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Analysis of Shortcomings Found in Most Appropriate Housing Delivery Method for Ameliorating Customer Satisfaction

Bhavna Shrivastava, Yogesh Garg, Nakul Dhagat

Abstract: ***Identify most appropriate housing delivery method is one of the critical emerging issues in the developing due to poor standard of living in cities. The scale and speed of urbanization and high population growth rate in India will pose an unprecedented managerial and policy level challenge on housing quality in residential areas. On the other side many stock of house were found vacant or non-usable. Even uses of an appropriate housing delivery method, some gaps /shortcoming are identifying. If these gaps can fulfill these gaps and can enhance customer satisfaction. This study was developing by using actual construction case data in quantitative data analysis methods such as Estimate track Estimate and Analytical Hierarchical process. This research focuses on the housing areas as understand primarily by available local housing delivery methods. This aim of the research is to develop a index for evaluating housing delivery performance of housing areas to improve the customer satisfaction of existing as well as upcoming housing areas.***

Keywords: Customer satisfaction, Housing Delivery methods, Housing quality levels, Performance levels

I. INTRODUCTION

The secondary data is compiled to develop on understanding of customer aspirations, measures of quality levels with respect to housing delivery methods. Evaluates 26 housing colonies residential ambiance in Bhopal. Criteria for selecting respondents are define and accordingly 26 multifamily housing and 267 households were selected in closed settlement sectors and groups of dwellers were selected for discussion and interviewed. Experiences of respondents were compiled and analysed **.**

II. METHODOLOGY

The aim is to assess the performance levels of housing delivery methods was achieved in three steps:

STEP 1: Various selection criteria for delivery methods, housing quality levels and customer satisfaction were collected through a literature review. Estimate track estimate method analysis was performed for gated housing community.

Table 1 shows the finalized variables after ETE method

Attributes	Variables	Abbreviation	Sub Variables
Customer Satisfaction With Reference To Housing Construction.	Design	Cshc-1	Layout Plan Light And Ventilation Aesthetics /Views Interior Expectations
	Specification	Cshc-2	Construction Specifications Material/Fitting Specifications
	Workmanship	Cshc-3	Structural Workshop Mechanical And Elect Workmanship Of External Component Reducing Material Wastage
Customer Satisfaction With Reference To Service Quality	Trust	Cssq-1	Behavior of The Supply Side Other Supporting Services
	Service Quality	Cssq-2	Tangible Reliable Empathy And Assurance Responsiveness
Customer Satisfaction With Reference To Time	Timly Completion Of Every Stage Of Work	Csst-1	Progress Of Every Stage Or Timely Completion Of Various Stages Of Work
	Timly Possession	Csst-2	Timely Possession
Customer Satisfaction With Reference To Housing Quality Levels.	Housing Quality Levels-1 [Individual Housing Level]	Cshql-1	Housing Dimensions Light And Ventilation Kitchen Dimensions Relations Between Spaces Privacy Store Spaces Visual Comfort Hygiene And Salubrity
	Housing Quality Levels -2 [Closed Settlement Level]	Cshql-2	Housing Environment Housing Access Process Housing Facility Parking Comprehensive And Convent Facility Infrastructure(Adequate Access Roads, Electrical And Sewerage System Convenient Society Health (Social Facility Such As Shops, Recreational Areas.)
Customer Satisfaction With Reference To Management And Security.	Security Management	Csms-1 Csms-2	Security Repair And Maintenance

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* Correspondence Author

Dr. Bhavna Shrivastava, Department of Architecture and Planning, MNIT, Jaipur, India. E-mail: srivastav.bhawna@gmail.com

Dr. Yogesh K Garg, Architecture and Planning Dept, MANIT, Bhopal ,India. E-mail: yogeshgarg@gmail.com

Dr. Nakul Dhagat, Architecture and Planning Dept. MANIT, Bhopal ,India.

STEP 2: The performance (i.e.) of 26 multifamily-housing construction projects that were actually built according to the delivery method chosen was evaluated. The correlation between the selection criteria developed in Step 1 and the evaluation results was analysed. The result of this process was the development of selection criteria for delivery methods that is directly related to the performance of multifamily-housing construction projects.

Table 2 shows the identified housing delivery methods after discussing with practioner

S. no.	Housing Delivery Methods	Abbreviation
1	Chief Contractor Method	DM1
2	Labour Contractor	DM2
3	Job Order Basis Execution Method	DM3
4	Design Build Housing Delivery Method	DM4
5	Design Bid Build Method	DM5
6	Turn Key	DM6
7	Build than Sell (BTS)	DM7
8	Sell than Build (STB)	DM8
9	Multiple Prime Contracting (MPC)	DM9

STEP 3: An Analytical Hierarchy process was applied to develop quantitative results.

Development of a hierarchical structure obtains the pair wise comparison of the relative importance of the criteria in achieving the goal and calculates the weights. The AHP approach [Satty,1980] as applied to the housing delivery methods selection problem. Analytical hierarchy process is a well organized statically tools for understanding customer perception and satisfaction. Rather than prescribing a "correct" decision, the AHP helps decision makers find one that best suits their goal and their understanding of the problem. It provides a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions.

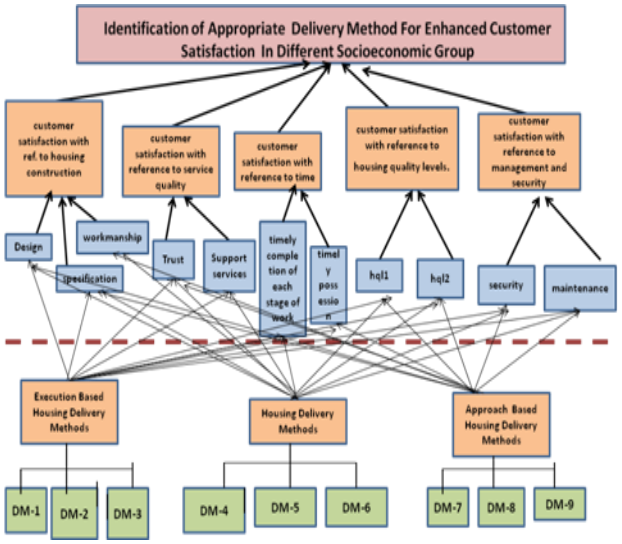

Figure 1 shows the hierarchy of application of AHP
Source: Author

A simplified application illustrates (shown in figure 1) the process. There are three levels are shown in hierarchical tree. Level -1, level-2 and level-3. Level 1 composed of the basic criterions .level 2 consist of five criteria's. That are being used to evaluate housing delivery method i.e. customer satisfaction with reference to housing construction i.e. architectural workmanship for design, specification and on-site workmanship. Customer satisfaction with reference to service quality i.e. trust and support services. Customer satisfaction with reference to time (i.e. timely completion of each stage of work and timely possession).customer satisfaction with reference to housing quality levels (i.e. housing quality levels-1 i.e individual housing sector and housing quality level-2 includes building sector as well as closed settlement sector).fifth criteria selected was customer satisfaction with reference to management and security considered. Level 2 and level 3 used for weights identification of housing delivery methods with respect to 11 customer satisfaction criterions.

The experts in construction must now develop a set of pair wise comparisons to define the relative importance of the criteria. If a expert believes that housing quality is equally to moderately more important than service quality value of 3 express this judgment. However, judgments not always perfectly consistent, for example, housing quality are judge moderately.The weights provide a measure of the relative importance of each criterion. This process is summarizing in the following three steps:

1. Sum the element of each column.
2. Divide each value by its column sum
3. Compute row averages.

Table 3 shows the pair wise comparison matrices for level 1 (from one expert)

Factor	Housing Construction Methods	Service Quality Measures	Time Management	Housing Quality Levels	Management
Housing Construction Methods	1	3.00	3.00	0.20	0.2
Service Quality Measures	0.33	1	0.2	0.14	0.11
Time Management	0.33	5	1	0.2	0.2
Housing Quality Levels	5.00	7	5	1	3
Management	5	9	5	0.33	1

Table 4 shows the Adjusted Matrix for level 1 (from one expert)

Factor	Housing Construction	Service Qualit	Time Management	Housing Quality	Management	Row average
Housing Construction	1/11.66	3.00/25	3.00/14.2	0.20/1.87	0.2/4.51	.110
Service Quality	0.33/11.66	1/25	0.2/14.2	0.14/1.87	0.11/4.51	.040
Time Managem	0.33/11.66	5/25	1/14.2	0.2/1.87	0.2/4.51	.090
Housing Quality	5.00/11.66	7/25	5/14.2	1/1.87	¾.51	.450
Managem	5/11.66	9/25	5/14.2	0.33/1.87	¼.51	.310
Total	11.66	25	14.2	1.87	4.51	1.00

The computations are shown in table above are one expert opinion. In this example the final weights for housing construction, service quality, scheduled time ,housing quality levels and management and security concerns having weights of .110,.040,.090,.450,.310 respectively. Therefore housing quality levels and management is judge to be [.45/.31=1.45] times as housing quality levels i.e. individual dwelling sector and closed settlement sector. About [.31/.110=2.18] as important as Housing Construction Methods. About [.31/.090=3.44] as important as time management by one of the expert.

Likewise, in the first level of criteria total 5 criteria, second level 11 customers preferences over 36 subcategories and third hierarchy nine identified housing delivery choices and methods based on execution, conventional delivery methods and approach were arranged. Following metrics were shows the housing delivery performance with respect to preferences of customers in level 2.

Table 5 shows the pair wise comparison matrices for first criteria of level 2 (from one expert)

Design	Execution based housing delivery method	Process based housing delivery method	Approach based housing delivery method.
Execution based housing delivery method	1	0.33	0.2
Process based housing delivery method	3	1	0.33
Approach based housing delivery method.	5	3	1

Table 6 shows the pair wise comparison matrices for second criteria of level 2 (from one expert)

Specifications	Execution based housing delivery	Process based housing delivery	Approach based housing delivery method.
Execution based housing delivery method	1	7	0.33
Process based housing delivery method	0.14	1	0.14
Approach based housing delivery method.	3	7	1

Table 7 shows the pair wise comparison matrices for third criteria of level 2 (from one expert)

Workmanship	Execution based housing delivery method	Process based housing delivery method	Approach based housing delivery method.
Execution based housing delivery	1	0.2	0.33
Process based housing delivery method	5	1	1
Approach based housing delivery method.	3	1	1

Table 8 shows the pair wise comparison matrices for first criteria of level 3 (from one expert)

DESIGN	Dm	Dm	Dm			Dm	Dm5	Dm6			Dm	Dm	Dn
Dm1	1	7	5		Dm	1	0.2	0.33		Dm7	1	5	3
Dm2	0.14	1	0.33		Dm	5	1	3		Dm8	0.	1	0.
Dm3	0.2	3	1		Dm	3	0.33	1		Dm9	0.	3	1
Weights	0.72	0.08	0.19		We	0.11	0.63	0.26		Weights	0.	0.	0.

Table 9 shows the pair wise comparison matrices for second criteria of level 3 (from one expert) With Respect to specification

SPECIFICATION	DM1	DM2	DM3			DM4	DM5	DM6			DM7	DM8	DM9
DM1	1	7	5		DM4	1	7	5		DM7	1	7	3
DM2	0.14	1	0.33		DM5	0.14	1	0.33		DM8	0.14	1	0.2
DM3	0.2	3	1		DM6	0.2	3	1		DM9	0.33	5	1
WEIGHTS	0.72	0.08	0.19		WEIG	0.72	0.08	0.19		WEIGHTS	0.64	0.07	0.28

The decision maker compares each pair of housing delivery methods with respect to the eleven-customer satisfaction criterias with respect to performance criteria's of housing delivery methods and housing quality levels. The weights of the housing delivery methods for each criterion are determined using the three-step procedure.

III. PERFORMANCE SCORE OF IDENTIFIED HOUSING DELIVERY METHODS

For a given housing delivery criteria these eleven weights are multiplied by the appropriate criteria weights in meeting the goal of the hierarchy and the results of the eleven multiplications are added together to compute the housing delivery method performance score. Each housing delivery performance score represents the estimated total benefits to be obtained from selecting the housing delivery methods. The Performance score of identified housing delivery methods with reference to customer satisfaction.Following figure shows the pair wise comparison matrices for results shows the weights.

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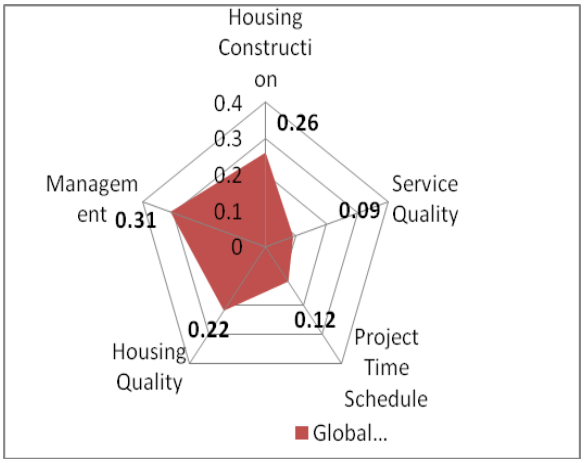

Figure 2 shows the weights at level 1 for Basic choices (comparision between basic choices)

IV. CUMULATIVE GLOBAL WEIGHTS FOR HOUSING DELIVERY METHODS

For quantification of performance level, identified housing delivery methods were classified into three groups based on execution, delivery and approached based housing delivery methods. Found results shows that 'Chief Contractor' execution based housing delivery method, 'Design Build' conventional housing delivery method and 'Build than Sell' approach based housing delivery methods have found high preferences by experts and analytical hierarchy process. Following figure shows the overall cumulative weights for housing delivery different methods.

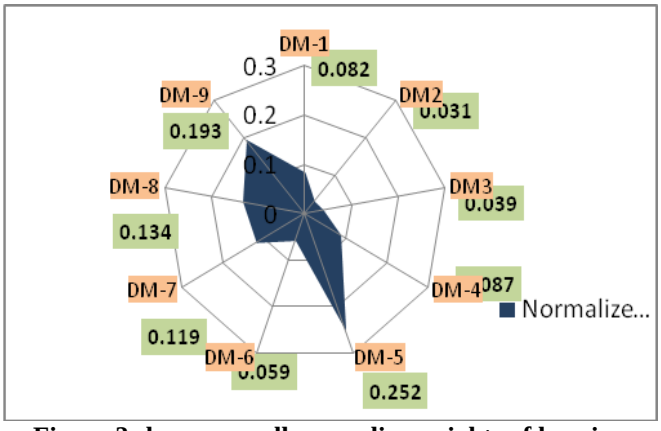

Figure 3 shows overall normalize weights of housing delivery methods

Weight allotment for different housing delivery methods as per hierarchy process: Weights found after analytical hierarchy process regarding first associate factor design the contribution of different housing delivery methods shown tables. Table based on global weights of housing delivery methods .and is using for identification weights of housing delivery methods for enhance customer satisfaction and table using as generation of housing delivery method index. After found all global weights, they were cumulated and then they normalize in 0-1 scale. This normalize weights were further used for generation of ideal range for different housing delivery methods.

Table 10 shows allotted weights for identified housing delivery methods

Classification	Housing Delivery Methods	Abbreviation	Weights
Execution based Housing Delivery Methods	Chief Contractor Method	DM1	0.082
	Labour Contractor Execution Method	DM2	0.031
	Job Order Basis Execution Method	DM3	0.039
Process based Housing Delivery Methods	Design Build Housing Delivery Method	DM4	0.087
	Design Bid Build Method	DM5	0.252
	Turn Key	DM6	0.059
Approach based Housing Delivery Methods	Build than Sell (BTS)	DM7	0.119
	Sell than Build (STB)	DM8	0.134
	Multiple Prime Contracting (MPC)	DM9	0.193

After discussion with 36 experts, by pair wise comparison and prioritize method found weights of customer satisfaction variables as per housing delivery performance level. All identified housing delivery methods were prioritizing for eleven customer satisfaction variables. For this purpose, local weights calculated through pair wise comparison .Weights given by experts after check their consistency, mean value taken for further analytical process. Global weights calculated for each housing delivery methods

These weights further used for identifying efficient housing delivery method for customer satisfaction. Table 10, shows the ranking of all available housing delivery methods. DM5 (Design Build) secured high ranking. Hence, this was the first conclusion of the research, that DM-5 is the most efficient housing delivery method as compared to others.

V. OBSERVATIONS

"Design Build" method. **Results shows more weight to "Build than Sell approach" (0.1934) while "Sell than Build" approach weight (0.134).** After Analytical Hierarchical Process the results were arranged in table 10, shows the weights for housing delivery methods for various criteria and alternatives. **Some of the observations were as follows**:

Design Build housing delivery method(Dm5) has got high preferences after analysis process. For achieving good "workmanship","service quality","scheduled time" ,"housing quality for individual housing sector" and "closed settlement sector" the found highest weight score.

Build than sell approach based housing delivery method (Dm9) has got high weight score for "specifications","possession time", "closed settlement sector" "management" and "security"concerns. Multiple prime contracting housing delivery method found high weight score for good "design".Lacunas: least score in .

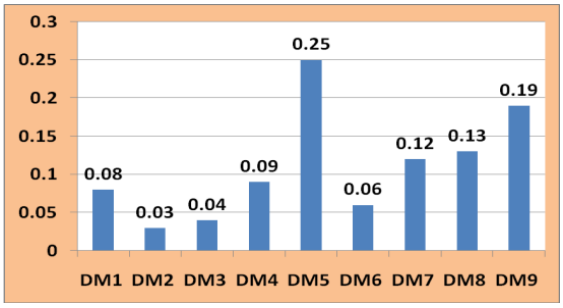

Figure 4 shows the ranking of all available housing delivery methods

VI. ANALYSIS OF SHORTCOMINGS FOUND IN MOST APPROPRIATE HOUSING DELIVERY METHOD:

After analysis process, high weight secured by Design Build process based housing delivery method. Through there are some lacunas that is why the upper most weight is 0.25 in 0-1 scale. Each housing delivery method has some contribution in construction that is why they are running in market and not obsolete. For better results, it is required to understand the shortcomings and identify the gap between highly performed housing delivery and efficient housing delivery method.

Following figure 5 shows the overall performance of Design Build method:

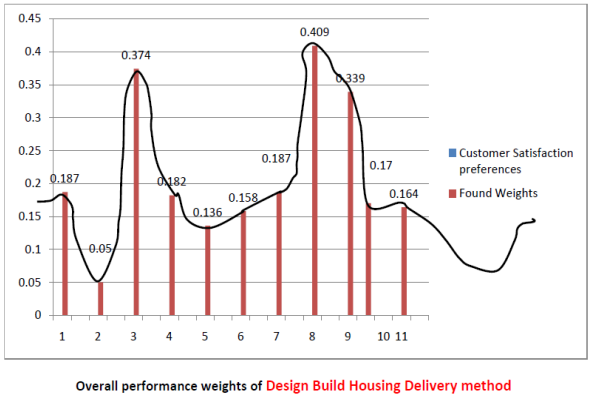

Figure 5 shows the overall performance weights of Design Build housing delivery method

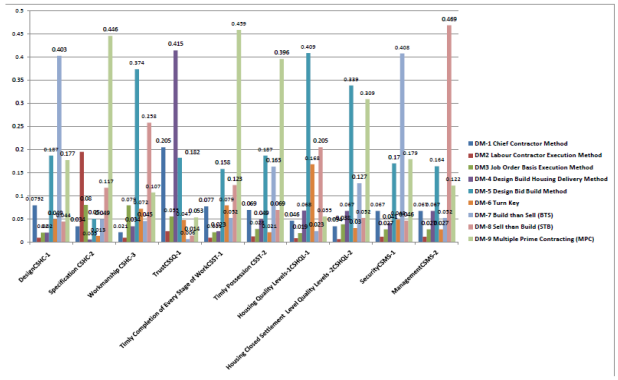

Figure 6 shows the comparison between performance of various housing delivery methods

VII. RESULT AND DISCUSSIONS

After analysis process on 11 variables of customer satisfaction following table 11, suggest the strength and weaknesses of Design Build method . **Good Workmanship and time management** found as the strength however at some points DB is good with combination with other approach. And it is somehow weak in somewhere ie service quality (trust , empathy) .

Table 11, shows the identified gaps in performance of Design Build housing delivery method

Customer Satisfaction preferences	Nomiclature	Found Weights	Rank	Gapes As Compared To high weighs	REMARK
Design-	Cshc	0.187	Moderate	0.216	STB+DB Good compatibility
Specification	Cshc-2	0.050	Low	0.251	Multiple prime contracting +DB good compatibility
Workmanship	Cshc-3	0.374	High Weights	0	Strength
Trust	Cssq-1	0.182	Moderate	0.21	Needs to improve
Service Quality	Cssq-2	0.136	Moderate	0.043	Needs to improve
Timly Completion Of Every Stage of	Csst-1	0.158	Moderate	0.301	Second highest weight
Timly Possession	Csst-2	.187	Moderate	0.209	Second highest weight
Housing Quality Levels-1	Cshql-1	0.409	High Weights	0	Strength
Housing Closed Settlement Level Quality Levels -2	Cshql-2	0.339	High Weights	0	Strength
Security	Csms-1	0.170	Moderate	0.229	Due to privatization
Management	Csms-2	0.164	Moderate	0.305	STB+DB Good compatibility

VIII. CONCLUSIONS

Quality control at every point of construction should regulate properly. Registered Experts team should be there for surprise visit, thy act as a quality control managers and appoint by authority, may restrict the poor workmanship in construction. Integrated housing delivery method should be involve in housing sector also with design build method can enhance workmanship as well overall development of housing project.

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AUTHORS PROFILE

Dr. Bhavna Shrivastava, is a Assistant Professor in Dept. of Architecture and Planning, MNIT,Jaipur. She is an Architect, planner and has specialization in housing ,Building Technology, Urban Planning and Sustainable Built Environment. She is a member of COA.and ITPI and having more than 10 of years teaching experience.

Dr. Yogesh K. Garg, is a professor in the Department of Architecture and Planning at MANIT, Bhopal. He specializes in quantitative research methods, computer applications in architecture and planning. He publised over 120 paper, reports, more than 10 books and collective volumes. He is a Fellow member in IIA, ITPI and Associate member of IIID and member of Indian Society for Technical Education and Indian Building Congress. More than 10 Ph.D guided by him. He was Principal investigator for more than 10 research projects sponsored by University Grants Commission, MP Council of Science and Technology, A.I.C.T.E., M.H.R.D. and Mizhou Informatics and research Institute, Japan

Dr. Nakul Dhagat, is an Architect Specialization in Architecture and Construction and faculty member of Department of Architecture and Planning.He was involved in Design and Preparation of Master plan for the campus of Makhanlal Chaturvedi National University of Journalism and Communication at Bishankheri, Bhopal. Member of Design team. He is a fellow member of IIA and member of COA.and having more than 25 years experience.