

# Factors Influencing the Project Performance of Housing Construction in Kathmandu Valley

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## Abstract

The project lifecycle of housing construction is one of the most dynamic and complex process because of the various factors that influence the project and numerous practices adopted by various decision-making teams in different stages of the project. In order to plan, manage and execute a commercially viable and successful project, proper development activities, its key issue and successful practices are imperative which must be properly planned and executed by the developer and their project management team. The goal of this research is to identify the key issues and factors that influence the project performance of the housing construction in different phases of the project life cycle. This paper also identifies the degree of influence of those identified factors in relation to each other. The influencing factors were identified and classified through literature review and the qualitative interview with the industry experts. The quantitative data were collected through questionnaire survey where a total of Twenty four respondents were selected from various housing development companies. AHP method was used to analyze and determine the weightage of the factors which helped in determining prioritization of the factors through multi-criteria decision-making process. The study identified availability and proximity of infrastructure and amenities, project manager's authority and competency, technical capability of the developer, adequate and on time project fund and resource allocation, housing unit and community amenities as the key factors that influence the success of housing projects.

## Keywords

Housing Construction, project life cycle, success factors, AHP, Multi- criteria decision-making process

## 1. Introduction

Property development is a substantial sector which has the major contribution in the economic activities and is imperative for the various sector of construction industry. Housing is the fundamental necessities of society which offers security, shelter, identity and comfort [1]. Housing has an important role to play as a social aspect of sustainable development and its quality and quantity can act as an indicator of the development level of society [2]. Nepal is a developing nation and is in the initial stages of stable economic development. The continuous growth in the need for better lifestyle has radically increased the demand for housing industry. However, the housing developers have to face various problems such as improper management and development practice, bureaucratic housing policies, poor leadership, unstable political and economic condition, poor geographic condition of land, scarcity of land in the

needed areas, high fluctuation in price of construction materials, etc. These problems act as a hindrance in delivering standard quality housing and meeting the needs of people. Housing industry is a stimulus to many other related small industries and it contributes to the increment of job creation index. Successful delivery of housing projects quantitatively as well as qualitatively, is a key solution to housing-related challenges to overcome the housing discrepancies. In order to achieve this, related critical success factors (CSFs) need to be primarily identified and analyzed. Hence, many studies have investigated the enhancement of housing provision regarding different criteria and constraints particularly in developing nations [1]. Being a dynamic process, the property development begins with the identification of the need and scope of the project, selection of development model in order to determine the attributes and process. The property's value depends upon those dimensions and its translations into the end product. The study

focuses on identifying the factors that influence the project performance of mass housing building construction of Kathmandu valley. It has classified the governing factors throughout the project life cycle of housing construction and it evaluates the degree of influence of factors that impact the project performance of housing construction.

**2. Literature Review**

**2.1 Property Development**

Property development is a multi-stage process which includes selection of land, funds arrangement, team organization, selection of capable contractor, project design, etc. Property development comes with its own eccentricities as it includes several complexities and dynamic activities because of the use of various scarce resources [3].

**2.1.1 Property Development Model**

A property Development Model is used to provide guidelines to explain numerous components of development process. This is a complex and dynamic process which varies according to the circumstances and the influences. In order to achieve a successful developmental model, the structures that influence actors and site should be known beforehand. Then the degree and area of influence on the factors these actors cause should be identified to control events and physical changes that occur on site. Taking decisions, making arrangements and signing contracts are the ways to control those influencing factors. The aim and the responsibilities of those actors should be known in the development process which includes action, agreement, decisions and contracts [4]. The factors that affect the property development model can be broadly classified into political, economic social and legal factors as shown in table 1 [5].

All actors work together to aim and achieve project success in each phase of a property development with their comprehensive aim and role such as:

- a. Opportunity/ Site selection:** The goal is to select a site which can help in attaining high productivity, profit, reducing manufacturing lead time and increasing stakeholder assets. Also, the location should be such that it can be expanded in the future as the needs increase and provide better services to the end user [6].
- b. Market analysis:** The goal is to analyze the

**Table 1: Major influences & actors**

Factors	Influences	Addressed by
Political Factors	Success of the management of a project	Government
Economic factors	Satisfaction of an end-user and the profit	Government & project team members
Social Factors	Success of the management of a project and the final product	Government & project team members
Legal factors	Success of the management of a project and the final product	Project team members

performance of the competitors in the market, market trend and the demand for the project and to see the condition that are essential for a successful project [7]. The actors involved in this process are developers, architects, engineers, market analysis appraisers, lending institution and other investors, etc. [7].

**c. Feasibility Study:** The goal of this phase is to establish developer’s unambiguous objectives and see whether he/she has an ability to achieve expected goals. Also, to see whether the selected site is suitable for intended use and trace the project’s potential criteria for success [8]. This stage includes the analysis of technical, financial and legal parameters that the developer and his team must operate within. It includes the analysis of income source or operating revenue that the that the project is expected to generate over a certain period of time [9].

**d. Professional Appointment:** The goal in this stage is to appoint capable project team members and other participants and establish a clear organizational structure to perform and attain the predetermined goals [7].

**e. Financing:** This stage has the goal to analyze the budget and financial arrangement for development and has a clear strategy for funding. This contributes in the faster turnover and profit along with the assurance for investors that the enterprise’s investment value is secure [7].

**f. Planning application:** This is carried out in order to decide the development of a property which can be achieved by clearly defining objectives, duties and responsibilities of the involved team Li and Duan (2014). Strong communication and coordination in

preparing detailed project program is essential. Regularly conducting a review, amending to meet any potential external challenges in the market condition and analyzing risks are essential in this stage [8].

**g. Design:** The importance of coordinated design process is a structured way where involved actors need to work together even before the project is started. The main goal of the design team is to develop a complete scope of work considering the complexities and size of the project. This phase also has the responsibility of preparing drawings, specification, schedule, conduct quality assurance, quality control and ensure the optimal decisions are made at appropriate time [10].

**h. Construction:** The goal of project team in this stage is to monitor progress, budget and develop final accounts, authorize payment, variation order in a coordinated way. It also includes the conduction of value engineering and avoid and reduce excess cost and establish performance measurement system [10].

## 2.2 Project life cycle management

Project management is a management technique which contains planning, monitoring and control, and encouraging involved project team members to achieve the project objective and concluding the project within the specified set of time, cost, quality, safety and performance and a project manager is significantly responsible for the project management [11]. The techniques for project management help to handle and resolve any problems encountered during the process in each step by means of integration, clearly defined scope, controlled cost, time, quality, risk, human resources, procurement and communication [12]. These techniques should be adopted in each aspect of project life cycle which consists of planning, designing, construction, handover and operation and maintenance [13]. The different stages of project life cycle and the activities associated with those stages are as follows [14, 13]:

### a. Project :

- Site Selection
- Due Diligence/ Feasibility Study
- Developing Financing
- Legislation and regulatory process
- Provision for flexibility and future expansion
- Design (simple, standardized and constructability)

- Size
- Uniqueness of the project
- Density of the project
- Life cycle
- Value
- Project scope
- Complexity of the project

### b. Project Procedure

- Selection of organization for design and construction of project
- Tendering method

### c. Project Management

- Strong top management commitment and support
- Organizational structures
- Strong financial capability
- Clear goals and objectives
- Realistic and well-planned project schedule
- Proper resource allocation
- Planning
- Marketing methods
- Sales

### d. Project Team

- Good relationship and continuous communications between teams and stakeholders
- Strong commitment and involvement
- Technical competency
- Experience
- Trouble shooting
- Effective risk management
- Proactive management
- Resources
- Health and safety record
- Quality of work
- Incentives and penalties

### e. External Factors

- Economic development strategy (Economical environment)
- Extensive government support (e.g., Funding, scheme for worker's training)
- Policies
- Strong demand from local and foreign companies
- Socio-cultural and political environment
- Existence of similar companies (Competitors)

- Client
- Sub- contractors

A proper project management while helps to achieve a successful outcome, cannot prevent failure completely. The success of the project depends on the outlook of the stakeholders involved in the project. The criteria to measure success varies according to the perspective of numerous stakeholders involved in the development process as each has their own expectations for the project. The criteria to measure the success of a project are time, the satisfaction of clients, end users, team members and stakeholders along with contractor’s profit and environmental impact [5].

### 2.3 Analytical Hierarchy Process (AHP)

Analytical Hierarchy Process is a multi-criteria decision-making tool that is used for all the applications related on the ability of people to make critical decisions [15]. AHP is used in various fields of planning, resource allocation, ranking problems in business and marketing, natural resources, environmental science and energy and health sector. Even if there are very limited data available, AHP is effective in decision making process related with multiple criteria. It compares the given criteria and develops the priorities for those alternatives and also provides a procedure to standardize the numeric scale for the measurement of qualitative performances [16]. It can be represented as shown in Figure 1.

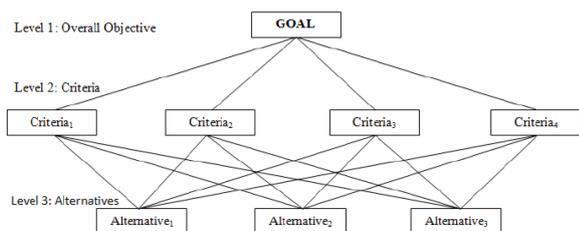


Figure 1: General Hierarchy of AHP

Source: Agrawal et al., 2014

Normally, AHP is based on three principles: decomposition, comparative judgment, and synthesis of priorities and its basic steps include hierarchy construction, priority analysis and consistency verification [15]. AHP helps in pairwise comparison a group decision making process. When a decision has to incorporate the views of multiple respondents, we need to aggregate their judgement and geometric mean of their combined judgement can be used for decision making [17]. Geometric mean will help in

accurately assessing and quantify preferences by relative weightage. Decision making process requires to determine the consistency of the weightage evaluation by calculating consistency ratio (CR). The Consistency ration of a matrix is calculated by equation  $CR = CI/RI$  where CI is consistency index and RI is Random consistency index. CI is calculated by:

$$CR = \frac{CI}{RI}$$

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

According to Saaty 1980 the ratio exceeding 0.1 may be too inconsistent to be reliable for the set of findings. So, CR should be below 0.1 or 10% to be reliable for set of findings [18]. The data should be added until the CR is within this range to make the evaluation consistent based on which decision makers can reach a conclusion of the result.

## 3. Research Methodology

### 3.1 Research Design

The study follows both qualitative and quantitative approach. The qualitative method is used for identifying factors and their roles in influencing the performance of mass housing building project. Qualitative interview with the industry expert with work experience of more than 15 years was conducted to validate the the identified factors from literature review. And it involves quantitative method by using AHP for analysis of collected data on the value of each criterion of factors. It supports to analyse the causal factors influencing project performance. AHP involves building a hierarchy of decision elements (factors) and then performing comparisons between pairs in a matrix to give a weight for each element and also a consistency ratio to evaluate the reliability of results for decision making process.

Thus, it attempts to develop an understanding of what and how different factors affect the project performance of mass housing building construction. Such relations are used to identify between the factors which plays major/higher role in influencing the different stage of construction management of mass housing.

### 3.2 Methodology Framework

The research is designed to identify and investigate the central theme of the study which is identification of factors influencing the project performance of housing construction in different phases of project development. The framework for methodology consisted of four sections which are as follows:

1. Conceptualization
2. Data collection
3. Data analysis
4. Conclusion and recommendations

Data collection phase which is a true and definite phase of research design includes the type and method of data to be collected which includes pilot case study to validate the factors identified from the literature review and questionnaire survey based on those factors identified. The next element is the analysis of collected data which was done by AHP. The overview of the methodology is shown in Figure 2.

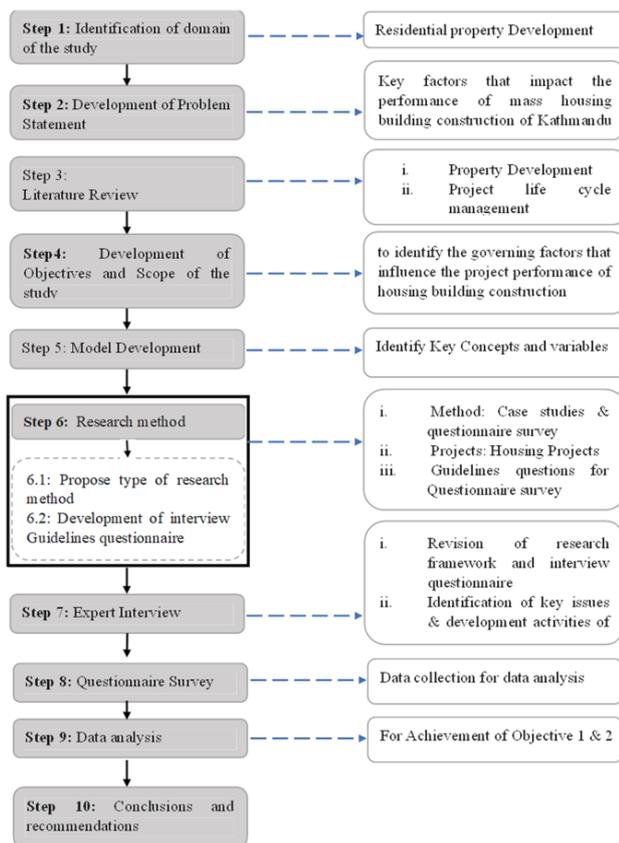


Figure 2: Methodology Framework

### 3.3 Sample population

According to Nepal Land and Housing Developer’s Association (NLHDA), there are 16 housing

development companies registered as its members that have completed the construction of housing projects containing housing units more than 25 in Kathmandu valley. And the number of completed housing having units more than 25 projects by those companies are around 32. The respondents for this research are the professionals associated in those projects. The AHP is a mathematical model rather than statistically-based model. So a statistically significant sample population is not required [19] as it can be used to analyze data ranging from 2-100. The sample size for this study includes 24 respondents.

## 4. Result and Discussion

The influencing factors identified from the literature review and expert interview are as shown in table below

### 4.1 Primary Factors

The chart in figure 3 indicates that among the list of primary factors, Team organization has the highest value whereas tendering and contracting as the lowest value. Similarly, site selection has second highest importance, followed by construction, design, feasibility study and promotion and sales respectively.

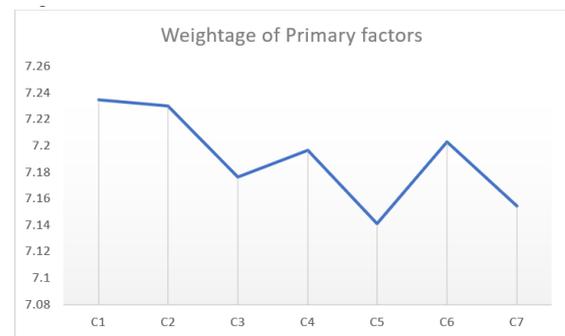


Figure 3: Rank of primary factors

### 4.2 Secondary Factors

#### 4.2.1 Team Organization

From the chart, it can be understood that C2 i.e., Project managers Authority, competency and leadership skill has the highest degree of importance in success of housing construction followed by number and qualification of design team members, Experience and qualification of senior executive team, Number and qualification of management team members and work force development and training respectively.

**Table 2:** Influencing factors in different stages of housing construction

Primary Factors	Secondary Factors
Team Organization	experience & qualification of senior executive team
	Project manager’s authority, competency and leadership skill
	Number and qualification of design team members
	Number and Qualification of management team members
	Work Force development and training
Site selection	Price of land
	Quality and proximity of infrastructures and amenities
	topography of land
Feasibility Study	Government policies
	Number of other competitors in the market
	Experience of the developer
	Technical Capability of the developer
	Identification of target customer
Design	Environmental impact of the project
	Size of the Project
	Complexity of the project
	Clarity and understanding of design among all the team involved
	Structured design approach
	Master plan and zoning policies
Tendering & contracting	Inclusion of infrastructure
	Fairness in competition among contractors
	Procurement Documentation
Construction	In-house construction and procurement team
	Adequacy of design detail & specification
	Realistic Cost and time estimates
	Adequate and on time Project fund and resource allocation
	Highly qualified and trained workers
	Consistency in design/ less change in plans and need for rework
Promotion & sales	Regular progress meetings
	Market analysis
	Client relationship management
	Advertising campaign
	Brand of the developer
Promotion & sales	Housing unit and community amenities

**Table 3:** Relative Weightage of Primary Factors

	Factors	Weightage	rank
C1	Team Organization	7.234	1st
C2	site Selection	7.230	2nd
C3	Feasibility Study	7.176	5th
C4	Design	7.196	4th
C5	Tendering and contracting	7.141	7th
C6	Construction	7.202	3rd
C7	Promotion and sales	7.154	6th

**Table 4:** Relative Weightage of secondary factors of team organization

	Factors	Weightage	rank
C1	Experience & qualification of senior executive team	5.0714	3rd
C2	Project manager’s authority, competency and leadership skill	5.138	1st
C3	Number and qualification of design team members	5.079	2nd
C4	Number and Qualification of management team members	5.0437	5th
C5	Work Force development and training	5.0430	4th



**Figure 4:** Rank of secondary factors in team organization

**Table 5:** Relative Weightage of secondary factors of Site Selection

	Factors	Weightage	rank
C1	Price of land	4.0008	3rd
C2	Quality and proximity of infrastructures and amenities (location of site)	4.0014	1st
C3	Topography of land	4.001	2nd
C4	Government policies	4.0004	4th

**4.2.2 Site Selection**

From the above data and chart, it can be concluded that the factor C2 i.e., Quality and proximity of



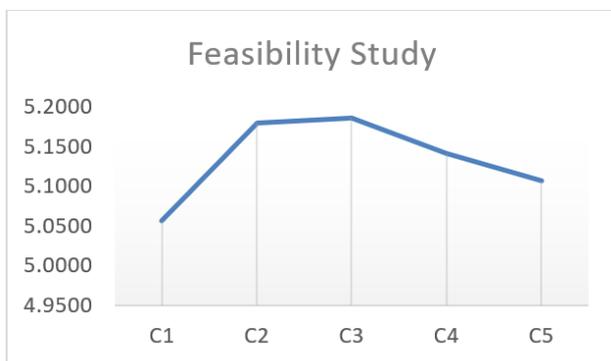
**Figure 5:** Rank of secondary factors in Site Selection

infrastructures and amenities should be given the most importance while selecting a site for housing construction. Similarly, Topography of land has the second highest importance for proper site selection. Price of land and government policies are of 3rd and 4th priorities respectively.

**4.2.3 Feasibility Study**

**Table 6:** Relative Weightage of secondary factors of Feasibility Study

	Factors	Weightage	rank
C1	Number of other competitors	5.0559	5th
C2	Experience of the Developer	5.1801	2nd
C3	Technical Capability of the developer	5.1861	1st
C4	Identification of target Customer	5.1410	3rd
C5	Environmental Impact of the project	5.1066	4th



**Figure 6:** Rank of secondary factors in Feasibility Study

From the data, it can be concluded that during feasibility study, the success of the housing project

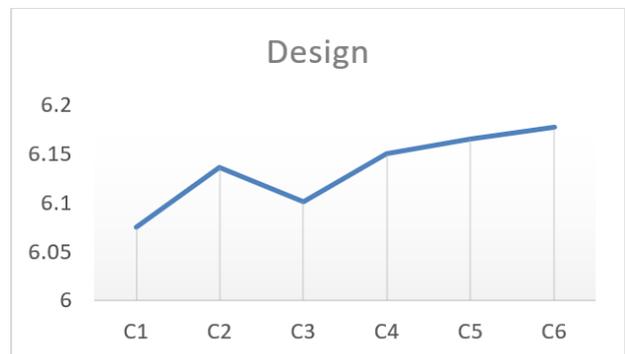
depends highly on the technical capability of the developer. Similarly experience of the developer has the second highest role for the project to be feasible. Identification of target customer has the 3rd most important ranking which is followed by environmental impact of the project. Thus, if all the above criteria are considered thoroughly in feasibility study phase, number of other competitors does not affect as much.

**4.2.4 Design**

**Table 7:** Relative Weightage of secondary factors of Design

	Factors	Weightage	rank
C1	Size of the project	6.075	6th
C2	Complexity of the project	6.136	4th
C3	Clarity and understanding of design among all the team involved	6.101485	5th
C4	Structured Design approach	6.15	3rd
C5	Masterplan and zoning policies	6.165	2nd
C6	Inclusion of infrastructure	6.177	1st

From the table and chart it can be concluded that in the design phase the most importance should be given to the inclusion of infrastructures. Similarly, master plan and zoning policies have the second most importance and structured design approach has the 3rd most importance. Complexity of the project is ranked as 4th and clarity and understanding of design among all the team involved and size of the project as 5th and 6th respectively.



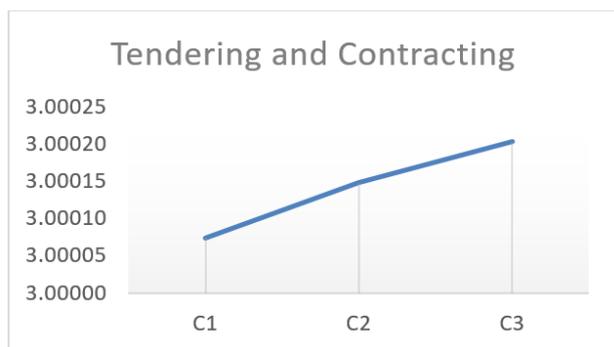
**Figure 7:** Rank of secondary factors in Design

**4.2.5 Tendering and contracting**

From the data above in the table and chart it can be concluded that for the housing

**Table 8:** Relative Weightage of secondary factors of Tendering & Contracting

	Factors	Weightage	rank
C1	Fairness in competition among contractors	3.00007	3rd
C2	Procurement Documentation	3.00015	2nd
C3	In-house construction and procurement team	3.0002	1st



**Figure 8:** Rank of secondary factors in Tendering & contracting

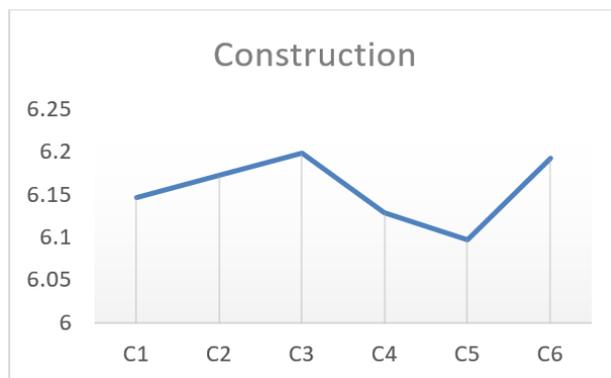
construction, availability of in house construction and procurement team has the most importance followed by procurement documentation. Since, most of the housing companies focus on having in house construction and procurement team, selection of contractors through bidding process is ranked 3rd among the factors.

**4.2.6 Construction**

**Table 9:** Relative Weightage of secondary factors of Construction

	Factors	Weightage	rank
C1	Adequacy of design detail & specification	6.1469	4th
C2	Realistic Cost and time estimates	6.1721	3rd
C3	Adequate and on time Project fund and resource allocation	6.1989	1st
C4	Highly qualified and trained workers	6.1287	5th
C5	Consistency in design/ less change in plans and need for rework	6.165	6th
C6	Regular progress meetings	6.1921	2nd

From the chart, it can be seen that the factor that has



**Figure 9:** Rank of secondary factors in Construction

to be given most priority while constructing a housing is “Adequate and on time project fund and resource allocation”. Similarly, regular progress meeting plays the second most importance in success of housing construction followed by realistic cost and time estimates as 3rd most important. Adequate design detail and specification, highly qualified and trained workers and consistency in design and requirements are ranked as 4th, 5th and 6th respectively.

**4.2.7 Promotion and sales**

**Table 10:** Relative Weightage of secondary factors of Promotion & sales

	Factors	Weightage	rank
C1	Market Analysis	5.139	3rd
C2	Client relationship management	5.114	2nd
C3	Advertisement campaign	5.083	5th
C4	Brand of the developer	6.1287	4th
C5	Housing unit and community amenities	5.17	1st



**Figure 10:** Rank of secondary factors in Promotion & sales

From the data in table 10, it can be concluded that the

factor that plays the most important role in promotion and sales phase is housing unit and community amenities and the factor that plays 2nd most important role is client relationship management. Similarly, market analysis brand of the developer and client relationship management as ranked as the 3rd, 4th and 5th most important factors in promotion and sales phase of housing construction.

### 4.3 Data Verification

For the data verification purpose three of the experts form the housing field who are currently working in development companies that have successfully completed the all the phases of project life cycle of housing developments were selected. According to them, the parameters for measuring the success status of any housing projects are:

- sales of all the units within targeted time
- generation of expected profit
- project completion within specified time with very little delay
- completion within specified BOQ with variation of not more than 20%
- user satisfaction.

From the identified factor form the data analysis, the experts were asked to rank the factors in the degree of their importance. For the primary factors: 2 out of three experts ranked team organization as the most important while one ranked site selection as most important. These factors were ranked as 1st and 2nd ranking from the data analysis respectively.

For the secondary factors: the factors that were prioritized in relation to each other in their respective phases were validated by the three experts shown in the table 11. The experts were asked to rank the factors from most important to least important and their mean was calculated to compare with the weightage calculated by AHP process.

Thus, from the data in table 11, it can be concluded that the data obtained form the analysis by using AHP process for prioritization of the factors are accurate.

## 5. Conclusion

In today's expanding urbanization, the need for better lifestyle, sense of security, comfort, identity, etc is also increasing. These demands can be fulfilled by better housing construction. Housing development is a significant sector which contributes greatly in the

**Table 11:** Weightage of secondary factors by experts

Factors	Weightage by experts	Weightage From analysis
Project manager's authority, competency and leadership skill	5	5.13
Quality and proximity of amenities and infrastructure	3.66	4
Technical Capability of the developer	4.66	5.1
Inclusion of infrastructures	6	6.17
In-house construction and procurement team	3	3
Adequate and on time Project fund and resource allocation	6	6.19
Housing unit and community amenities	5	5.17

economic development of the country and it helps in the development of other various industries. The process of housing development begins right from the selection of land and development of strategies to the execution and sales of the completed units. There are various factors associated in each step of the development process that contributes greatly in the project performance of the housing construction. The poor decision and management of developer and his team can lead to the formation of poor practice which cannot be corrected in later stages. This can significantly affect the operational and business aspect of the project. This can be resolved by identifying the influencing factors prior to project commencement and focusing on the most influential factors in each stage.

The dynamic and complex process of housing development has various stages that the developers and his team need to focus on such as team organization, site selection, feasibility study, design, tendering and contracting, construction and promotion and sales. Among these, the factor that developer's team need to give most emphasis is on team organization as good team can contribute to the better functioning of other stages and develop better strategies, make proper execution plan and schedule, risk management technique, etc.,. Similarly, the project manager when given necessary authority, has good leadership skill and competency, the project can be successful. While selection of site for project, the

location of land should be the primary focus. Such site should be selected which is in proximity to amenities and infrastructure and also the topography of land should be given priority over the price of land. If the technical capability of the developer is strong, the project can be considered feasible. In the design aspect, the housing with proper infrastructure are found to be more successful. Similarly, in construction phase, the most influential factor for the smooth running of project is adequate and on time fund and resource allocation along with regular progress meetings. For the promotion and sales phase of the project, if the housing unit and community has better amenities, it is easier to sell those structures and generate higher profit.

### 6. Acknowledgements

The authors express their sincere gratitude to all the faculty members, respondents, friends and all the supporting hand whose motivation has been a major source of progress and completion of paper within the limited time frame.

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