International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 05 | May 2021 www.irjet.net p-ISSN: 2395-0072

FEASIBILITY STUDY FOR A RESIDENTIAL CONSTRUCTION PROJECT: A CASE STUDY

Pranav B. Maske[1], Dr. Ajay K. Gaikwad[2]

[1]P.G Student (Construction Management), Department of Civil Engineering, Pimpri Chinchwad College of Engineering, Pune, India.

[2]Associate Professor, Department of Civil Engineering, Pimpri Chinchwad College of Engineering, Pune, India.

Abstract - *Every construction project must give benefit to the investors. In every construction project financial risk is involved. So the Feasibility study analysis gives information about the value of investment and benefits that investors will get. The feasibility of an investment has to be considered with several different aspects in order to determine whether the investment should be realized or not. To check the project is feasible or not the commonly used criteria are Net present value (NPV), internal rate of return (IRR) and Benefit Cost Analysis. For successful implementation of residential project, it is necessary to study financial feasibility of the project. The aim of this paper is to perform the feasibility of a residential project in Pimpri Chinchwad area to predict whether the project is feasible or not.*

Key Words: Feasibility, Residential project, Benefit Cost ratio, Net Present Value, Internal Rate of Return.

1. INTRODUCTION

Feasibility studies are primary studies undertaken in the early stage of a project. They tend to be carried out when the project is large or complex and the investment is high. Every construction project must give benefits for the investor. These benefits includes of profit, business development, etc. The profits are achieved in a long period and must have an accurate forecast of the investment so that the investors still have willingness to invest their money. Feasibility study analysis also provides information about the value of investment and the benefits that investors may get. The return on investment can be seen from feasibility study. Generally, Net Present Value (NPV), Internal Rate of Return (IRR) and Benefit-Cost Ratio are value that used by investors to consider this project is feasible or not. Risks can influence the profits and it will decrease the feasibility for investing in the project. To those assumption, risks must have been anticipated and calculate it into the feasibility analysis.

Investment in construction project can give higher benefit beside of its high uncertainty. The influence of the identified risk has to be evaluated and calculated towards the project feasibility. Before the investment, the feasibility of the project has to be done that gives the cash flow of the project. This can be one of the considerations for making a decision whether this project is feasible or not. For preparation of feasibility study, various stakeholders, authorities and other third parties may need to be consulted.

Financial feasibility is an important factor in feasibility study as most investments are not realized if they do not generate profit for the project owners. Precision and reliability of financial feasibility analysis relies on the accuracy of information used for the analysis. To assess the financial feasibility of the project, relevant criteria must be chosen. Using only one criteria to determine feasibility will not give accurate results. Hence, we have considered multi criteria such as B/C ratio, NPV and IRR to determine the financial feasibility of the project.

1.1 Problem Statement

Implementation of any construction project in any region involves an investment of capital. According to the characteristic of construction industry, it has high uncertainty. Hence before commencement of any project it is essential to perform feasibility study.

1.2 Objectives of Study

1. To determine the benefit cost ratio for the project.
2. To determine the net present value (NPV) & internal rate of return (IRR) for the project.
3. To analyze the parameters to decide the feasibility of proposed project.

1.3 Limitations of Study

This study is not a business plan, which is prepared later in the project development process and acts as an outline for a firm's business operations for execution. The feasibility study isn't intended to determine new ideas or concepts for the project. These ideas should be clearly determined prior

to the study. The feasibility study will not assure if the project will be started, since that relies upon the project owners, who will invest into the project.

2. LITERATURE REVIEW

[1] *Moonseo Park et.al (2010),* presented construction project investment decision tools: Project Present Value (PPV), Project Rate of Return (PRR), and Firm Rate of Return (FRR). These are developed to be free from the issues associated with net present value and Internal Rate of return and to produce additional reliable and economically significant investment performance indices for construction managers. In addition, this paper also presents the assessment procedure that helps to apply the proposed methods on an actual project, based on the reality of construction industry. According to author, to propose new methods and their procedures, we need to exam the assumptions embedded in the existing evaluation tools, especially implicit ones.

[2] *M.B. Murkute et.al (2015)* shows how sensitivity analysis can contribute to improve decision-making, but little can be found about the advantages of exploring model sensitivity visually to aid the decision maker. Finally, the aim of this work is to develop effective interactive visualisation techniques to help people that are using models for decision making but who need to explore the usually complicated relationships between the values of model variables and the model output. Hence, feasibility study is important before starting it. After preparing a sensitivity model of residential project, this model can be implemented to other residential projects.

[3] *Eliot H. Sherman (2015)*, addresses many of the techniques that financial managers need to develop in order to help their firms sustain growth and plan for the future. Excelling in financial analysis and interpretation goes beyond the mechanical application of techniques and modelling. Although the increased use of sophisticated computers can greatly simplify the financial manager's task, the manager needs to learn the proper application of these concepts and techniques and to identify the underlying issues and assumptions. Qualitative as well as quantitative data are required for financial decisions.

[4] *Aishwarya Patil et.al (2019)*, performed sensitivity analysis for residential project. The author uses method of internal rate of return after analysing of each possible situation with cost of capital of company and able to determine the practical feasibility of residential and commercial project for each situation. For improving decision making how sensitivity analysis is superior for exploring model is to aid the decision maker. After preparing a sensitivity model of residential and commercial project, this model can be implemented to other projects.

[5] *Faridah Muhamad Halil et.al (2016)*, explored the concept of a feasibility study and economic assessment in Green Building Projects. The benefits of preparing of financial feasibility study enables the client to decide with considerable confidence whether the project is feasible or not. The study concluded that the result of the overall assessment of market and financial feasibility study provides the information to the clients whether to proceed or discontinue the project proposed for the development. If the clients decided to proceed with the project, the necessary improvements and modifications must be taken into account that may have appeared at the stage of a feasibility study.

[6] *Anna Regína Björnsdóttir (2010)*, examined how assessment models can be structured and used for financial feasibility analysis of investment projects. The author also presents an overview of financial feasibility assessment methods as well as a general assessment model that can be used as a base when constructing new models. A case study of a geothermal cogeneration plant is used to demonstrate the use of a model to evaluate the financial feasibility. Finally it is concluded that the Net Present Value, Internal Rate of Return and Modified Internal Rate of Return shall be used to assess financial feasibility of investment projects. In addition to calculating the financial feasibility, assessment models should allow the user to perform sensitivity analysis, scenario analysis, and simulation to analyze risk associated with the investment project.

[7] *Dr. Arshad Ali Amjad (2004),* presents the methodologies that can be applied while conducting Cost Benefit Analysis for construction projects using a case study. In the case of the present study, researcher adopted the combined approach since it is the best for a case study.

[8] *Ondrej Zizlavsky (2014),* focuses on techniques that can be employed for evaluation of single innovation project. The framework is based on detailed literature review and net present value (NPV) approach analysis. Furthermore, the author investigates its pros and cons and discusses methods able to deal with NPV weaknesses. The author draws upon the literature about the NPV approach to evaluation of innovation projects.

3. STUDY AREA

Case Study: Silver Gracia in Ravet, Pune by BVG Developers is a proposed residential project. The project offers apartment with perfect combination of contemporary architecture and features to provide comfortable living. The apartments are of the following configurations: 1BHK, 2BHK and 3BHK. The project is spread over a total area of 5 acres of land. Silver Gracia has a total of 4 towers and a separate building for MHADA flats. The construction is of 2P+18 floors.

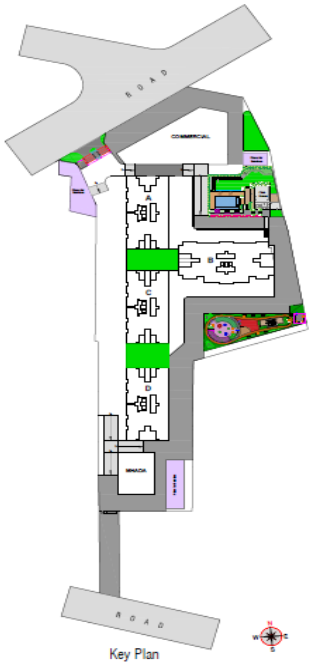

Figure-1: Project Key Plan

4. METHODOLOGY

The methodology / scope of the project work consist of the following:

- To collect all required data.
- To prepare schedule for the project to determine duration of work.
- To prepare preliminary cost estimate for the project.
- To calculate the revenue generated after the completion of project.
- To calculate Benefit-Cost ratio, NPV and IRR.
- To suggest on the feasibility of the project.

4.1 Project Scheduling

Scheduling is a fundamental and challenging part associated with the management and execution of construction projects. There are various techniques used for scheduling a project depending upon its size, complexity, personnel and owner requirements. There are two general methods that are commonly used: the Gantt or bar Chart and the Critical Path Method.

Scheduling of this project is done by preparing Gantt chart using Microsoft Project software. The estimated duration of the project was found to be 1028 days i.e. 2.8 years ≅ **3years**.

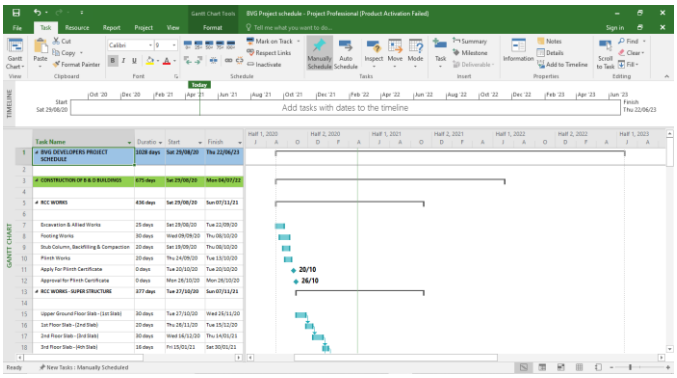

Figure-2: Project Scheduling using MSP

4.2 Preliminary Cost Estimate

Table -1: Preliminary cost estimate of project

Sr. No	Description	Height	Unit	Total Area In Sq.Ft	Rate	Amount
1	Building-A	2P+18	Sq.Ft	1,51,075	1,350	20,39,51,250
2	Building-B	2P+18	Sq.Ft	1,78,822	1,350	24,14,10,148
3	Building-C	2P+18	Sq.Ft	1,51,075	1,350	20,39,51,250
4	Building-D	2P+18	Sq.Ft	1,51,075	1,350	20,39,51,250
5	Parking Podium Area	1	Sq.Ft	44,891	550	2,46,89,898
6	Mhada Building	G+7	Sq.Ft	61,355	1,000	6,13,54,800
8	Connected Terrace (Amenities)	3	Sq.Ft	51,690	1,500	7,75,35,029
9	Club House +Landscape	G+1	Sq.Ft	5,016	1,500	75,24,036
10	Swimming Pool	1	Ltr	1,00,000	25	25,00,000
11	Transformer Room	1	Sq.Ft	907	400	3,62,660
12	STP	1	Ltr	2,062	12	24,744
	TOTAL		-		**₹ 102,72,55,067**	

Preliminary estimates are generally made during the initial stages of a project. It essentially helps reveal whether a project is economically feasible. This preliminary cost estimate is prepared to determine the total cash outflow at

the end of the project duration. Any delay in the project may increase the project costs that need to be updated.

Therefore the total cost required for the project is estimated to be Rs. 102,72,55,067 approx. This will be the total cash outflow within the estimated project duration.

4.3 Price Trend

The Price trend data was collected from the surrounding area and nearby sites having similar specifications. This data was collected by visiting the projects in Ravet area and also from the internet. This price trend is useful to decide the basic price of the apartments on per sq.ft basis to calculate the minimum revenue that will be generated at the completion of project. The graph below shows the price trend in Ravet area during past few months. It was observed that the basic price of apartment in the surrounding area is about ₹5900 per square feet. This price will be used for further calculation of revenue.

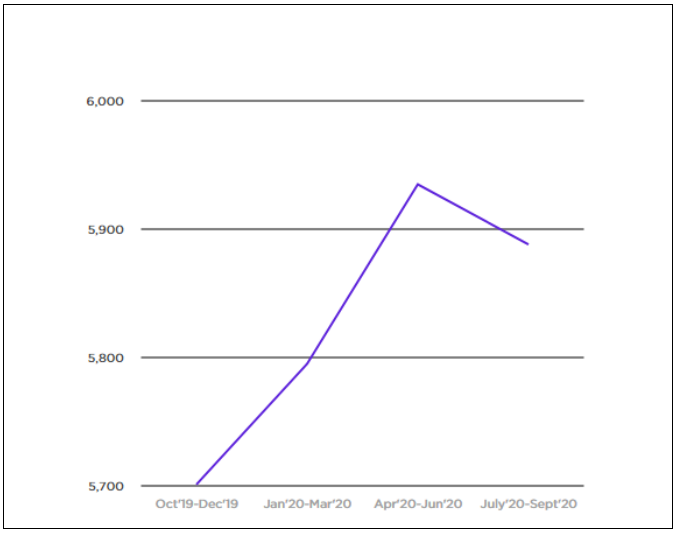

Chart -1: Price trend for apartments in Ravet

4.4 Project Revenue

Revenue is the total cash inflow that will be generated at end of project period. These are positive cash flows which are indicated in the cash flow diagrams. The projected revenue of the project helps to estimate the future earnings from the project and hence determine feasibility to proceed with the project. Generally, revenue of the project should be greater than the expenses so as the project is considered to be profitable. If the expenses are more than the revenue the project is not feasible.

In our case, the total projected revenue from the project will be from the sales of the apartments. Hence, the revenue that will be generated by selling each flat has to be determined. The revenue may vary on the number of apartments that will be sold at the end. The amount received will be total revenue that will be split between the land owner and the developer at a fixed ratio of 60:40.

Table -2: Summary of total project revenue

Building	Projected Revenue
A	541658704
B	677854363
C	541658704
D	541658704
MHADA	139520056
TOTAL	**₹244,23,50,531**

Therefore, the actual revenue for developer would be,
Revenue of developer =2442350531 × 0.6 = **₹146,54,10,319**

5. ANALYSIS AND RESULTS

The two most important critical variables which will affect the project cash flow are given below,

a. Bookings by customers
b. Delay in construction

The above factors are not in the control of the project promoters. Thus, the Benefit-Cost ratio, Net Present Value and Internal Rate of Return is calculated which help company to take the investment decision.

5.1 Acceptance Criteria for Project

The project is considered to be financially feasible when the following conditions are satisfied simultaneously:

a) The Benefit Cost ratio (B/C) for the project must be greater than 1.

b) The Net Present Value (NPV) of the project must be positive for a minimum discount rate of 10%. Also the net cash flow at end of the project should be positive.

c) The Internal rate of Return (IRR) must have greater value than the discount rate.

5.2 Booking Situation

Bookings of flats by customers will decide the cash inflow or the revenue generated from the project. The more the bookings then the chances of project to be feasible will also be more.

For the calculation of Net Present Value (NPV) and Internal rate of Return (IRR) the project costs are indicated by negative sign since they are the cash outflow and project revenue is positive as it is the cash inflow. The difference

between cash inflow and the cash outflow is the net cash flow of project. The discount rate for NPV is assumed as 10%.

Table -3: Summary of results for varying bookings

Situation no.	Booking %	B/C ratio	NPV	IRR
1	20	0.29	₹ -76,08,16,827	-71.5%
2	40	0.57	₹ -49,43,78,587	-42.9%
3	60	0.86	₹ -22,79,40,347	-14.4%
X	***77***	***1.1***	***0***	***10%***
4	80	1.14	₹ 3,84,97,892	14.1%
5	100	1.43	₹ 30,49,36,131	42.7%

For bookings situation,
The NPV and IRR changes from negative to positive between 60% to 80% of bookings. To determine to critical booking percentage we assume NPV to be zero.
If NPV = 0, then IRR = 10%
Project Revenue = Project Cost + (Project Cost × 10%)
= 102,72,55,067 + (102,72,55,067 × 0.1)
= ₹112,99,80,574
Hence, by method of approximation we can find the booking % when NPV is zero.

Booking %	Project Revenue
60	₹87,92,46,191.3
X	₹112,99,80,574

$$X = \frac{60 \times 112,99,80,574}{87,92,46,191.3} = 77.11 \cong 77$$

Therefore, at 77% bookings the NPV will be zero and IRR will be 10%.

It is observed that the NPV is zero for 77% bookings of apartments. Thus, the NPV will be negative below 77% bookings. In the above table 3, the values indicated by red are not permissible and cannot be accepted.

For ideal situation no. 5, when the bookings are 100% the B/C ratio is greater than 1. Also the NPV is positive and IRR is greater than the discount rate.

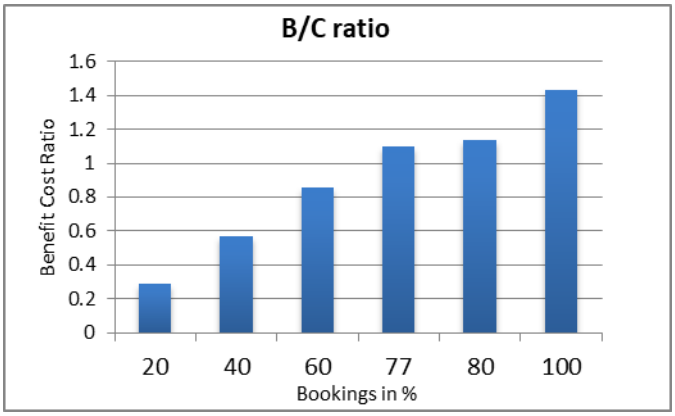

Chart-2: Benefit Cost ratio for varying bookings

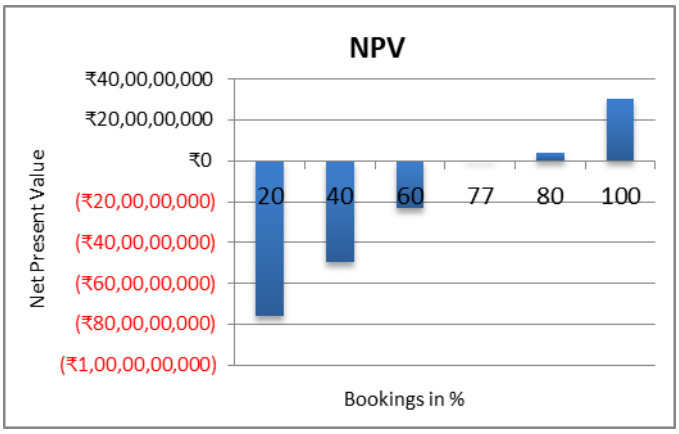

Chart-3: Net Present Value for varying bookings

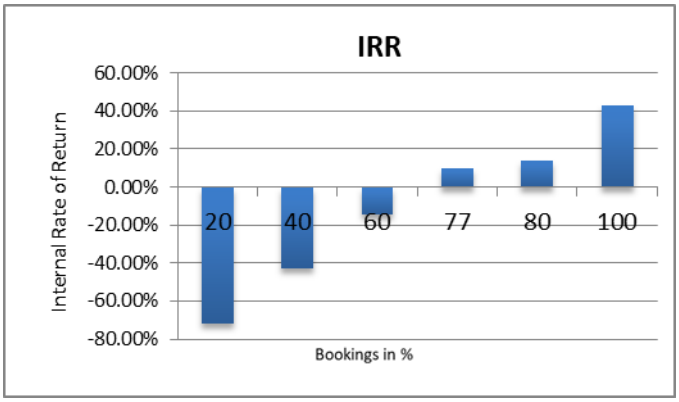

Chart-4: Internal Rate of Return for varying bookings

5.3 Delay in Construction

Delay in construction period of the project has direct impact on the project expenditure which results in negative cash flow. Generally, there is an increase of 10-15% in project cost per year for the delay period. These costs include labour payments, expenses from operating activities and other miscellaneous works. For this project the estimated duration of the project is 3 years. The values are calculated considering an interval of 6 months after the end

of project duration. In this case, the revenue of the project remains the same whereas the cost increases at the rate of 15% per annum.

Table -4: Summary of results for varying duration

Situation no.	Duration (months)	B/C ratio	NPV	IRR
1	36	1.43	₹ 30,49,36,132	42.7%
2	42	1.33	₹ 23,05,82,867	33.0%
3	48	1.24	₹ 15,08,47,872	24.0%
4	54	1.16	₹ 6,53,41,617	15.7%
Y	***57***	***1.1***	***0***	***10%***
5	60	1.08	₹ -2,63,53,627	7.9%
6	66	1.01	₹ -12,46,85,820	0.6%
7	72	0.94	₹ -23,01,35,351	-6.2%

For delay in construction,
The NPV changes from positive to negative between the duration of 54 to 60 months. To determine to critical duration we assume NPV to be zero.
If NPV = 0, then IRR = 10%
∴ B/C ratio = 1 + (1 × 10%) = 1.10

$$\text{Project Cost (IRR @10\%)} = \frac{\text{Project Revenue}}{1.1}$$

$$= \frac{146,54,10,319}{1.1}$$

$$= ₹133,21,91,199$$

Hence, by method of approximation we can determine the duration of project when NPV is zero.

Duration (months)	Project Cost
54	₹126,68,49,582
Y	₹133,21,91,199

$$Y = \frac{54 \times 133,21,91,199}{126,68,49,582} = 56.78 \cong 57$$

Therefore, at the duration of 57 months the NPV will be zero and IRR will be 10%.

It is observed that the NPV is zero for project duration of 57 months. Thus, the NPV will be negative for further delay than 57 months and also the IRR will be less than the discounted rate.

In the above table 4, the values indicated by red are not permissible and cannot be accepted. Situation no. 7 is the ideal situation at which the project will be completed within the estimated period of 36 months.

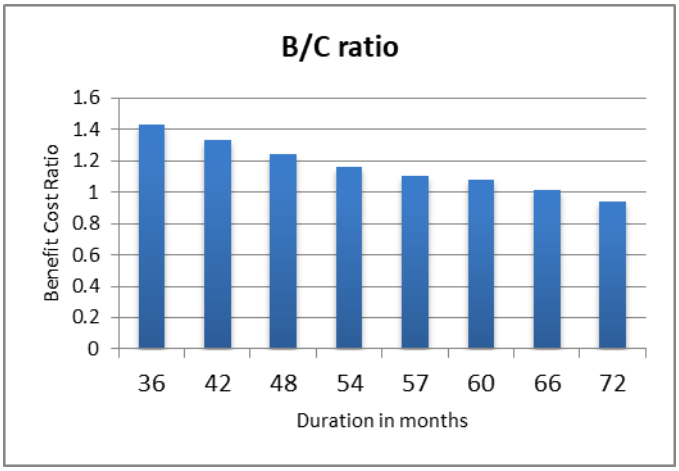

Chart-5: Benefit Cost ratio for varying duration

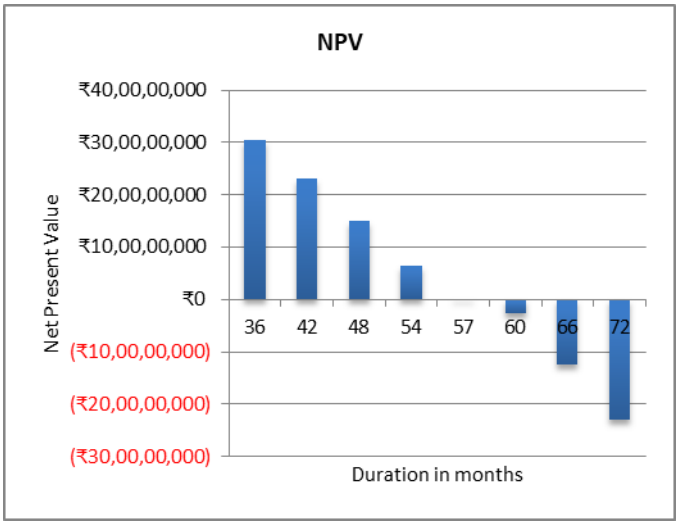

Chart-6: Net Present Value for varying duration

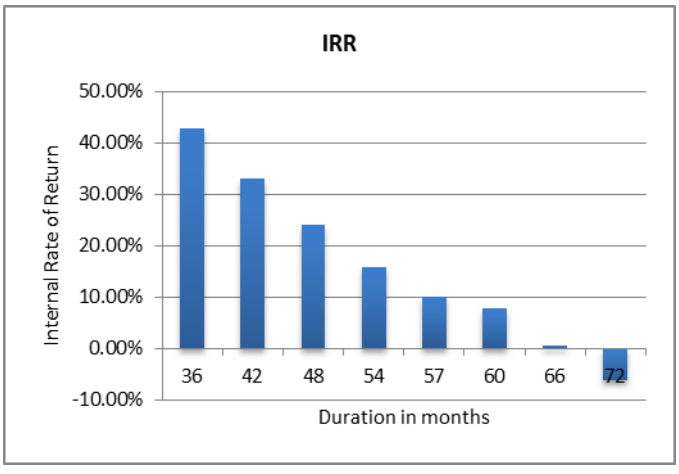

Chart-7: Internal Rate of Return for varying duration

6. CONCLUSIONS

As mentioned earlier, feasibility analysis should evaluate all aspects of investment projects. The decision-making process for large projects is very complicated and obviously all aspects cannot be covered. Most decisions are based on multiple factors, of which all cannot be measured quantitatively. Therefore, multi-criteria assessment methods are often needed to attain a complete evaluation of the project's feasibility. The best criteria for analyzing financial feasibility are the NPV, IRR and B/C ratio.

Study of Residential project suggest that, it is not that much easy to predict the feasibility of project. To check the feasibility of such project, there is need to list out those factors which cannot be control by project promoters, but such factors greatly effect on the project cash flows.

The case studied for the residential project "Silver Gracia" it was found that all the three parameters i.e. Benefit cost ratio, Net Present Value and the Internal Rate of Return were within acceptable limits for ideal situations. It is concluded that the project is feasible when either the percentage of bookings are more than 77% or the project is completed within 57 months from starting of project.

REFERENCES

[1] Moonseo Park et.al, "Evaluation methods for construction projects", Journal of Civil Engineering and Management-ISSN: 1392-3730 (Print) 1822-3605 (Online)

[2] M.B. Murkute et.al, "Feasibility Study of Residential Project – Special Emphases on Sensitivity Analysis", International Journal of Engineering Research in Computer Science and Engineering (IJERCSE) Vol 2, Issue 3, March 2015 .

[3] Eliot H. Sherman, "A Manager's Guide to Financial Analysis-Sixth Edition", American Management Association (2015) ISBN 13: 978-0-7612-1561-5

[4] Aishwarya Patil et.al, "Feasibility Study of Residential Building", International Research Journal of Engineering and Technology (IRJET), Volume: 06 Issue: 05 | May 2019

[5] Faridah Muhamad Halil et.al, "Feasibility Study and Economic Assessment in Green Building Projects", Procedia - Social and Behavioral Sciences 222 (2016) 56 – 64

[6] Anna Regína Björnsdóttir, "Financial Feasibility Assessments" (2010). Master's thesis, Faculty of Industrial Engineering, Mechanical Engineering and Computer Science, University of Iceland 2010

[7] Dr. Arshad Ali Amjad, "Cost Benefit Analysis for Construction Projects", IEP-SAC Journal 2004-2005

[8] Ondrej Zizalavsky, "Net present value approach: method for economic assessment of innovation projects", Procedia - Social and Behavioral Sciences 156 (2014) 506 – 512

[9] Helena Gaspars-Wieloch, "Project Net Present Value estimation under uncertainty", Springer (2017)

[10] Alexander Maravas et.al, "A New Approach to Studying Net Present Value and the Internal Rate of Return of Engineering Projects under Uncertainty with Three-Dimensional Graphs", Hindawi, Advances in Civil Engineering, Volume 2018, Article ID 6108680.