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Study and Analysis Construction Project Parameters to Achieve Project Life Cycle

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***Abstract*- Risk management is important for every construction project. It is use to improve performance of project and increase the profit. Now a day, project become very complex and they have particular budget. So, companies and manager have responsibility to complete the work with time and schedule. Project work presents an application of risk management in the early stage of a project life cycle of a construction.**

Project life cycle is a function of several parameters mainly the site selection, Design phase, Selection of Contractors, Project mobilization phase, Project operation phase and Project completion phase. The first three phases can be considered at the planning phases where the optimization and analysis is of great importance. The last three phases are the execution phases where in the real time field work and monitoring plays avital role. But very little scope for optimization is possible as it is much involved with man management.

In that we study, analyse the planning phase i.e the Pre-project phase that involves the site selection, design phase and supplier selection phase, project mobilization phase. Questionnaire was prepared and circulated among thirty respondents and based on frequency three criterion were selected for study. These criterions were then optimized by using Minitab software. Software included an arrangement by Taguchi method and One-way ANOVA method was used to find the optimal values for the criterion. The recommendations of these critical components were then done for optimal project life cycle.

***Keywords:* Project Life Cycle, Risk Management, Site Selection, Design Phase, Taguchi method, ANOVA**

I. INTRODUCTION

1.1 Risk Management

Risk management is most critical parts of commissioning. This indicates strong relationship between managing risk and project success. Also risk management described as the most difficult area in construction management and its application promoted in projects to avoid negative consequences.

One concept wildly used in risk management is called risk management process. It's consist of four main steps: identification, assessment, taking actions and monitoring the risks. More construction companies are starting to become aware of the risk management process but are still not using models and techniques aimed for managing risks. Risks differ because of every project is unique. But still many practitioners not realized the importance of risk management for the process of delivering the project. The aim of each organization is to be successful and risk management can facilitate it.

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1.2 Project Life Cycle

Initiation, planning, implementation, and closure these are the major phases of standard project. These phases represent the path a project. It takes from the beginning to its end. They are generally referred to as the project "life cycle."

The tool of risk management project life cycle is used as a management tool to improve a projects performance. There are several terms are often used within one particular sector even though a number of phases can vary. So, it is difficult to systemize also provide one common scope.

1.3 Problem Statement

It is clear from the literature that effective project management is a key to the enhanced project life cycle. Project life cycle is to be maximized to deliver maximum value to the customer. Through effective risk management, project completion time schedule can be maintained, waste can be reduced, and by application of innovation in the process methods the project life cycle can be enhanced.

1.4 Objectives of Project

1.Identification of various risks involved at various stages of project execution.

2. statistical analysis of the same to find the co-relation and interaction between various factors and identify the significant factors.
3.Proposal of innovation in construction methods, materials to the significant factors and test the feasibility of the same
4.Application of statistical tools like factorial design and ANOVA to the predict the effect of the various factors on project life cycle by use of Minitab 17 software

1.5 Scope of project

In the project work a detail study of a processes will be done to identify the current practices followed their problems and pitfalls and the statistical tools will be used to co-relate the cause and effect and interaction between various elements to find out the significant elements in process. Then these elements will be replaced via innovation by different novel methods.

II. LITERATURE REVIEW

1. **Dr.Neeraj D. Sharma, Hiren A. Rathod** they deals with risk identification analysis in construction project. Firstly, he collected data using questionnaire. They worked on the architects, contractors. Structural engineer and developer. For the data analysis, he used RII technique and IMPI techniques used. Poor design check by consultant, mistake in design, change in design because of poor understanding, not finding bank finance, delay in contract issue, poor design because of inappropriate design parameters, these six events found by him by using both technique. **Pejman Rezakhani** he deals with investigation of different risks which is involved in construction projects. Firstly, project management function categorized and then analyse key risk factor in every category. Finally, a hierarchical risk classification used for covering effective risk factors in construction projects. Case studies shown that by utilizing proposed hierarchical risk breakdown, most of the risks in regular and complex projects are covered and as a result an effective risk management plan conducted. **R. Takim, A. Akintoye and J. Kelly** they deal with project stakeholders, factors used to manage their needs and expectations. Also study of impact of mismanaging of needs and expectations of project because of stakeholder in the area of Malaysia. They took survey related to four construction stakeholders include to Government, private clients, consultants and contractors. Using questionnaire and their respond they decided their level of importance. The Krushal-Walls test of One-way ANOVA used to examine different opinion about four groups and found out formalised process more effective in identifying project stakeholders. **Yu-Ren Wang, G. Edward Gibson, Jr** they deal with this research summarizes preprojective planning data collected from 62 industrial projects and 78 building projects, representing approximately $5 billion in total construction cost. Based on the information obtained, preprojective planning was identified as having direct impact on the project success (cost and schedule performance). Two techniques were then used to develop models for predicting cost and schedule growth: statistical analysis, and artificial neural networks (ANN). The research results provide a valuable source of information for the industry practitioners that proves better planning in the early stage of the project life cycle have positive impact on the final project outcome.

III. METHODOLOGY & INVESTIGATIONS

3.1 METHODOLOGY:

1. System design of Project life cycle as for the component of system selection, company profile selection, Process selection etc.
2. The Process parameters under study …Design specific questionnaire preparation for every phase selection (Site selection, design selection, supplier selection, project mobilization)
3. Mathematical modelling (Design of experiment using Taguchi method)
4. Analysis of variance using Minitab software to find the influential factors.
5. Selection of optimal values of the parameter for maximum project life cycle
6. Results and discussion.

3.2 DATA COLLECTION:

Firstly, start to collect relevant data to project. Start with preparing questionnaire for various aspect. This questionnaire divided into four categories. These are: site collection, design, supplier and implementation.

3.2 (a) Site Selection Questionnaire

Site search and selection is a major element of the process. Before initiating a site search, it is important to first develop the project concept. It's including defining the site and configuration requirements for the proposed project.

The site selection process is become successful when we following some criteria. It's including size, location, proximity to services.

❖ **Questionnaire for Site Selection**

a) Site Requirements

Site requirements at full Capacity
Total Land Requirement
Construction Surface
Soil Load Bearing
Building Foundation and Depth Requirement
Preferred water table depth
Rail Access
Highway Access
Hospital Access
Schools Access
Mall / Cinema / Recreation Facility Access

b) Site Utility Requirements

Site utility requirements at full Capacity
Electric
Demand (Mega Watt)
Usage Megawatt hour / year
Natural Gas
Peak demand (Nm3/H)
Usage of Natural gas Nm3/year
Water
Industrial Water Average usage (m3/hr)
Industrial water Estimate Consumption (m3/day)
Drinking water (m3/day)
Waste
Industrial waste water(m3/day)

c) Business Environment

Top Industrial clusters
Recreation Gardens - Walking Plaza etc.
Worship Canters (Temple / Mosque/ Church)
Major Educational Institutions/ Universities

3.2 (b) Questionnaire for Design Phase:

Sr. No	Index Question
1)	Geo tech Survey
2)	Complex size
3)	Water Management
4)	Performance & Efficiency
5)	Budget
6)	Amenities
7)	Materials & Quality
8)	Legal & Administration
9)	Additional services

3.3 (c) Questionnaire for Supplier selection:

Sr. No	Index Question	Abbreviation
10)	Quick time delivery	QTD
11)	Quality performance	QP
12)	Quick response to emergency	QRE
13)	Quantity Precision	QPE
14)	Service Performance	SP
15)	Cost of Product	CP
16)	Communication system	CS
17)	Flexibility to respond unexpected demand	FRUD
18)	Willingness to change product	WCP
19)	Use of advanced technology	UAT
20)	Presence of Certification	PC
21)	Willingness to share product information	WSPI
22)	Willingness to participate in firms new product.	WPNP

➢ **Questionnaire for Project Mobilization Phase**

Sr. No	Index Question	Abbreviation
1)	Type of Contract (work basis)	TOC
2)	Quantity based payment	QBP
3)	Pre-agreed unit price irrespective of quantity	PAUP
4)	Reimbursement -Actual cost	RAC
5)	Cost Status -Budget base Performance	CSBP
6)	Work safety- environment impact	WSEI
7)	Material management to attain project goals	MMPG
8)	Paper work and Documentation	PWD

9)	Work Progress payment	WPP

3.3 DATA ANALYSIS:

❖ Optimization of process parameters for site selection:

Table no. 1 Optimisation of process site selection parameters

Sr no	Proximity To Railway Station (m)	Proximity to Schools and education centres (km)	Proximity to Malls _Entertain ment hubs	Selection Criterion
	750	0.2	1.5	0.897938
	750	0.18	1.2	0.874235
	750	0.16	0.9	0.756669
	750	0.14	0.6	0.73107
	500	0.2	1.2	0.878975
	500	0.18	1.5	0.827777
	500	0.16	0.6	0.819244
	500	0.14	0.9	0.809763
	350	0.2	0.9	0.842947
	350	0.18	0.6	0.833466
	350	0.16	1.5	0.874235
	350	0.14	1.2	0.815452
	275	0.2	0.6	0.889405
	275	0.18	0.9	0.880872
	275	0.16	1.2	0.872339
	275	0.14	1.5	0.86665

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Welcome to Minitab, press F1 for help.
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Runs:     16
Columns of L16(4^5) Array
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Taguchi Analysis: selection Criterion versus RST_p, School_p, Mall_ent_p

```
Response Table for Signal to Noise Ratios
Smaller is better
Level  RST_p  School_p  Mall_ent_p
1      7.186  8.817  7.414
2      7.938  8.235  7.547
3      8.111  7.672  8.410
4      8.684  7.194  8.548
Delta  1.499  1.623  1.134
Rank       2      1

Response Table for Means
Level   RST_p   School_p   Mall_ent_p
1       0.4373  0.3657  0.4266
2       0.4015  0.3906  0.4203
3       0.3939  0.4141  0.3826
4       0.3750  0.4373  0.3783
Delta   0.0623  0.0716  0.0484

Rank         2        1        3
```

- **Main Effects Plot for Means**

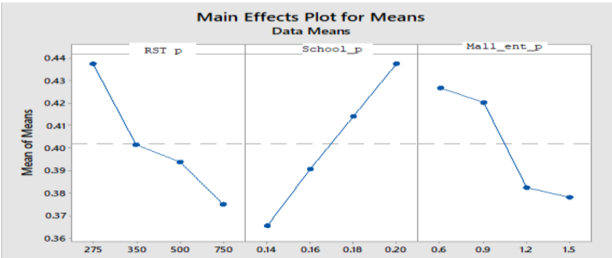

Fig. 1 Main effects plots for means

- **Main Effects Plot for SN ratios**

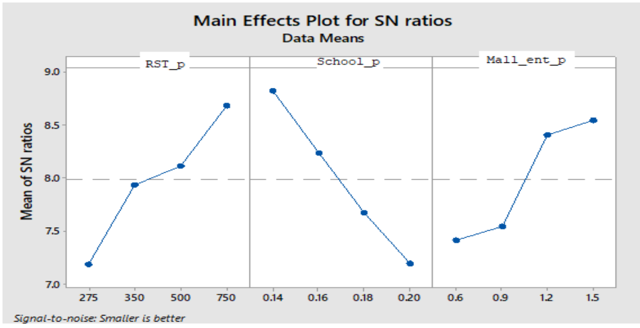

Fig 2 Main Effects Plot for SN Ratios

❖ **Optimization of process parameters for design:**

Table no.2 Optimisation of process design parameters

Sr no.	Budget	M&Q	L& A	Selection Criterion
1.	75.0	0.2	1.5	0.457938
2.	75.0	0.18	1.2	0.434235
3.	75.0	0.16	0.9	0.316669
4.	75.0	0.14	0.6	0.29107
5.	50.0	0.2	1.2	0.438975
6.	50.0	0.18	1.5	0.387777
7.	50.0	0.16	0.6	0.379244
8.	50.0	0.14	0.9	0.369763
9.	35.0	0.2	0.9	0.402947
10.	35.0	0.18	0.6	0.393466
11.	35.0	0.16	1.5	0.434235

12.	35.0	0.14	1.2	0.375452
13.	27.5	0.2	0.6	0.449405
14.	27.5	0.18	0.9	0.440872
15.	27.5	0.16	1.2	0.432339
16.	27.5	0.14	1.5	0.42665

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Columns of L16(4^5) Array
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Taguchi Analysis: Selection Criterion versus Budget, M & Q, L & A

Response Table for Signal to Noise Ratios
Larger is better

```
Level  Budget   M & Q   L & A
1      -7.186  -8.817  -8.548
2      -7.938  -8.235  -8.410
3      -8.111  -7.672  -7.547
4      -8.684  -7.194  -7.414
Delta   1.499   1.623   1.134
Rank        2       1       3
```

```
Response Table for Means
Level  Budget   M & Q   L & A
1      0.4373  0.3657  0.3783
2      0.4015  0.3906  0.3826
3      0.3939  0.4141  0.4203
4      0.3750  0.4373  0.4266
Delta  0.0623  0.0716  0.0484
Rank        2       1       3
```

- **Main Effects Plot for Means**

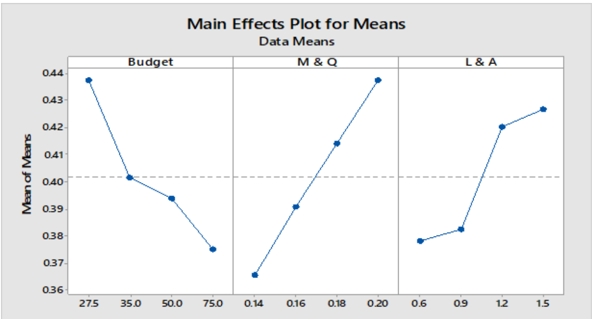

Fig. 3 Main effects plots for means

- **Main Effects Plot for SN ratios**

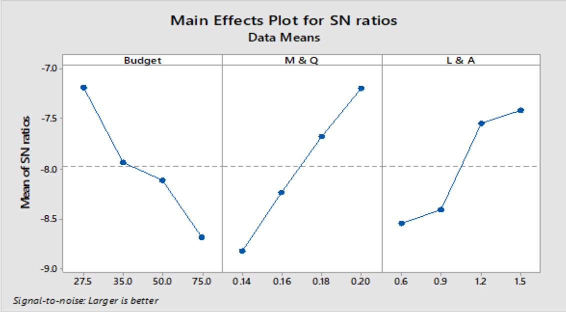

Fig 4 Main Effects Plot for SN Ratio

- **Optimization of Process Parameters for Supplier Selection**

Sr no.	QTD	SP	FRUD	Selection Criterion
1.	1.00	1.00	0.90	0.966667
2.	1.00	0.95	0.85	0.933333
3.	1.00	0.90	0.80	0.900000
4.	1.00	0.85	0.75	0.850000
5.	0.95	1.00	0.85	0.933333
6.	0.95	0.95	0.90	0.933333
7.	0.95	0.90	0.75	0.850000
8.	0.95	0.85	0.80	0.866667
9.	0.90	1.00	0.80	0.900000
10.	0.90	0.95	0.75	0.850000
11.	0.90	0.90	0.90	0.900000
12.	0.90	0.85	0.85	0.866667
13.	0.85	1.00	0.75	0.850000
14.	0.85	0.95	0.80	0.866667
15.	0.85	0.90	0.85	0.866667
16.	0.85	0.85	0.90	0.866667

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Taguchi Design
Taguchi Orthogonal Array Design
L16(4^3)
Factors:  3
Runs:     16
Columns of L16(4^5) Array
1 2 3
```

Taguchi Analysis: SELEECTION CRITERION versus QTD, SP, FRUD

Response Table for Signal to Noise Ratios
Larger is better

```
Level      QTD       SP     FRUD
1      -1.2851  -1.2851  -1.4116
2      -1.1212  -1.1212  -1.0791
```

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```
3        -0.9633  -0.9633  -0.9211
4        -0.8051  -0.8051  -0.7630
Delta     0.4800   0.4800   0.6487
Rank           3        2        1
Response Table for Means
Level      QTD       SP     FRUD
1        0.8625   0.8625   0.8500
2        0.8792   0.8792   0.8833
3        0.8958   0.8958   0.9000
4        0.9125   0.9125   0.9167
Delta    0.0500   0.0500   0.0667

Rank          3        2        1
```

- **Main Effects Plot for Means**

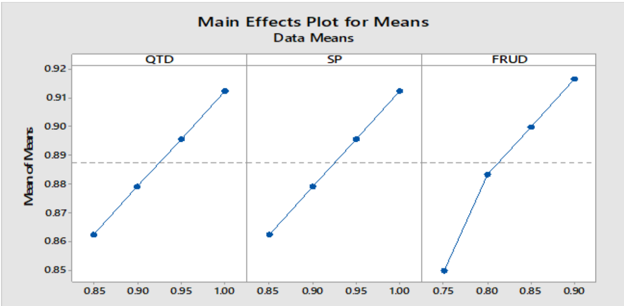

Fig.5 Main Effects Plot for Means for supplier selection

- **Main Effects Plot for SN ratios**

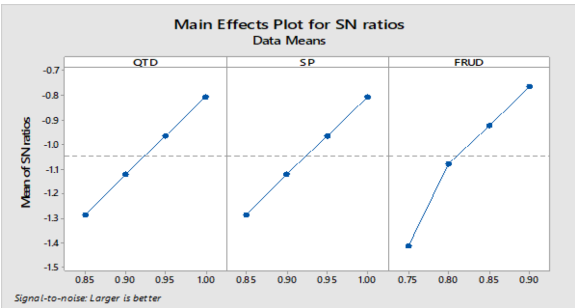

Fig.6 Main Effects Plot for SN ratios for supplier selection

- **Optimization of Process Parameters for Project Mobilization**

Sr no.	Cost Status Budget Base Performance CSBP	Material Management Project Goal MMPG	Work Progress payment WPP	Selection Criterion
1	90.00	0.88	1.00	0.960000
2	90.00	0.80	0.95	0.916667
3	90.00	0.75	0.90	0.883333
4	90.00	0.70	0.80	0.833333
5	85.00	0.88	0.95	0.910000
6	85.00	0.80	1.00	0.900000
7	85.00	0.75	0.80	0.816667
8	85.00	0.70	0.90	0.833333
9	80.00	0.88	0.90	0.866667
1	80.00	0.80	0.80	0.806667
1	80.00	0.75	1.00	0.856667
1	80.00	0.70	0.95	0.823333
1	75.00	0.88	0.80	0.820000
1	75.00	0.80	0.90	0.826667
1	75.00	0.75	0.95	0.826667
1	75.00	0.7	1	0.826667

```
Taguchi Design
Taguchi Orthogonal Array Design
L16(4^3)
Factors:  3
Runs:    16
Columns of L16(4^5) Array
1 2 3
Taguchi Analysis: SC versus CSBP, MMBP,
WPP

Response Table for Signal to Noise
Ratios
Larger is better
Level     CSBP     MMBP      WPP
1       -1.6710  -1.6273  -1.7331
2       -1.5353  -1.4584  -1.3894
3       -1.2693  -1.2976  -1.2292
4       -0.9429  -1.0351  -1.0667
Delta    0.7281   0.5922   0.6664
Rank          1        3        2
Response Table for Means
Level     CSBP     MMBP      WPP
1       0.8250   0.8292   0.8192
2       0.8383   0.8458   0.8525
3       0.8650   0.8625   0.8692
4       0.8983   0.8892   0.8858
Delta   0.0733   0.0600   0.0667
Rank         1        3        2
```

- **Main Effects Plot for Means**

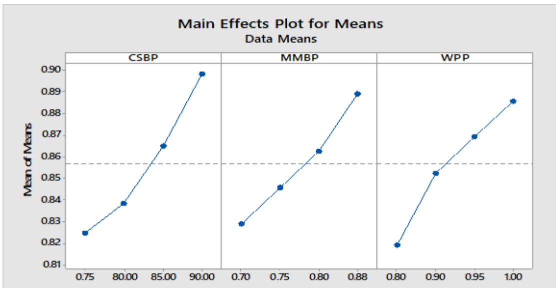

Fig.7 Main Effects Plot for Means for project mobilization

- **Main Effects Plot for SN ratios**

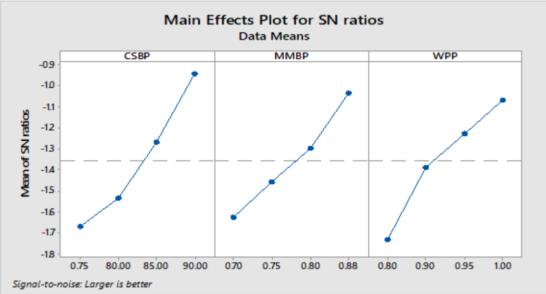

Fig.8 Main Effects Plot for SN ratios for project mobilization

IV. RESULTS AND DISCUSSION

1.The Data collection phase done for the Site selection, design parameters, supplier and project mobilization and then results tabulated and analysed.

2. Selection of optimum level of site selection parameters

The least variation and the optimal design are obtained by means of the S/N ratio. Higher the S/N ratio, more stable the achievable quality (Tosun et al., 2004). Figure 3.2 shows the S/N ratio plots for site selection criterion. It is clear from Figure 3.2 highest S/N ratio first level of RST_P (750m), second level of SCHOOL_P (0.14 km), third level of MALL_ENT_P (1.5km) Therefore, the optimal setting of process parameters which yield maximum frequency is A1B4C1

3. Selection of optimum level of design parameters

The least variation and the optimal design are obtained by means of the S/N ratio. higher the S/N ratio, more stable the achievable quality (Tosun et al., 2004). Figure 3.4 shows the S/N ratio plots for Design. It is clear from Figure 3.4, S/N ratio first level of Budget (27.5), second level of M & Q_P (0.20), third level of L & A_P (1.5) Therefore, the optimal setting of process parameters which yield maximum frequency is A4B1C1

4. Selection of Optimum Level of Parameters

The least variation and the optimal design are obtained by means of the S/N ratio. Higher the S/N ratio, more stable the achievable quality (Tosun et al., 2004). Figure shows the S/N ratio plots for criterion. It is clear from above Figure, highest S/N ratio first level of QTD (1), First level of SP (1), first level of WPP (0.9) Therefore, the optimal setting of process parameters which yield maximum efficiency in the supplier selection phase is A1B1C1

5. Selection of Optimum Level of Parameters

The least variation and the optimal design are obtained by means of the S/N ratio. Higher the S/N ratio, more stable the achievable quality (Tosun et al., 2004). Figure 7.4 shows the S/N ratio plots for criterion. It is clear from Figure 5.4, highest S/N ratio first level of CSBP (90), First level of MMBP (0.88), first level of WPP (1.0) Therefore, the optimal setting of process parameters which yield maximum efficiency in the project mobilization phase is A1B1C1

V. CONCLUSION

From the results and with the references conclude the following:

1.Four phases parameters were identified that influences project life cycle. Following are: Site selection, Design, Supplier, project mobilization.

2.Site selection, design, supplier and project mobilization criteria was selected and detailed questionnaire for data was prepared. This questionnaire will be used for data collection and analysis.

3.Using site selection analysis, if railway distance near to 750m, school distance near to 0.14km, mall distance near to 1.5km ideal condition of from project.

Using design selection analysis, if budget near to 27.5 lac, material and quality with 0.20 error, legal and administration 1.5% ideal condition of for project. So, can achieve project life cycle.

Using supplier collection analysis, if Quick time delivery 100% possible, service performance 100% good, flexibility to respond unexpected demand 90% possible these are ideal condition of for project. So, can achieve project life cycle.

Using project mobilization analysis, if Cost status budget base performance 90% possible, material management project goal achieves 88% possible, work progress payment 100% on time possible these are ideal condition of for project. So, can achieve project life cycle.

4. All these results shows most valuable parameters for every phase of project life cycle. found out most important process parameters which yield maximum frequency for success of project. Using results, will help to achieve project life cycle.

Acknowledgement

I would like to express gratitude and heartfelt thankfulness to my project guide Prof. H. H. Salunkhe for his valuable co-operation extended to throughout the duration of development of the project.

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