

# Study of Decision Support System for Residential Land Development Site Selection

<sup>1</sup>Patil Vrushali Sambhaji, <sup>2</sup>Deelip B Kalekar, <sup>3</sup>Madhura C. Aher

<sup>1,2</sup>Student, <sup>3</sup>Assistant Professor  
NDMVP COE, NASHIK, INDIA

**Abstract:** We know In recent years, several factors have had an increasing influence on the current practice of selection of residential land development, that are Increased ecological and environmental awareness, Social acceptance of land development activities, Complex permitting process, Multiple plan reviews by numerous regulatory agencies. An important phase within the overall residential land development process is preliminary project planning, which a highly coordinated effort is involving a number of decisions that are made by a variety of individuals. One critical decision faced by the project owner and the development team, during the preliminary planning phase, is the initial selection of the most appropriate site for a proposed conceptual development plan.

The scope of this paper deals with (1) formulating a model for the preliminary planning phase of residential site selection; and (2) developing an associated decision support system that can assist the decision makers during this phase of the project. The analytical hierarchy process was the decision making theory used in the site selection decision support system. Analytical hierarchy process uses a hierarchical structure comprising both quantitative and qualitative factors that are based on factual data and the knowledge and experience of the decision makers.

To understand this survey was conducted and decision support system technique was applied to study the interaction and relation of one factor over another. These factors are also prioritized to see the priority of one factor over another. The result of this study discovered that the depending upon respondent's feedback he can decide impact factors that affect selection residential building sites from project managers point view in Nashik city.

**Keywords:** Residential land development site selection, Safety impact factor selection; F-AHP (triangular scale); MCDM.

## I. INTRODUCTION

### Fuzzy Analytical Hierarchy Process (FAHP)

In this article, by using fuzzy AHP technique we propose a new method for safety impact factor selection problem. In this research paper, FAHP is used to make the decision of most suitable site selection factors in residential projects. The pair-wise comparisons are used to derive accurate ratio and scale priorities, Developed by Thomas Saaty, FAHP helps to capture both subjective and objective evaluation measures, providing a useful mechanism for checking the consistency of the evaluations thus reducing bias in decision making, [3,6]. In its simplest form, this structure comprises objectives, criteria and alternatives level. In this we given the preferences to each alternative of each main criterion and on the basis of given priority weights we decide the different site selection factors that affect land development process of residential construction

Each set of criteria would then be further divided into an appropriate level of alternative, recognizing that the more criteria included, the less important each individual criterion

The questionnaire interview was carried out among number of project manager and contractors small construction residential companies which are located in the Nashik region of Maharashtra (India). The majority of these firms are operating in Residential and G+4 projects. The interviews were carried out among top-level project managers who have an experience more than 8years and owners of the companies.

Top-level managers and owners were selected for the interviews because they were assumed to have sufficient knowledge about the land development site selection process, working site conditions and various criteria. The 12 interviews took place over a 3 month period between February to May 2018 and each lasted approximately half to one hours. The questionnaire was carried through face-to-face interviews and it consisted of questionnaire format including different FAHP tables. The interviews reflects the opinion of experts from 12 firms, Results for Whole impact Factor Mean Score, and Fuzzy Analytic Hierarchy Process (F-AHP)

### a) Application Fuzzy Analytic Hierarchy Process

The Fuzzy AHP methodology is applied in Decides impact factors that affect site selection on residential sites from project managers point view in Nashik city India. Therefore an example is considered for deciding the impact factors that affect land development process for residential sites among the number of alternative available in Nashik city residential building among four factors, selection attributes were identified and these are: MA- Market analysis, FA-Feasibility analysis, EF-Environmental Factor, RC-Regulatory condition

And best other alternatives in residential construction.

### Objectives of Study

- i. To find factors contributing to efficient supply chain in residential projects of Nashik region.
- ii. To understand the importance of supply chain management for client, contractor, consultant & sub- contractors perspective.
- iii. Decide supply chain management factors from client, contractor, and consultant & sub-contractors point of view, On the basis of conducted questionnaire survey in Nashik region important Index, spearman Rank and prepare Analytic hierarchy Process (A H P) model.

## I. METHODOLOGY

A questionnaire survey conducted in Nashik region with the following Project Business supply chain partners (particularly for MEGA PROJECTS):

### A. SUPPLY CHAIN PARTNERS IN MEGA PROJECT

The Supply chain partners are the players who formulate the supply chain directly or play some role in completion of the project indirectly. A Project Business supply chain has the following partners (particularly for residential projects):

- Supplier
- Client
- Consultants
- Contractor
- Government/Politicians/Public
- Financial Services

a). Please respond to the following on the basis of the below mentioned criteria:

Importance	Rating scale/range
Strongly satisfied	5
Satisfied	4
Equality (undecided)	3
Not agree	2
Strongly unsatisfied (disagree)	1

1). Please rate the selection procedure for vendors

Response	1	2	3	4	5	RII
Direct quotation	0	04	03	04	08	0.73
Direct selection	01	05	04	08	01	0.6
Tendering	0	0	05	09	06	0.81

This question was asked to know the preferred choice of appointing suppliers for a project. We wanted to know that whether the client/contractor likes to go for known suppliers (Direct quotation), or client/contractor choose a trusted supplier (Direct selection), or they like go get good quality at competitive price (Tendering).

The RII of all the options shows that the trend today is to get good quality at competitive price. Tendering is the preferred procedure for selecting a supplier.

2) Which procurement procedure does your organization follow.

Response	
Centralized	12
Decentralized	04
Both	04

This question was asked to know the preferred choice of procurement procedure for a project. We wanted to know that whether the organization likes to go for centralized, or decentralize procurement. Response shows that centralized procurement procedure follows by most of the organization.

4) Phase in which you think involvement of the Supply Chain Framework would significantly influence the project effectiveness.

Response	1	2	3	4	5	RII
Concept & Feasibility Stage	0	0	06	07	07	0.81
Funding Raising & Financial Closure	02	03	04	06	05	0.69
Tendering & bidding Stage	0	05	03	07	05	0.72
Project Planning and Procurement	0	0	04	07	09	0.85
Execution, Monitoring & Control	0	03	03	05	09	0.8
Contract Closure, Claims Settlement	04	03	0	05	08	0.7
Project Operations & Maintenance	02	03	03	03	09	0.74

This question was asked to know how much construction industry is ready for integration of supplier into the supply chain.

The RII results show that the construction industry is far away from producing results as the production industry. Construction industry still feels that the project planning and procurement and concept phase is the best phase for introducing suppliers into the project.

5) Please rate the Impact of technical expertise of the Supplier on your residential project work

Response	1	2	3	4	5	RII
Technical expertise of supplier has helped us immensely to finish the project as per given schedule and budget.	0	0	02	09	09	0.87
Supplier has dominated (over power) the proceedings on entire project	0	04	06	08	02	0.68
Supplier promptly delivered services during emergency	0	03	0	07	10	0.84

This question was asked to know the impact of technical expertise of suppliers on your project.

The RII results show that the Suppliers' technical expertise has helped us immensely to finish the project as per given schedule and budget.

6) Please rate the inspection procedure followed in Supply Chain Network of your residential project

Response	1	2	3	4	5	RII
Supplier ensured execution of work according to QA & QC, International Standards etc.	0	0	0	08	12	0.92
Supplier doesn't ensure the guarantees as per standards and it causes the delay.	02	09	05	04	0	0.51
Third party inspection is preferred frequently	0	0	06	06	08	0.82

This question was asked to know the inspection procedure followed by Supply Chain Network in the project.

The RII results show that the Suppliers itself ensured execution of work according QA & QC, international standards etc. in most of the projects and they have taken the guarantees of supply of materials as per the standards.

7) Please rate your negotiation procedures with your Supplier/Subcontractor with regard to which of the following elements

Description	1	2	3	4	5	RII
To Obtain the Quality Specify?	0	0	03	10	07	0.84
To Obtain the Fair and Reasonable Price?	0	0	03	10	07	0.84
To Get the Supplier to perform the contract on time?	0	0	02	09	09	0.87
To Persuade the Supplier to give maximum cooperation to your Company?	0	0	04	05	11	0.87
To develop a sound and continuing relationship with competent suppliers?	0	04	03	09	04	0.73
During Negotiation you inform Sub contractors the factors, which will be involved in the Source Selection?	0	0	04	16	0	0.76
Do you take the advantage of mistakes in the Supplier's Proposals?	04	05	04	03	04	0.58

This question was asked to know the negotiation procedure followed by the client in selection of Supplier/ Subcontractor in Supply Chain Network in the project. The RII results show that the Suppliers itself ensured that to persuade the supplier to give maximum cooperation to your Company.

8) Please mention your stand to encourage supplier /subcontractor for waste elimination.

Response	1	2	3	4	5	RII
Provides incentives for waste elimination	0	0	05	09	06	0.81
Penalty For Wastage	0	0	06	14	0	0.74
Encourage participation at design stage	0	0	02	06	06	0.6
Not practicing waste elimination	09	08	03	0	0	0.34

This question was asked to know the client to encourage supplier /subcontractor for **waste elimination**. The RII results show that the Suppliers provides incentives for waste elimination procedures. This shows that organization is very keen about the waste elimination and work in a positive way.

9) Please rate your Supplier's geographical reach based on following points

Response	1	2	3	4	5	RII
Responsiveness	0	0	03	11	06	0.83
Effectiveness (short term supply)	0	03	04	08	05	0.75
Resourceful (wide variety of supply)	0	0	0	07	13	0.93

This question was asked to know if suppliers are selected on the basis of their responsiveness, effectiveness or resourcefulness.

The RII results show that construction industry prefers suppliers who are able to provide the materials in short lead time. This trend is closely followed by the people who select the suppliers based on the wide variety of resource they can supply.

10) Please rate resourcefulness of your supplier on following

Response	1	2	3	4	5	RII
One –off project	0	0	04	13	03	0.79
Supplier mostly devoted their resources for your project(buddy supplier)	0	0	07	13	0	0.73
Consistent performance and quality	0	0	0	14	06	0.86
During emergency provide credit	0	0	03	06	11	0.88

This question was asked to know if suppliers are selected on the basis of the resources that they can provide and on the basis of the quality of the resources.

The RII result shows that the construction industry likes to go for the suppliers who provides credit during the emergency it is more important.

11) Please rate your experiences regarding transparency and openness of supplier

Response	1	2	3	4	5	RII
Suppliers are more cooperative while dealing with technical work	0	03	03	10	04	0.75
Suppliers are not primarily open in negotiating financial matters	0	09	05	06	0	0.57
Suppliers are not at all transparent and open in all matters.	0	07	07	0	06	0.65

This question was asked to know the client to transparency and openness of supplier. The RII results show that the Suppliers are more cooperative while dealing with technical work and give assistance during the work completion.

12) Please rate your Expectations from suppliers to ensure quality and timely work on residential projects.

Response	1	2	3	4	5	RII
Certification of supplier	0	0	03	10	07	0.84
Past record on quality practices	0	0	0	14	06	0.86
Specific contracts are framed to ensure quality work	0	0	05	12	03	0.78
Continuous monitoring and control	0	04	0	12	04	0.76

This question was asked to know how the supplier can satisfy quality and timely completion of work. The RII results show that the expectations from the suppliers to ensure quality and timely completion of work is more rely on the past records on quality practices.

13) Please rate impact of the client briefing on your decision regarding supplier and sub-contractor selection on residential projects?

Response	1	2	3	4	5	RII
Client intervened for preferred nominated subcontractor and supplier	00	10	03	05	02	0.59
Client played a major role in selection process	03	09	03	02	03	0.53
Client has given few guidelines for selection process	00	00	03	10	07	0.84
Client was neutral	05	00	08	07	00	0.57

This question was asked to know the how client will innervate during the the selection of subcontractor and supplier by main contractor. The RII results show that the client will give brief guidelines during the selection of suppliers and subcontractors.

14) Mention Attitude of client towards supplier selection in any residential project.

Response	1	2	3	4	5	RII
Highly interfering	00	08	04	03	05	0.65
Has more concerned for specialist work	00	03	07	04	06	0.73
Client has given free hand in supplier selection	00	04	00	11	05	0.77
Client insisted for his preferred suppliers	00	10	03	06	01	0.58

This question was asked to know if the client interfered in the process of supplier selection or not.

The RII results show that the client was more concerned for the specialist type of work that are carried out in the organization. This may be due to the awareness of client towards better quality that they want to provide to the end user but more response says that client has given free hand in supplier selection.

15) Please mention the necessary skill requirement of subcontractors to execute your work

Response	1	2	3	4	5	RII
Good performance on past projects	00	00	00	11	09	0.89
Technical competency matters	00	00	05	07	08	0.83
Fleets of equipment and machineries	03	00	00	10	07	0.78
Variety and quality of of raw materials they can procure	00	03	00	09	08	0.82
Connection with vendors and suppliers (vendor base)	00	00	04	09	07	0.83

This question was asked to know the necessary skill requirement of subcontractors to execute your work

The RII results show that the subcontractor should be well experience in similar kind of projects and he has executed the same kind of work earlier. Responses have given more weight age on the past performance of the projects.

16) Please mention the method which would ensure proper coordination on residential project work.

Response	1	2	3	4	5	RII
Requirements are put forward in advance	03	0	0	08	09	0.8
Weekly meetings	0	07	05	03	05	0.66
All parties were in contact throughout the project duration	0	0	0	12	08	0.88
Conflict resolution by consensus	0	03	04	09	04	0.74
Discrepancies are sorted out amicably	0	03	03	10	04	0.75

This question was asked to know the method in which the ensure the proper coordination of work. The RII results show that the all parties should be contact throughout during the residential project duration. Through maintain the contact; they can follow up the progress of the work.

17) Please rate the impact on material availability due to frequent design changes .

Response	1	2	3	4	5	RII
Suppliers are responsive enough to deliver materials upon design changes	0	03	03	11	03	0.74
Design changes cause delays due to material unavailability	0	07	05	04	04	0.65
Supplement materials from other site	04	0	07	06	04	0.69

This question was asked to know if the suppliers and subcontractors cooperation was sought for in case of frequent design change. The RII results show that the organization prefers that suppliers are responsive enough to deliver materials upon design change.

18) Please rate the reasons for adopting Supply Chain Management in residential Projects

Response	1	2	3	4	5	RII
Cost saving in labor, material, equipments and methods	0	0	02	14	04	0.82
Reduction in design and construction rework	0	04	03	13	0	0.69
Schedule variance and delay in projects	0	0	04	13	03	0.79

This question was asked to know the importance of supply chain management in residential projects and why organization has adopted supply chain management in residential projects.

The RII results shows that the adopting supply chain management will be beneficial for residential project in cost saving in labour, material and methods.

19) Please rate the Project challenges in the adoption of supply chain management policies in residential projects.

Response	1	2	3	4	5	RII
Lack of awareness regarding supply chain management policies	0	0	05	15	0	0.75
Less coordination	0	04	12	02	02	0.62
Conflict of interest	0	04	02	11	03	0.73

This question was asked to know the challenges while adopting the supply chain management in residential projects. The RII results shows that in residential projects the lack of awareness still exist regarding supply chain management policies.

## II. SURVEY COMPOSITION

The respondents were all industry practitioners including the mega project contractors, clients, subcontractors, engineers, assistant managers etc. To do effective analysis of the SCM in mega projects we have collected all the samples with different roles in the projects.

## III. CONCLUSION AND SUMMARY

We initiated this study with the objective to explore and understand the nature of supply chain management in Residential Projects. A questionnaire is designed to capture the opinions of respondents (Clients, Contractors, subcontractors, suppliers involved in Residential projects). These factors generated through survey are quite useful for practicing managers involved in Residential projects. These factors includes resource fullness (0.93), QA/QC practices of suppliers (0.92), technical expertise of suppliers (0.92), track record on earlier projects (0.89), cooperation throughout project (0.88), the stage involvement of player (0.85).

## References

- [1] Amar Ramudhin, Chaher Alzaman and Akif A. Bulgak “Incorporating the cost of quality in supply chain design” Journal of Quality in Maintenance Engineering Vol. 14 No. 1, 2008 pp. 71-86.
- [2] Andrew Cox, Glyn Watson, Chris Lonsdale and Joe Sanderson “Managing appropriately in power regimes: relationship and performance management in 12 supply chain cases” Supply Chain Management: An International Journal, Volume 9 • Number 5 • 2004 • pp. 357–371.
- [3] B.S. Sahay, Jatinder N.D. Gupta and Ramneesh Mohan “Managing supply chains for competitiveness: the Indian scenario” Supply Chain Management: An International Journal, 11/1 (2006) 15–24.
- [4] [13] Barbara B. Flynn, Baofeng Huo Xiande Zhao “The impact of supply chain integration on performance: A contingency and configuration approach” Journal of Operations Management 28 (2010) 58–71.
- [5] [14] Benita M. Beamon and Tonja M. Ware “A process quality model for the analysis, improvement and control of supply chain systems” International Journal of Physical Distribution & Logistics Management, Vol. 28 No. 9/10, 1998, pp. 704-715.