Centrifugal Agri Monobloc Pump sets, Domestic Monobloc Pump sets, regenerative and self – priming pump sets.Deccan Pumps Private Limited is equipped with infrastructure to manufacture a variety of Pump sets, such as Mini submersible (sub sevak) & tiny submersible pump sets.

Deccan Service Unit

This is a fully functional service centre that operates within the company with the facility to repair any pump set within 24 hrs.

Research and Technology Centre

The Info Institute of Engineering function as an in- house arm and technical centre for Deccan group of companies and has helped the group make giant strides in terms of innovation & improvisation. A dedicated team of qualified professionals and research analyst work to understand market dynamics and accordingly work on product enhancements.

Deccan Enterprises

Deccan Enterprises is one of the largest distributors for Finolex Cables and wires in India. It is also a well known distributor of BCH Electric Limited, one of the largest manufacturers of low voltage electrical and electronic controls in India.

Agri Business

In keeping with the Group's commitment to a greener planet, farm has been instituted at Vedsandur. Deploying modern organic farming methods, the farms are spread over 120 acres and include coconut, mango, tamarind plantations, etc.

Real Estate and Property Development

Coimbatore, an established industrial city and an emerging Tier- II IT hub offers immense scope for real Estate & Property development. Being an astute business group, Deccan has taken active interest and involvement in the acquisition of prime lands and properties in and around Coimbatore. Under its fold are Apartments, Commercial and office complexes etc.,

MANUFACTURING FACILITIES

The strength of their infrastructure has been a key factor in delivering quality products on time, every time. The company is installed with all modern and precise machineries required to manufacture the pumps in high calibre. Their stainless steel sheet metal unit has excellent state-of-the-art manufacturing facilities for producing stainless steel components.

The company has 3 manufacturing units with a total built up area of about 80000 sq. ft

is the country's largest and all products are routed through exhaustive testing processes before they reach the market

Apart from this a land measuring about 2.5 hectares is available in the vicinity of the company for future expansion and diversification. Modern methods are used for stocking and handling and even the raw materials stored in the stock yard are through pallets. Internal and external training programs on productivity, inspection, quality management systems and housekeeping are conducted regularly.

RESEARCH AND TECHNOLOGY

At Deccan, improvisation and innovation go hand in hand. While product improvisation is a constant process, innovations take place depending on market needs and demands. We have a strong R&D set up at the Info Institute of Engineering. The institute functions as an In-house arm and technical centre for Deccan group of companies and have helped the group make giant strides in terms of innovation and improvisation. A dedicated team of qualified professionals and research analysts work to understand market dynamics and accordingly work on product enhancements. The R&D personnel are highly qualified with doctorates and Ph.Ds in their own field and include specialists in the material/mechanical/electrical segments. More than 1/4th of their turnover is spent on new product development and research every year.

1.4 OBJECTIVES:

Primary objectives:

To study the operational efficiency of the existing layout and to propose the new layout.

Secondary objectives:

1. To study the productivity & profitability of the existing layout and proposed layout.
2. To analysis the existing layout and to reduce the total elapse time of new proposed layout.
3. To study the existing layout with regard to material handling and transportation of material and suggest the convenient floor space for material handling .

1.5 STATEMENT OF THE PROBLEM:

Plant layout problem is an area of arranging facilities such as equipment , department , section , etc. inside the plant or work place. It is one of the most critical strategic decisions.

- (i) Plant layout is generally a onetime activity as it is very difficult to frequently rearrange the facilities.

- (ii) It requires a long term vision about factory so that minimal dislocations occur when the factory expands or goes through minor changes in process , production schedule or product mix.

- (iii) Wrong arrangements of facilities lead to more travel time between processes. This causes more through-put time, more work-in-process, more material handling , etc.

1.6 SCOPE OF THE STUDY:

To reduce the timing for production and increase the productivity and also the efficiency system that meets requirements of quantity and quality in the most economical way. The systematic direction of the processes that transform inputs into finished goods & services. to minimize cost of production . to ensure efficient control over the various processes of production.

CHAPTER - 2

LITERATURE REVIEW

Mr. S.P. Singh done a project on “**An improved heuristic approach for multi-objective facility layout problem**”. Multi-objective facility layout problem (MFLP) generates a different layout by varying objectives weights. Since the selection of objective weights in MFLP is critical, stages of designing layout having multiple objectives. The objective weights therefore play an important role in the layout design of MFLP. In practice, it is selected randomly by the layout designer based on his/her past experience that restricts the layout designing process completely designer dependent and thus the layout varies from designer to designer. This paper aims to resolve the issues of selecting the objective weight for each objective. We propose four methods to determine objective weight which makes the design process of MFLP completely designer independent.

Mr. Tanchoco done a project on “**The double row layout problem** “. This research explores the double row layout problem (DRLP) that deals with how to place departments or machines on both sides of a central corridor. This type of layout problem is commonly observed in production and service facilities. Over the last 40 years, researchers have extensively studied a similar problem called the single row layout problem (SRLP) or one dimensional space allocation problem (ODSAP); as a result, several practical approaches are currently available for the problem. However, the DRLP has not received much attention in the literature although it often provides a better structure for layout designers. In this research, we first develop an MIP model for the DRLP that involves more variables and constraints than existing formulations of the SRLP. In turn, conditions yielding a good solution are analysed based on the proposed model. Five heuristic algorithms are developed to provide a reasonably good initial solution and corresponding upper bound of the DRLP. The performance of these heuristic algorithms, as well as MIP solutions by CPLEX 10.2, is compared in a series of experiments.

Mr. Jing-wen done a project on **Simulation study of coordinating layout change and quality improvement for adapting job shop manufacturing to CONWIP control.**Constant work-in-process (CONWIP) has been highlighted for its superiority over kanban for application in job shop environments. Smooth operation of CONWIP yet depends on some critical practices, including: layout change (from functional to cellular), quality improvement (QI) and set-up time reduction induced by layout change (STR) Simulation modelling was employed in this study to investigate the coordination of these conditions. QI was experimented with the mean magnitude and probability of occurrence for step shifts (MMSS and POSS, respectively); it has major effects on flow time variability only. If STR is below 60%, a functional layout with push control was found favourable while QI is not effective.STR needs to reach 60% to justify layout change; POSS and MMSS reductions are effective for cellular layouts with CONWIP and push control, respectively. At this stage, promotion of improvement activities should be the major concern for replacing push control with CONWIP. The performance of CONWIP is superior if a 70% or larger STR is achieved. In this case, it enables greater delivery performance upgrade via strengthening the effectiveness of QI in reducing flow time variability. Essential guidelines were ultimately derived for reforming traditional job shop practices, progressing through layout change, towards the realisation of CONWIP.

Mr. Dhamodharan done a project on **“A genetic algorithm and queuing theory based methodology for facilities layout problem”.**Facilities layout, being a significant contributor to manufacturing performance, has been studied many times over the past few decades. Existing studies are mainly based on material handling cost and have neglected several critical variations inherent in a manufacturing system. The static nature of available models has reduced the quality of the estimates of performance and led to not achieving an optimal layout. Using a queuing network model, an established tool to quantify the variations of a system and operational performance factors including work-in-process (WIP) and utilisation, can significantly help decision makers in solving a facilities layout problem. The queuing model utilised in this paper is our extension to the existing models through incorporating concurrently several operational features: availability of raw material, alternate routing of parts, effectiveness of a maintenance facility, quality of products, availability of processing tools and material handling equipment. On the other hand, a queuing model is not

large search space, has been selected and implemented to solve the layout problem modelled with queuing theory. This combination provides a unique opportunity to consider the stochastic variations while achieving a good layout. A layout problem with unequal area facilities is considered in this paper. A good layout solution is the one which minimises the following four parameters: WIP cost, material handling cost, deviation cost, and relocation cost. Observations from experimental analysis are also reported in this paper. Our proposed methodology demonstrates that it has a potential to integrate several related decision-making problems in a unified framework.

Mr. K. Krishna done a project on **“Mitigation of risk in facility layout design for single and multi-period problems”**. The most desirable characteristic of a facility layout is its ability to maintain its efficiency over time while coping with the uncertainty in product demand. In the traditional facility layout design method, the facility layout is governed by the flow intensity between departments, which is the product flow quantity between departments. Hence, an error in the product demand assessment can render the layout inefficient with respect to material handling costs. Most of the research integrates uncertainty in the form of probability of occurrence of different from-to charts. In an environment where the variability of each product demand is independent, the derivation of 'probabilistic from-to chart' based scenario cannot be used to address uncertainty of individual demands. This paper presents an FLP (facility layout problem) approach to deal with the uncertainty of each product demand in the design of a facility layout. Two procedures are presented: the first procedure is utilised to assess the risk associated with the layout, while the second procedure is used to develop the layout that minimises the risk. Results from case studies have shown that the procedure produces a reduction of risk as high as 68%.

Mr. Zhaoqing done a project on a **“Robust fixture layout design for multi-station sheet metal assembly processes using a genetic algorithm”**. The optimal fixture layout is crucial to product quality assurance in the multi-station sheet metal assembly processes. Poor fixture layout may lead to product variation during the assembly processes. In this paper, a genetic algorithm (GA)-based optimisation approach has been presented for the robust fixture layout design in the multi-station assembly processes. The robust fixture layout is developed to minimise the sensitivity of product variation to fixture errors by selecting the appropriate

for variation propagation in the multi-station sheet metal assembly is developed for the first time, which is the mathematical foundation of optimal algorithm. An e-optimal is applied as the robust design criteria. Based on the state space model and design criteria, a genetic algorithm is used to find the optimal fixture layout design. The proposed method can greatly reduce the sensitivity level of product variation. A four-station assembly process of an inner-panel complete for a station wagon (estate car) is used to illustrate this method.

Mr.Sahin done a project on **“A new hybrid tabu-simulated annealing heuristic for the dynamic facility layout problem”**.In today's market conditions of increasing global competition, rapid changes in technology and shorter life cycle of product, it is required to evaluate the facility layout as the dynamic facility layout problem (DFLP). The objective of the DFLP is to determine layouts for each period in the planning horizon such that the sum of material handling and rearrangement costs are minimised. In the literature several researchers proposed new algorithms and models to solve the problem. The purpose of this research is to present a new hybrid heuristic based on the simulated annealing (SA) approach supplemented with a tabu list for the DFLP. We call this heuristic TABUSA. The efficiency of the TABUSA algorithm is analysed by solving the problems in a well known data set from the literature. We have also solved the same problems by using a pure SA algorithm, and a pure tabu search (TS) algorithm for comparison purposes. The results show the effectiveness of the TABUSA algorithm.

CHAPTER-3

RESEARCH METHODOLOGY

3.1 SOURCES OF DATA:

The following are the sources of data which i have collected the information.

- Primary data
- Secondary data

Primary data:

This includes information collected through period of interview from production manager ,Trainer in production department and other staffs of the company.

3.2 STATISTICAL TOOLS:

In this study the statistical tool is used for measuring the time gap between two different process ,in this the time gap is measured using stop watch and cost sheet.

Plant layout

1. Layout is a fundamental of every organization and enterprise.
2. Plant layout involves the development of physical relationships among building equipment and production operation which will enable the manufacturing process to be carried on efficiently.
 - a. Plant layout – Placement of departments,
 - b. Placement of workgroups within departments,

c. Placement of workstation

d. Placements of machines

Factors influencing layout.

- Nature of products
- Production process
- Type of machinery
- Human needs
- Plant environments
- Future changes
- Factory building

Types of layout.

1. Product layout
2. Process layout
3. Fixed position layout
4. Combined layout
5. Cellular layout

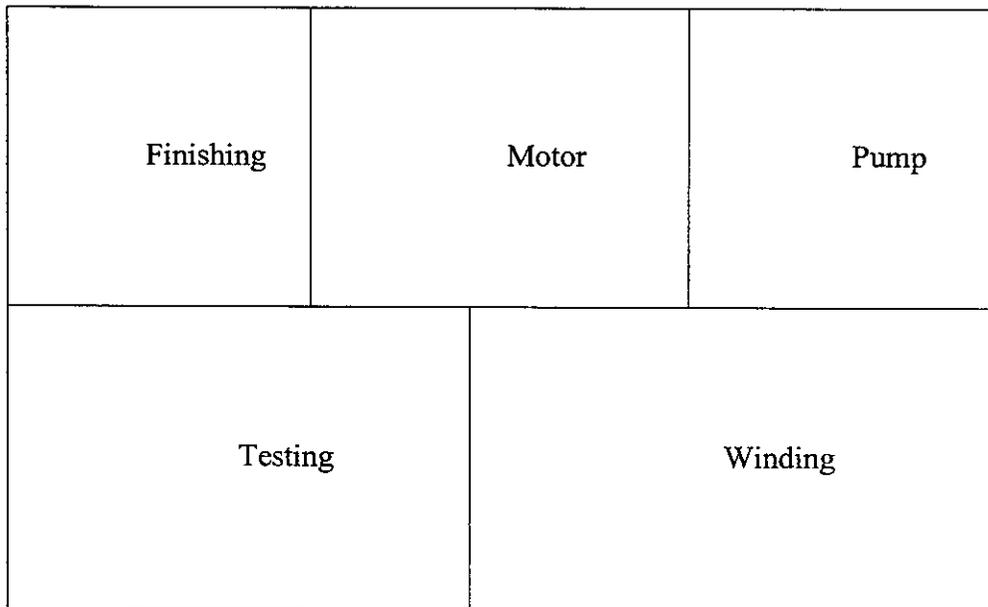
A. Product layout

- Machinery and material are placed following the product path. this type of plant layout is useful when the production process is organised in a continuous or repetitive way.
- Continuous flow: The correct operation flow is reached through the layout design and the equipment and machinery specification
- Repetitive flow (assembly line): The correct operation flow will be based in a line balancing exercise , in order to avoid problems generated by bottle necks. The plant layout will be based in allocating a machine as close as possible to the next one in line , in the correct sequence to manufacture the product.

Finishing	Motor	winding	testing
-----------	-------	---------	---------

B. Process layout

This type of plant layout is useful when the production process is organized in batches. Personnel and equipment to perform the same function are allocated in the same area. The different items have to move from one area to another one, according to the sequence of operations previously established. The variety of products to produce will lead to a diversity of flows through the facility. The variations in the production Volumes from one period to the next one (short periods of time) may lead to modifications in the manufactured quantities as well as the types of products to be produced.

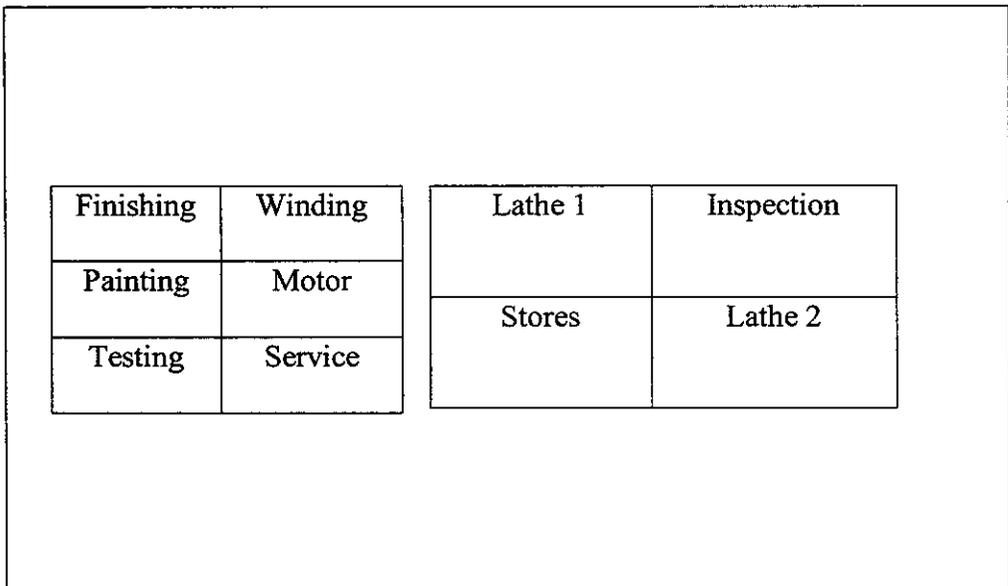


C. Fixed layout

In fixed product layout , the products generally circulate within the production facilities (machines , workers , etc); in this particular type of layout , the products does not move , the different resources are moved to perform the operations on the product. This type of layout is commonly found in industries that manufacture large size products , such as ships or aircrafts. The equipments is brought to the object being processed , and the object does not move. Arranging materials and concentrically around the production point in their order of use.

D. Combined layout

Manufacturing concerns where several products are produced in repeated numbers with no likelihood of continuous production, combined layout is followed. Generally, a combination of the product and process layout or other combination are found, in practice for industries involving the fabrication of parts and assembly, fabrication tends to employ the process layout, while the assembly areas often employ the product layout



E. Cellular layout

Group of equipments and workers that perform a sequence of operations over multiple units of an item or family of items. Looks for the advantages of product oriented layout is efficiency and process oriented layout is flexibility. Grouping outputs with the same characteristics to families , and assigning groups of machines and workers for the production of each family. In cellular layout the designs is not according to the functional characteristics of equipments , but rather by self-contained groups of equipment (called cells)

needed for producing a particular sets of goods or services. Group technology ,or cellular manufacturing , classifies parts into families so that efficient mass-production-type layout can be designed for the families of goods or services.

ABOUT THE LAYOUT:

The existing layout and the proposed layout shows the process type of layout and here in the assembly and the machine shop. the layout redesign to the efficiency of the productivity and facilitate the traffic flow and increase the employee morale and minimize the risk of injury and the damages to the property .utilizing the available space effectively and efficiently.

The proposed layout was effective in the production in assembly and machine shop as for as small business is concerned and it requires a small area or space and can be located in any kind of building as long as the space is available and it is convenient

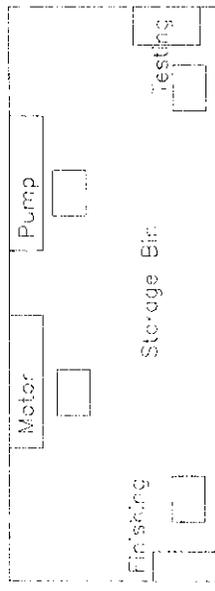
winding
Inspector

Paint

Finished Goods

RestRoom

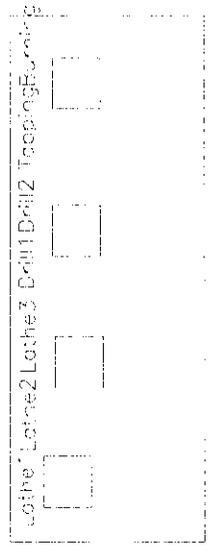
Stores



Assembly Section

Service

Accounting Inspector



Machining Shop

No.	Rev. No./Date	Date

Drawn: _____
 Title: _____

Project Name and Number:
 Title:
 Date:
 Scale:
 Author:

Drawn	Checked	Date

CHAPTER-4

ANALYSIS & INTERPRETATION

4.1 ASSEMBLY SECTION:

SLNO	SECTIONS	ACTUAL TIME IN (SEC)	CHANGE TIME IN (SEC)
1	Motors	4 sec	2 sec
2	Pump	4 sec	2 sec
3	Testing	7 sec	4 sec
4	Finishing	7 sec	4 sec

Interpretation

From the above table the motor section takes time to 4 sec in actual time and it is reduced to 2 sec in the change time, and also in pump section. in testing and finishing section the actual time is 7 sec and it reduce to four sec so the assembly section has reduced the actual time and increase the productivity time.

4.2 MACHINE SHOP

SLNO	SECTION	ACTUAL TIME IN (SEC)	CHANGE TIME IN (SEC)
1	Lathe1	5 sec	3 sec
2	Lathe2	5 sec	3 sec
3	Lathe3	5 sec	3 sec
4	Drill1	5 sec	3 sec
5	Drill2	5 sec	3 sec
6	Tapping & Burnishing	5 sec	3 sec

Interpretation

From the above table the lathe , drill and tapping & burnishing section the actual time is 5 sec and it reduced to 3 sec in the change time. Through this the efficiency of the machine shop was increased so no of pumps can increased.

4.3 COST BENEFIT ANALYSIS :

Existing layout:

Direct labour for producing 96 pumps in a shift = 7200

cost of labour per pumps = $7200 / 96 = 75$

Proposed layout:

Direct labour for producing 100 pumps in a shift = 7200

cost of labour per pumps = $7200 / 100 = 72$

Cost of production per pump decrease by Rs = 3

No of shift per month = 30

No of shift per year = $30 * 12$

= 360

Total no of pumps produce = $360 * 100$

= 36,000

In existing layout the labour cost of 36,000 pumps = $75 * 36000$

= 27,00,000

In proposed layout the labour cost of 36,000 pumps = $72 * 36000$

= 25,92,000

The difference of existing and proposed layout = $27,00,000 - 25,92,000$

= 1,08,000

Yearly the company can reduce a cost of Rs. 1,08,000 , if the proposed layout can used in the unit.

4.4 COMPARISON COST FOR PRODUCTION OF 100 PUMPS IN EXISTING & PROPOSED LAYOUT.

Particulars	Existing	Proposed
Material cost	2,80,000	2,80,000
Labour cost	7,500	7,200
Productivity cost	1,400	1,400
Administrative cost	8,500	8,500
Marketing & selling overheads	23,000	23,000
Cost of sales	3,20,400	3,20,100
Profit	64,600	64,900
Sales	3,85,000	3,85,000

Increase in profit % for every 100 pumps

Production profit - Actual profit

= * 100

Production profit

64,900 - 64,600

Increase in profit = * 100

64,900

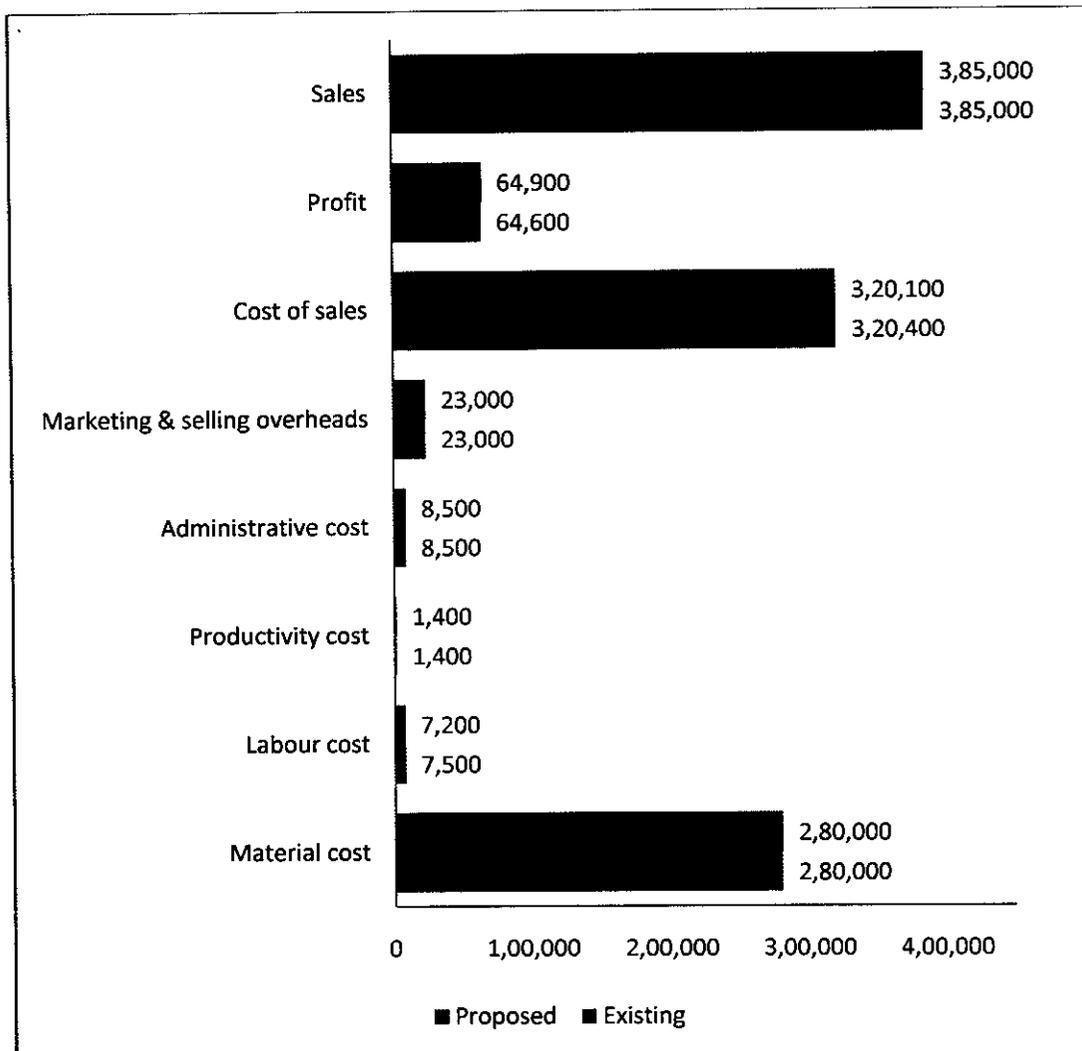
= 0.0004 * 100

= 0.48

= 0.5

For every 100 pumps the profit will increase 0.005 % times.

BAR DIAGRAM



CHAPTER-5

FINDINGS, SUGGESTION & CONCLUSION

5.1 FINDINGS:

From the above table shows the assembly section of actual time (in sec) are 22 for one process and in machine shop the actual time was 30 (sec) for one process with a systemized approach towards manufacturing and lead time reduced. this will increase the productivity.the labour cost of producing 96 pumps in a shift Rs 7200 and cost labour per pump is 75, In the existing layout. The labour cost in proposed layout for 100 pumps is also 7200 and labour cost for one pump is 72.

5.2 SUGGESTION:

- From this the change time is reduced to 12 sec for one process and in machine shop the total time reduced to 18 sec for one process.
- The suggestion through this project was the efficiency of the layout is increased and also the productivity.
- The reduction cost and time was reduced to minimized the handling and transportation of material.
- An optimum layout would permit an uninterrupted flow of work through the factory.
- It ensures best possible utilization of machines, workers & space.
- In the proposed layout the cost per pump reduce to 3 Rs.
- Yearly company can reduce a cost of Rs.1,08,000, if proposed layout used.

5.3 CONCLUSION:

Through this the process was increased in assembly and machine shop , therefore 100 pumps will be produced instead of 96. so the productivity was increased in the efficient of

proposed layout. The utilization of capital equipment and inventory storage levels, and the productivity of workers was minimized.

In this proposed layout the profit will increased for every 100 pumps in 0.5% and the labour cost was reduced in the new proposed layout , so the company can efficiently used the proposed layout. Total no of pumps produced in a year was 36000. If proposed layout used in the company.

BIBLIOGRAPHY

1. <http://www.deccanpumps.com>
2. <http://www.search.ebsco.com>
3. <http://www.wikipedia.com>
4. Mr. B. Raghavendra reddy (2007) Facility planning & layout design , 1st edition
5. Tompkins .J and J. white (1984) Facilities planning .Newyork