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Editor in Chief
Dr. Vinay Kumar Sharma
D. Litt. - Gold Medalist

sanchar
Educational & Research Foundation

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AN INTERNATIONAL BILINGUAL PEER REVIEWED REFEREED RESEARCH JOURNAL

APPLICATION OF OPERATIONS RESEARCH TOOLS AND TECHNIQUES IN PROJECT MANAGEMENT

Mr. Onkar Arun Wagh*
Prof. Sarang Annasaheb Dani**

ABSTRACT

The world is witnessing the fourth industrial revolution and all the business activities are changing the way in which business was executed in traditional way. The fourth industrial revolution is concurrent in nature and which will convert entire enterprise into the seamless digital enterprise. The automation and data exchange is an enabler for the quick decision making.

In today's context the world is a global village and organizations have access to the last mile both from demand and supply side hence agile business functions becomes utmost priority for any organizations. Project management department plays a vital role in ensuring customer satisfaction by ensuring timely delivery at the optimum cost with agreed quality standard. Hence effective project management implementation is seen as a tool for sustainable competitive advantage.

The research paper highlight the importance of application of operation research tools and techniques such as effective planning with project management triangle, PERT, RACI matrix, Gantt chart and Project charter. In order to reduce the delivery time as well as cost. It is a post facto study to determine reason of delay in the delivery of the project by critically analyzing the delay in the planning and execution also author attempts to determine the cost associated with factors causing the delay in delivery of the project.

Keywords: *Automation, Project management, Gantt chart, PERT, Project Charter*

1.0 INTRODUCTION

Automation in manufacturing means manufacturing industries with the use of control systems and information technologies to reduce the need for human work in the production of goods". Automated production systems can be classified into three basic types:

I. Fixed automation,
II. Programmable automation,
III. Flexible automation

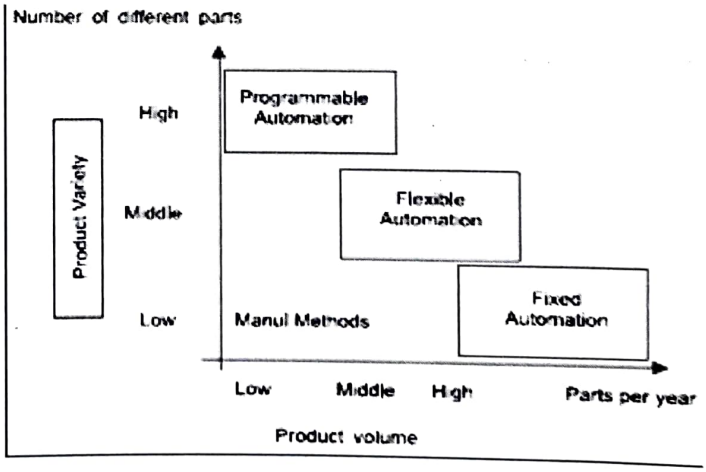

Fig 1.1 Type of automation

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Tested operations research tools for project management:-

1. RACI
2. PERT
3. Project management triangle
4. Gantt Chart
5. Project Charter

2.0 LITERATURE REVIEW

Project is defined as a piece of planned activity that is completed in a set period of time and anticipated to achieve the purpose

Project charter is a brief document that describes the entire project and it used from planning to execution of the project and all the milestones are mapped in the same.

Gantt chart is visual tool used to represent the activities which are scheduled in the given time frame.

RACI matrix is widely used tool in project management for responsibility allocation. The chart is useful in allocating various roles responsible to carry out each task, and which person are accountable for the action items also it maps out which personnel is consulted and informed while executing the task.

PERT is initially used by US navy in early 1950 to visualize the deadlines or timelines and work to be completed. The same is used in the project management planning to determine the time to complete the project

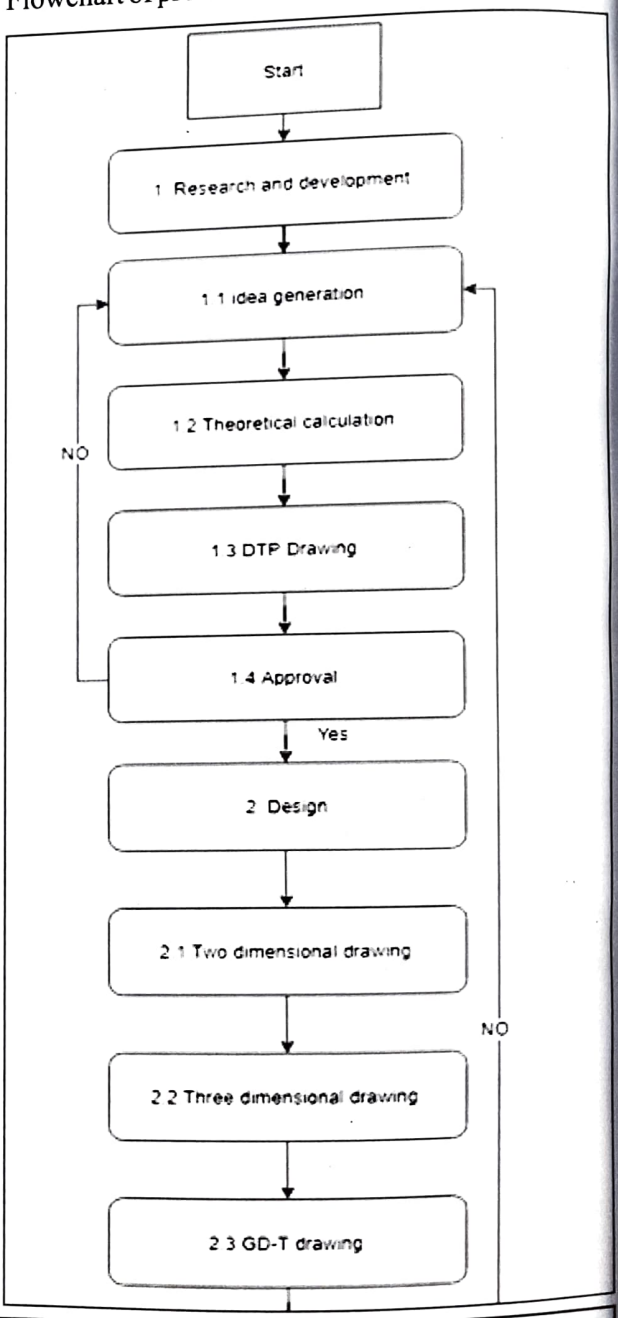
3.0 RESEARCH METHODOLOGY:-

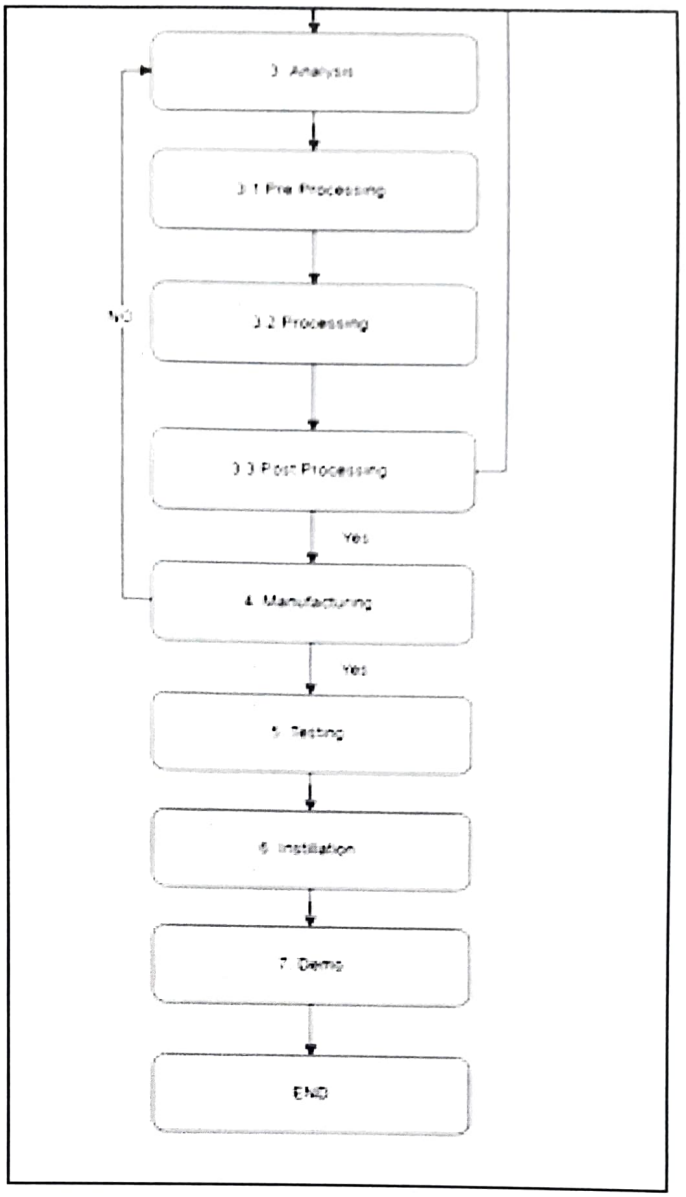
Primary data is data that is collected by a researcher from first-hand sources, using methods like surveys, interviews, or experiments. It is collected with the research project are the in mind, directly from primary sources. For collection of Primary data there are some technique to find out it. Basically primary data is new and fresh data. For finding it there are some techniques which has given below:-

- Questionnaire
- Interview
- Schedule
- Observation
- Experiments

For This project **personal interview** method is used. One pre described format is given to the respected Manger while doing the interview. A structured interview follows a specific questionnaire. And this research instrument is usually used for most quantitative surveys. A standardized structured questionnaire where specific questions are asked in a set order and in a set manner.

Flowchart of process flow mapping:-





4.0 Data Analysis and interpretation:-

1. Components of Project Triangle:-Time

	Start date of the project	End date of the project	Time span
Actual	April 2018	April 2019	12 month
expected	April 2018	Feb 2019	10 month

Table No 4.1: - Delivery Schedule Chart

Costing for manpower-

Department	Members
R&D	4
Design	8
Analysis	3
Manufacturing	11
Testing	2
Installation	5
Total	33

Table No 4.2: - Total Number of team

2. PERT:-

It is a project management tool used to schedule, organize, and coordinate tasks within a project. To conduct PERT Analysis, three time estimates are obtained that are optimistic, pessimistic, and most likely for every activity along the critical path. Using those estimates in the formula below to calculate Te:

Formula: Te = (P+4M+O)/6

Optimistic Time (O): the minimum possible time required to complete the task, assuming that everything proceeds better than is normally expected.

Pessimistic Time (P): the maximum possible time required to complete the task, assuming that everything goes wrong (excluding major catastrophes).

Most likely Time (M): the best estimate of the time required to complete the task, assuming that everything proceeds as normal.

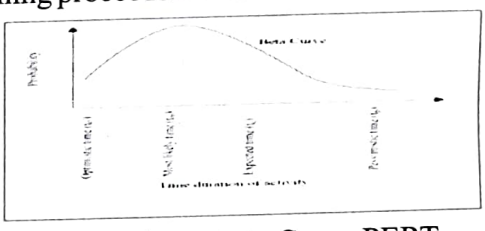


Fig no 3.1: - Beta Curve PERT

Research and development:

R&D	Description	To	Tm	Tp	Te	ó
	Idea generation	6	9	12	9	1
	Theoretical Calculation	5	8	15	8.67	2.78
	DTP	6	7	10	7.33	0.44
	Client approval	5	6	8	6.16	0.25
	Total days	22	30	45	31.167	14.69

Table no 4.3:- PERT of R&D

Design:

Design	Description	To	Tm	Tp	Te	ó
	2-D drawing	30	45	50	43.33	11.11
	3-D drawing	50	45	50	46.67	0
	GD-T	20	30	35	29.16	6.25
	Total days	100	120	135	119.16	34.02

Table no 4.4:- PERT of Design

Analysis: -

Analysis	Description	To	Tm	Tp	Te	σ
	pre processing	11	12	15	12.33	0.44
	processing	6	8	10	8	0.44
	post processing	5	10	12	9.5	1.36
	Total days	22	30	37	29.83	6.25

Table no 4.5:- PERT of Analysis

Manufacturing: -

Manufacturing	Description	To	Tm	Tp	Te	σ
	Drawing	1	1	2	1.16	0.02
	Process	17	20	30	21.16	4.69
	quality check	17	21	25	21	1.78
	Assembly	15	18	33	20	9
	Total days	50	60	90	63.33	44.44

Table no 4.6:- PERT of Manufacturing

Testing: -

Testing	Description	To	Tm	Tp	Te	σ
	electrical connection	8	12	14	11.66	1
	Output required	5	6	7	6	0.11
	required process	7	12	14	11.5	1.36
	Total days	20	30	35	29.16	6.25

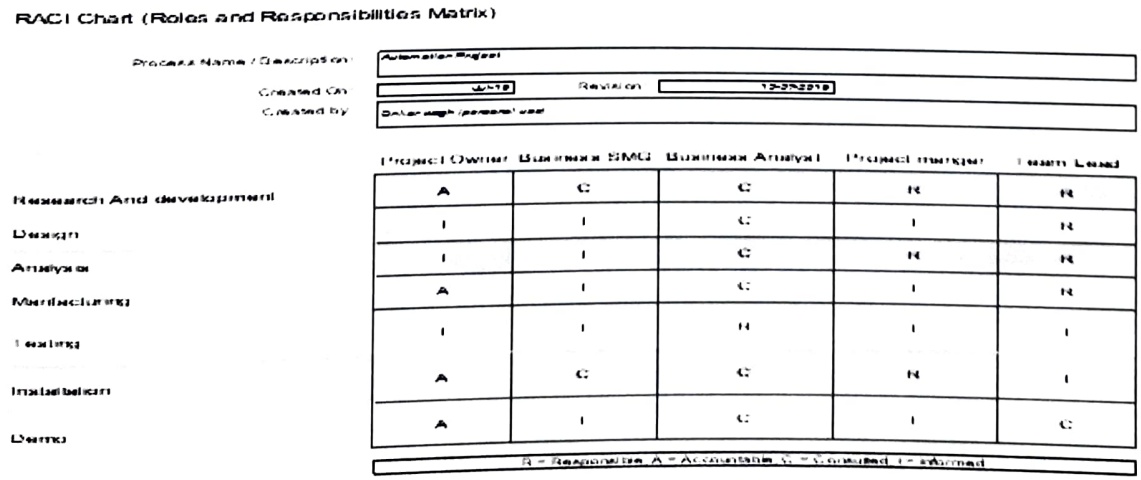
Table no 4.7:- PERT of Testing

Total: -

Total	Description	To	Tm	Tp	Te	σ
	Total days	241	300	374	306	491.36

Table no 4.8:- PERT of total

RACI Matrix:-



RACI Chart (Roles and Responsibilities Matrix)

Process Name / Description: Automation Project

Created On: [illegible] Revision: [illegible]

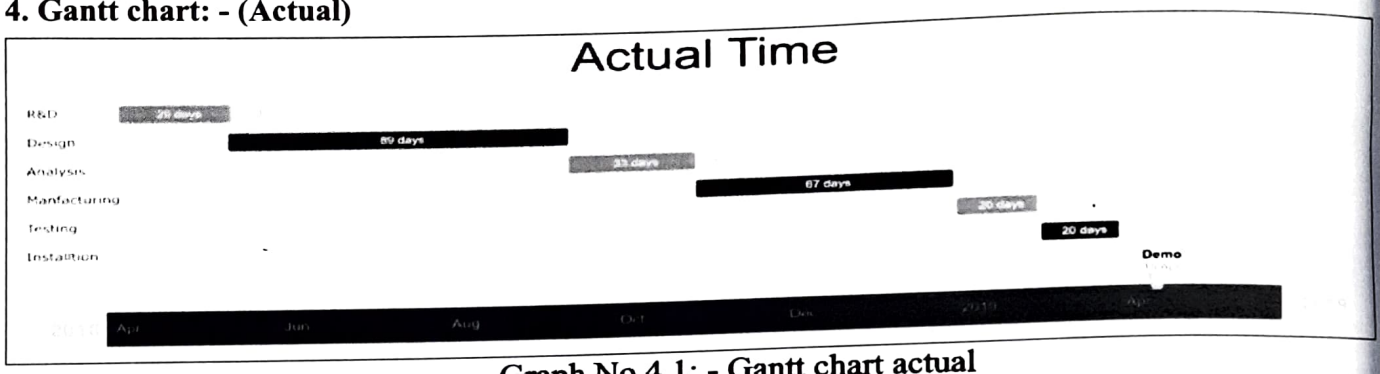
Created by: [illegible]

	Project Owner	Business SMG	Business Analyst	Project manager	Team Lead
Research And development	A	C	C	R	R
Design	I	I	C	I	R
Analysis	I	I	C	R	R
Manfacturing	A	I	C	I	R
Testing	I	I	R	I	I
Installation	A	C	C	R	I
Demo	A	I	C	I	C

R = Responsible, A = Accountable, C = Consulted, I = Informed

Table No 4.9:- RACI Matrix

4. Gantt chart: - (Actual)

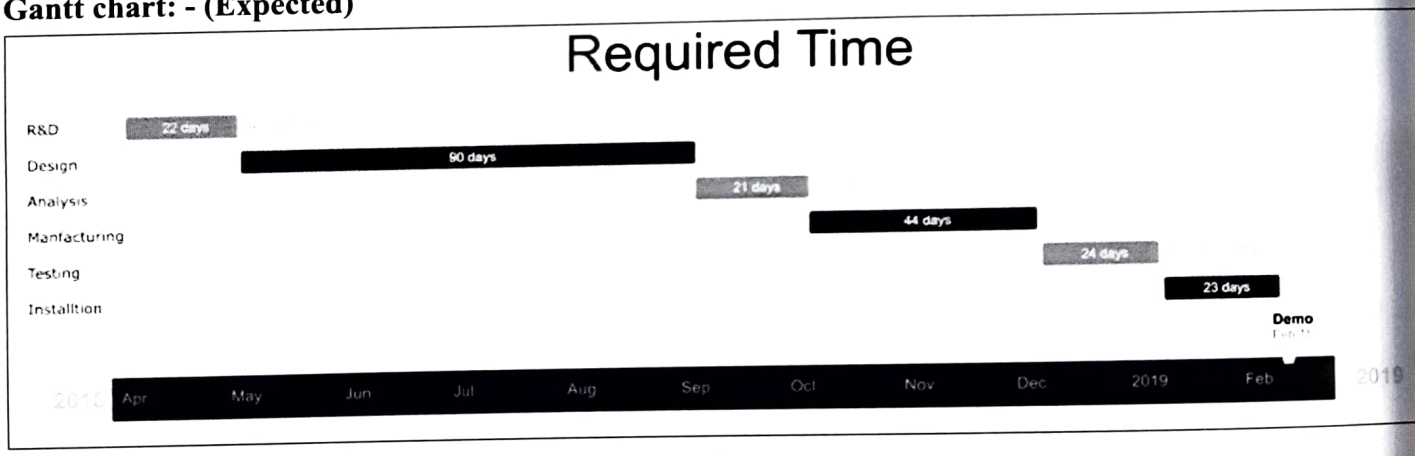


Graph No 4.1: - Gantt chart actual

Title	Start date	End date	Duration (in days)	% Complete
R&D	05-04-2018	15-05-2018	29	15
Design	15-05-2018	15-09-2018	89	25
Analysis	16-09-2018	31-10-2018	33	40
Manufacturing	01-11-2018	01-02-2019	67	74
Testing	03-02-2019	03-03-2019	20	85
Installation	05-03-2019	01-04-2019	20	95
Demo		15-04-2019	-	100

Table No 4.10- Gantt chart actual

Gantt chart: - (Expected)



Graph No 4.2: - Gantt chart expected

Title	Start date	End date	Duration (in days)	% Complete
R&D	05-04-2018	05-05-2018	22	15
Design	07-05-2018	07-09-2018	90	25
Analysis	08-09-2018	08-10-2018	21	40
Manufacturing	09-10-2018	09-12-2019	44	74
Testing	11-12-2019	11-01-2019	24	85
Installation	13-01-2019	13-02-2019	23	95
Demo		15-02-2019	-	100

Table No 4.11:-Gantt chart expected

Department	Purpose	Team size	Percentage
R&D	The R&D process consists of innovation that is typically defined as the ideas, the products, the services, or processes that are taken as new and different.	4	15%
Design	A design is a plan or specification for the construction of an 3-D object and result of that plan or specification in the form of a prototype, product or process.	8	25%
Analysis	Ansys structural analysis software enables you to solve complex structural engineering problems.	3	40%
Manufacturing	Manufacturing is the process which forms the products for use or sale using labour and machines, tools.	11	74%
Testing	Automation line testing consist of electrical connection process and output checking process	2	85%
Installation	Basically installation is the final step for our organization. In this step mainly there are 3 major activities are there, in that activity most important activity is fixing all the part in assembly.	5	95%

. Finding

I. It is found that Delay in project is because of three departments out of seven departments mainly name as research and development, analysis and manufacturing.

II. It is found that R&D department consist of a delay of a half month (15 days) i.e. More than expected.

III. Another finding is delay is related to analysis department which was another 15 days and it will extend the ongoing project.

IV. It is found that Last delay was in the main and important department which was manufacturing department and the delay which was comes out from above calculation and theory is 1 month extra i.e. 30 days more.

V. So calculate all above days which were delayed it was comes out to be 60 days. I.e. the total delayed time which was found out from different techniques. (15 + 15 + 30 = 60 days)

6. Conclusion:-

1. The very first thing concluded from this project is that after facing the delay of two month, this automation project is successfully started in the respective organization. This company uses too many techniques that are used for making the decision. One of the important and commonly used techniques is 4D.This 4D stands for

- ✓ Delete
- ✓ Delegate
- ✓ Defer it
- ✓ Do it

2. This company also goes for 80-20 rule to find out different solution while facing the major problem in the on-going project. Basically it states that, for many events, roughly 80% of the effects come from 20% of the causes. As per management project is concerned main conclusion comes out from the project is delay reasons. Basic outcome of my project is to find out where the delay actually was and after defining the delay, we goes for different techniques to find out the delay. To finding out delay we use
   - ✓ PERT
   - ✓ Project Charter
   - ✓ Project Management Triangle
3. Also we conclude that there must be proper vendor management team to handle out the respective manufacturing process. Also I concluded that skilled worker or technical people should able to attain the respective demo of the automation project so that they can improve themselves in upcoming project. Department wise my conclusion is there is very excellent communication between each and every department and this communication will be good for organization growth. All the safety parameters are considered while manufacturing the automation project. Because all this parameters will bring the best out of you. Supply chain of different products of the organization is very strong because ready made parts or directly manufactured parts are available within a single day.

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