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Investment Model through Risk Assessment of Residential Real Estate

Dwarka Expressway as Case Study

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Abstract: Profitable investment into Real Estate residential projects requires a realistic and more practical approach for evaluating its financial performance and efficiency. Uncertainty in the residential real estate has always been an issue. Till date, financial return of a residential project in India is calculated using a Discounted cash flow model (DCF) which gives a single point value (deterministic result), not including risks and uncertainties. Addressing risks and uncertainties into otherwise deterministic models avoids irrelevant and impractical financial decision and help in framing a more feasible forecasting model.

The objectives of this thesis is to develop a suitable investment model for residential real estate along Dwarka Expressway, Gurugram, India using both deterministic and probabilistic financial analysis models- Discounted cash flow (DCF) model and Monte Carlo Simulation respectively. Master plan analysis and real estate market analysis led to selection of 'three' different stretches on Dwarka Expressway for which forecasting investment models is developed for better investment decisions.

The study divides different risks involved in the study area under five categories- economical, technological, political, legal and social risks. These identified risks are then classified under 7 quantifiable major risks categories that have an impact on the cash flow - Sales risks, Market growth risk, Leverage Risk, Development risk, Inflation risk, Interest rate risk and Taxation risk.

These risks with their range of possible values are incorporated into DCF model through Monte Carlo simulation (Probabilistic Model) and a comparison is made between their financial returns for choice of investing along Dwarka Expressway.

Index Terms **- Residential Real Estate, Risk Identification and assessment, Forecasting Investment Model, Monte Carlo Simulation**

I. INTRODUCTION

Dwarka Expressway, also known as the Northern Peripheral Road (NPR) is planned as per Gurugram Master plan 2021 and is strategized to connect Gurugram, Delhi and Manesar. Extending along 18 kms, 150-metre-wide ,8 lane, expressway connects Dwarka in Delhi to Kherki Daula toll plaza in Gurugram, intersecting NH-48 (Delhi-Jaipur Highway). This new mobility corridor on the border of Delhi and Gurugram, will boost access to IGI airport and is considered as the upcoming of real estate investment in NCR. The corridor has future growth potential and is certain to emerge as a real estate hub of NCR. Dwarka Expressway offers comparatively less expensive (lesser by 30-40%) residential choices to buyers besides giving an integrated development of mixed use and commercial segments. Two major development policies by the government and there are-

1. New Integrated Licensing Policy 2015 (NILP-2015): Under NIPL-2015, the least area norms for developing a residential colony has been reduced from 100 acre to 25 acre. Licenses will be granted for area beyond 20% allowed in each sector for Group Housing.

2. Transit Orient Development (TOD) Policy: Under the policy, areas which fall under particular distance on side of the MRTS Corridor will be eligible for increased Floor Area Ratio (FAR).Since metro is planned along expressway, it falls under this category.

Because real estate is a vital sector for economic and social development, investment analysis with risk is essential for making decision about buying or selling residential properties. Risk assessment requires careful analysis of certain variables (Ribeiro, et al., 2017).

This study will thus develop a forecasting Investment model for residential real estate incorporating risks around Dwarka Expressway, for better financial returns.

II. NEED IDENTIFICATION AND PROBLEM STATEMENT

Real estate appraisal is of great significance to many socio-economic agents, particularly to buyers and sellers for individual welfares, municipalities for tax purposes, financial institutions for loan procedures, and others for marketing activities, who desire to have a realistic picture of the real estate market performance for right and timely decisions (Kettani, et al., 1998).Residential real estate investment is significant for investors but the assessment of risk and return is not explored well. Present investment models shows very low risk and surplus returns (Domian, et al., 2015). Uncertainty in the real estate is increasing more in today's residential real estate market.

Undoubtedly, uncertainty will always play a role in real estate investing whether developers acknowledge it or not. Presently in real estate, return of a residential project is calculated using a discounted cash flow model (DCF-model) which gives a single point value. The return is generally wrongly interpreted because of lack of data and risks, therefore the cash flow model remains uncertain because the future is incompletely/incorrectly predicted (Suhonen, 2014). New financial strategies of real estate should focus on incorporating probabilities into forecasting models to take uncertainty into consideration (Peter, 2012).

III. Aim

To develop an investment model incorporating risks for investing in real estate residential projects around Dwarka Expressway, Gurugram.

IV. Objectives

1. To select different stretches of Dwarka expressway depending on different parameters of residential real estate in Gurugram.
2. To identify and assess the risks associated with residential real estate- Dwarka Expressway as case study.
3. To analyze risks for incorporating uncertainties into investment model for better decision making.
4. To prepare an investment model for deriving optimum financial returns in residential real estate projects around Expressway.

V. Research Methodology

To meet the research objectives, following research steps are proposed, which are also described in figure 1 below-

Step 1: Selection and analysis of different stretches based on certain parameters/characteristics
Step 2: Identification of risks (micro and macro level) and categorization into quantifiable risks (affecting cash flow)
Step 3: Data collection and Analysis: Historical data, trend analysis, Case examples, Case Studies data collection and analysis
Step 4: Developing an investment model

(a) **DCF** (Discounted cash flow model)- Deterministic

(b) **MCS** (Monte Carlo Simulation)- Probabilistic. This is done by feeding in range of values (Optimistic, most likely and pessimistic) into the DCF model for simulation up to 2000 runs. This would give a range of min, max and most likely values of IRR (Internal rate of return), NPV (Net present Value) and ROI (Return on Investment) and their probability distribution. For each stretch value of resultant risk will be factored as risk premium for all configuration of residential units.

Step 5: Comparison between Investment models among the stretches

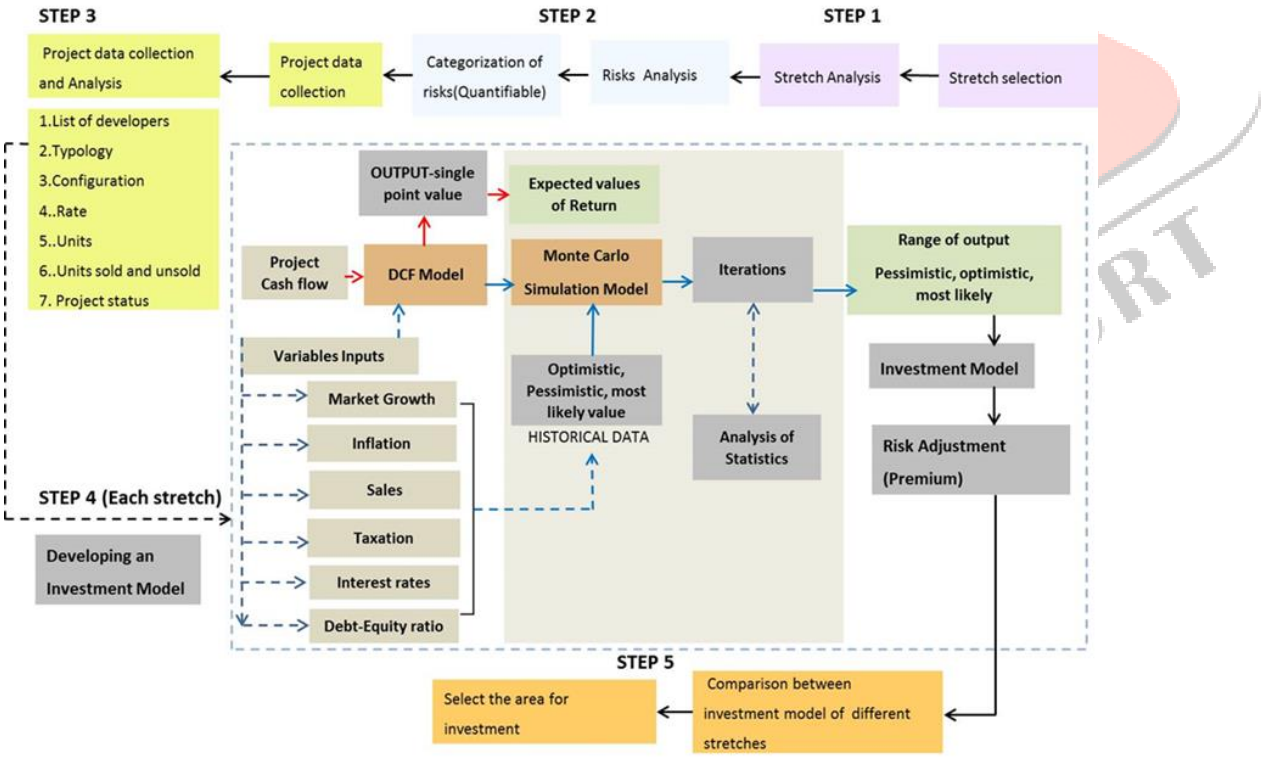

Figure 1 General methodology for developing an investment model for residential real estate

VI. Literature Review

The study focuses on following keywords and key findings from literature referred-

6.1 Residential Real Estate

The real-estate industry is inseparably linked to socio-economic growth and development. Increasing the availability and affordability of housing improves the overall real Estate market of a region. The main criteria affecting the sales of residential projects are the following: location, price, quality of work, neighborhood, brand value and reputation, financial transparency, Economic indicators (Interest rates, Investors etc.), Government policies (Burinskiene, et al., 2011). Residential real estate market is thus directly related to socio, economic, environmental, technological and other growth factors.

6.2 Risk Identification and assessment

The concept of risk and uncertainty has been discussed widely in the academia, but they can be defined as follows (Byrne, et al., 1984) (French, et al., 2004)):

- Uncertainty. This is anything that is not known about the outcome of a venture at the time when the decision is made.
- Risk. This is the measurement of a loss identified as a possible outcome of the decision.

(Zhai, et al., 2018) describes that Real estate projects have a lot of risks due to large investment, long cycle, multiple relations, and uncertain factors. It uses Monte Carlo method to build probability distribution model analyze the residential risk factors. It identified project related risks based on project characteristics, historical data and determined range of values for all risks. Development Risk, social risks, political risks, economical risks, legal risks , technological risks, operational risk, Business risk, leverage risks are some of the major category of risks encountered by Residential real estate market with other project specific risks.

6.3 Forecasting Investment Model

6.3.1 **DCF Model:**

Discounted cash flow is an income valuation approach where a discount rate is applied to a series of cash flows for future periods to discount them to a present value (IVSC, 2011).To use discounted cash flow analysis to evaluate real assets it is necessary to (Damodaran, 2002)

(1)Measure the underlying risk associated with the real asset investment and to estimate an appropriate discount rate accordingly.

(2)Estimate future cash flows of the real asset.

(Kelliher, et al., 2000)states three components of DCF model:

(1)Amount of future cash flows, (2) Timing of future cash flow, (3) An appropriate discount rate

6.3.2 **Probabilistic Model:**

Deterministic models have certain limitations when it comes to incorporating risks or uncertainties. Probabilistic Model incorporates a range of input values from pessimistic, most likely to optimistic values, incorporating risks and uncertainty into their investment models for optimum results.

6.4 Monte Carlo Simulation

MCS assigns probability distributions or value ranges as input parameters for each input/Risks. MCS then randomly selects the input values from these assigned ranges or probability distributions and carries out the process. There are multiple outcomes that are analyzed using statistical tools (e.g. mean, range, standard deviation) (French, et al., 2004) (Pyhrr, 1973)

VII. STRETCH SELECTION

Dwarka Expressway is witnessing new residential developments as the corridor is mostly residential in land use. There is some commercial and mixed land use as well for overall development of facilities for a real estate hub.

Many renowned estate players like Sobha, Godrej, Hero Homes, TATA, Mahindra, Shapoorji Pallonji, etc. are involved in residential projects with Cost lesser(30-40%) that main Gurugram and Golf course Extension.

According to (Magicbricks, 2016), market has most demand for 3BHK, which forms 50% of total supply, followed by 2BHK with 30% demand, followed by 4BHK and above with around 15% demand and 1BHK with around 5% demand. Major demand is in sectors Gurugram side, with optimum price, followed by central then Delhi side.

Three stretches are chosen based on parameters like Completion of Dwarka Expressway, connectivity, social infrastructure, Metro, public transport, property prices, Services, demand and supply etc. Figure 2 shows the stretch selection and following 3 stretches is briefed below-

7.1 Stretch 1:

- Gurugram Side, close proximity to central Gurugram, Golf course area, Delhi-Jaipur highway(NH-8)
- The demand is highest in this stretch
- Size of sector 37 D increased according to master plan 2031, boosting more residential density, thus optimizing the overall price.
- Commercial and Mixed used projects
- Dwarka Expressway is functional, public Ready to move in properties.
- Market Price range: Rs/sq.ft 4930-5250

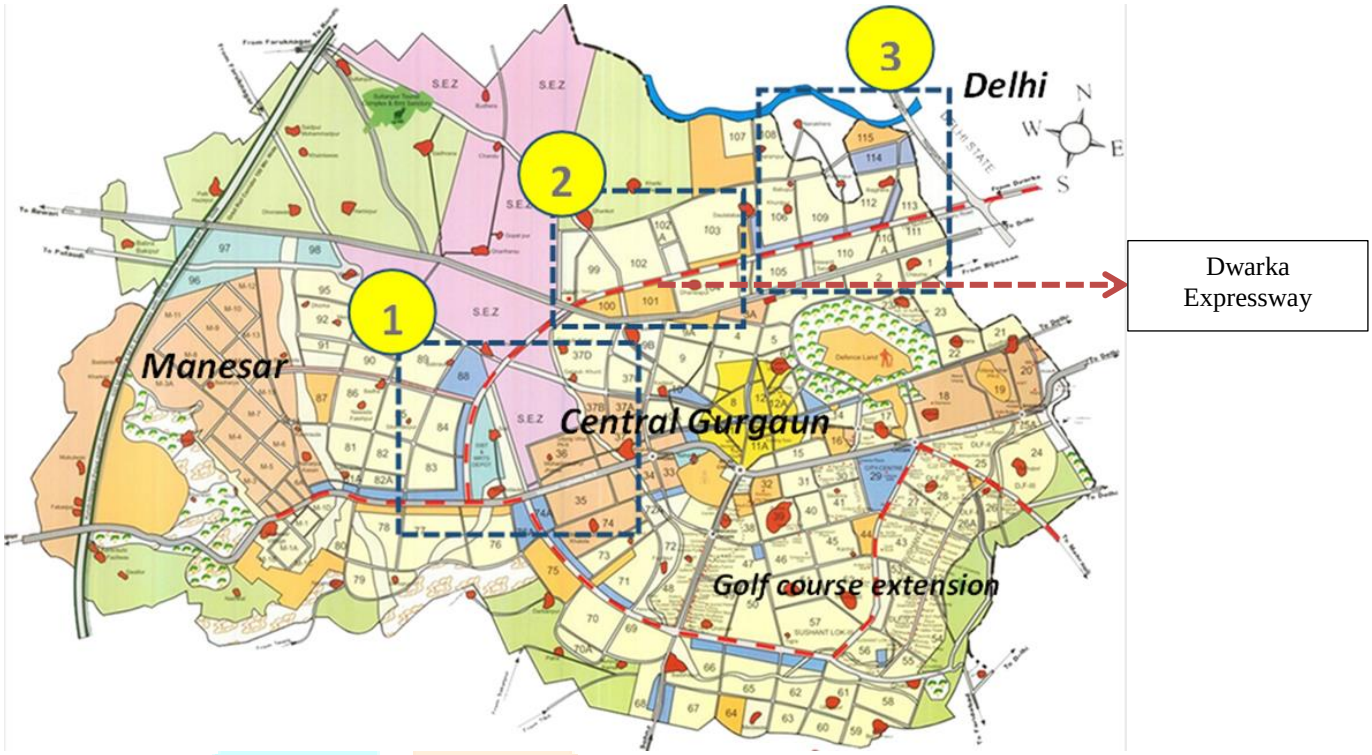

Figure 2: Master plan showing different stretches along Dwarka

7.2 Stretch 2:

- Central side, Demand high due to proximity to DE and proposed metro.
- Dedicated green land as per master plan
- Master plan 2031, converts SEZ into residential and commercial sectors allowing a high-density residential cluster.
- Greater demand, lower price range(Rs/sq.ft 4150-5160)

7.3 Stretch 3:

- Lie very close to Dwarka Sector 21, and benefit from **proximity to Delhi, and Udyog Vihar**.
- The supply costlier than 1 crore forms a significant 36% of the supply.
- Comparatively lesser demand because of its distance from Dwarka Expressway and higher cost.
- Market Price range-
  Rs Rs/sq.ft 4930-5250

Investment models are developed for these three stretches for Deterministic and probabilistic analysis. Risks identified (described in section below) are incorporated in the DCF analysis by Monte Carlo simulation.
This is the procedure for stretch selection and analysis for residential projects for future scope of study.

VIII. Identification and Categorization of Risk

In this study, 32 Risks have been identified under Social, Economic, Technological, and Legal risks, their impact in cash flow is studied and then categorized into 7 major categories of risks. They are then used in Probabilistic Model (Monte Carlo Simulation) with their range of possible values (Pessimistic, Optimistic and most likely values) found through case studies, historical trend analysis, primary and secondary data. The major risks are:

1. Sales Risk (Demand and supply)
2. Interest rate risk
3. Market growth rate risk
4. Inflation Risk (Escalation)
5. Development/construction risk
6. Leverage risk (Debt-Equity Risk)
7. Taxation risk

IX. Developing Discounted Cash Flow Investment Model (Stretch 1)

9.1 Case Study Details:

Table 1: Input data of project for DCF model

Cash Flow Input Data For DCF Model (Stretch 1)	
Project Type	Residential housing
Land Area and built up area	270072 sq.ft, 913395sq.ft. respectively
Land cost, Hard cost, soft cost (Market price 2019)	3500/sq.ft., 1550/sq.ft, 350/sq.ft respectively
Total project cost	268.07
Time of sales	6years
Duration of construction	43 months
No. of flats and Type of flats	650 flats- 2BHK(Type 1- 950sq.ft, Type 2- 1200 sq.ft), 3BHK(Type 1- 1350sq.ft, Type 2- 1550 sq.ft), 4BHK (1700sq.ft)
Absorption rate of different configurations (2,3,4 BHK)	2 BHK-32%, 3 BHK 55%, 4 BHK-13% (Magic bricks report,2016)
Sale pattern and price	As per developer's project requirement
Sales type	CLP –Construction linked plan (70%), Down payment plan (30%)
Loan amount :	80 Cr, taken equally in a period of 10 months
Debt equity Ratio:	0.43
Rate of interest	18%
Loan repayment Pattern	When cash flow gets positive
Inflation (RBI)	4%

9.2 Analysis of Results of DCF Model

Table 2: Analysis of results of DCF Model

Time considered for model	6 years							
Duration of construction	43 months							
Discount Rate	7%							
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Cumulative cash flow(in Cr)	-94.53	-21.91	-26.75	13.28	31.73	52.33	70.44	72.19
PV of cash flow(in Cr)	-94.53	67.87	-4.23	32.68	14.07	14.69	12.07	1.09
Cumulative PV(in C)	-94.53	-26.66	-30.89	1.79	15.86	30.55	42.62	43.71
Net Present Value -NPV(in Cr)	**43.71 Cr**							
Internal Rate of Return(in Cr)	**25.23%**							
Total Profit	**72.19 Cr**							
Return on Investment (ROI)	**24.69%** on total investment of 292.38 Cr							

The DCF Model is developed according to developer's requirement keeping in consideration the existing market price for cash inflow (revenue from sales) and outflow. Figure 2 shows yearly cash flows (cash inflow, cash outflow and cumulative cash flow) for the DCF model. NPV ((Net Present Value), ROI (Return on Investment), IRR (Internal Rate of Return) are calculated for the project. 7 risks identified with their probabilistic range of values (Pessimistic, most likely and optimistic value) are incorporated in DCF Model to get a range of possible results as shown in section VIII.

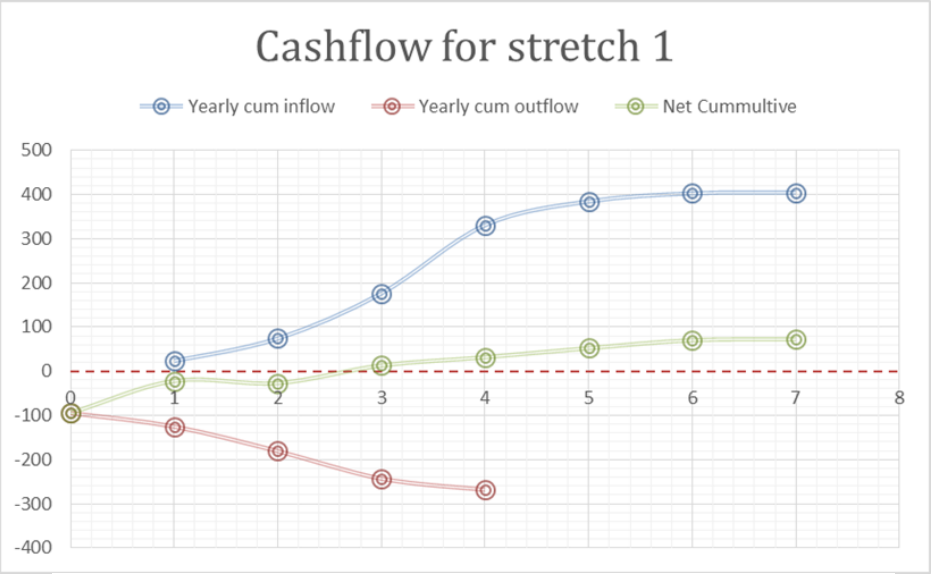

Figure 3:Yearly Cashflow of DCF Model stretch 1

X. DEVELOPING MONTE CARLO MODEL (STRETCH 1)

10.1 Data Analysis from Case Studies

Severn existing case studies and many other case examples from Dwarka Expressway were studied in each stretch and range of values(Pessimistic, most likely and optimistic) for identified risk are mentioned. These range of possible values are derived from case studies, case examples, historical data , and literature.

Table 3: Case study data analysis forpossible range of Input variable

10.2 Steps undertaken for Monte Carlo Simulation-

Stretch 1										
Case Studies	**Project 1**	**Project 2**	**Project 3**	**Project 4**	**Project 5**	**Project 6**	**Project 7**			
Built up area(Sq.ft)	1595447	178691	1293789	1353858	1501719	1617236	1270685			
Site area (Sq.ft)	191454	1489090	842459	162463	180206	194068	152482			
Project cost(Cr.)	370.145	345.47	300.16	314.096	348.4	375.2	294.8			
Input Variables								**Pessi-mistic**	**Most likely**	**Opti-mistic**
Interest rate(%)	18.25	19.85	16.50	19.54	15.00	17.85	20.00	20%	18%	15%
Taxation										
Material (%)	22.05	23.00	21.22	21.33	21.45	20.00	21.75	23.00%	21.50%	20.00%
Labour(%)	18.50	17.2	19.00	17.75	18.15	17.00	18.20	19.00	18.00	17.00
Debt equity Ratio	0.55	0.30	0.63	0.34	0.50	0.42	0.38	0.63	0.45	0.30
Absorption Rate for 2 BHK	88.45	86.23	85.00	87.33	90.00	85.47	89.67	85%	87.50%	90%
Absorption Rate for 3 BHK	92.70	94.09	90.00	93.80	92.34	95.00	93.09	90%	92.50%	95%
Absorption Rate for 4 BHK	83.78	80.00	84.67	82.44	85.00	82.45	83.65	80%	82.50%	85%
Rate/sq.ft (2019)	5250	6250	5650	6020	4930	5450	4500	4930	6250	5250

Step 1: Risk considered with Probabilistic values of risk- all range of risks values are mentioned below to be used in MCS.

Table 4: Risk considered with Probabilistic values of risk

Stretch 1					
Risk identified	**Effect in cash flow**	**Pessimistic**	**Most likely**	**Optimistic**	**Source**
Demand and supply	***Sale of flats 2 BHK***	85%	87.50%	90%	1.Historical Data 2. Anarock research report 2018,2019
	Sale of flats 3 BHK	90%	92.50%	95%	
	Sale of flats 4 BHK	80%	82.50%	85%	
Market growth	***Price of flats***	4930	6250	5250	Sqaureyards, 99acres(rate-2019)
Leverage Risk	***Debt-equity ratio***	0.63	0.45	0.30	Case study and Literature
Development risk	***Cost overrun***	5%	3%	2%	Literature
Inflation	***Inflation***	4.5%	4%	3.43%	RBI
Interest rate	***Interest rate***	20%	18%	15%	RBI
Taxation policy	***Material Tax***	23.00%	21.50%	20.00%	Case studies
	Labour Tax	19.00	18.00	17.00	

Step 2: The risks are incorporated In the DCF model & value of each risk will occur for all the numbers in the range as in table 3:
Formula used- *Randbetween [Mostlikely x{(Pessimistic/Most likely),(Optimistic/Most likely)}]*

Step 3: The data For NPV, IRR in the earlier DCF Model will undergo simulation for 2000 number of inputs as the value of each risk will vary from Pessimistic, Most likely and Optimistic Value by What if Analysis**.**

Step 4: The Probability distribution for each outcome is calculated for all 2000 runs.
Formula used *- NORM.DIST (Value, Average, Std deviation, False)*

10.3 Analysis of Results-

1. The bell curve and the histogram is formed
   a. *Within 1sigma or 1 Standard deviation the probability is:68%*
   b. *Within 2 sigma or 2 Standard Deviation the probability is:95%*
   c. *Within 3 sigma or 3 Standard Deviation the probability is:99.7%*
2. The Minimum, Maximum and Average value and Standard Deviation is collected, as shown in table 4.

Table 5: Analysis of resultsby Monte Carlo simulation (incorporating risks)-

Risk Analysis Results	***Min***	***Most likely***	***Max***	***Std. dev***	***Standard deviation %***
NPV	*6.13*	*36.95*	*63.91*	*10.1995*	*27.60%*
IRR	*10.95%*	*22.33%*	*31.85%*	*0.043529*	*15.41%*
ROI	*8.25%*	*21.75%*	*37.03%*	*0.05518*	*25.37%*

3. Graphical Analysis:

Monte Carlo simulation runs up to 2000 gives possible values for all the runs for NPV, IRR and ROI. The normal distribution curve shows all possible values of NPV, IRR and ROI. X Axis represents their possible values and Y Axis represents the probability of their occurrence.

Probability distribution for NPV, shows value of NPV ranging between 6.13 to 63.91 (on x-axis). Most likely value comes out to be 36.95Cr. Similar explanation holds for IRR and ROI.

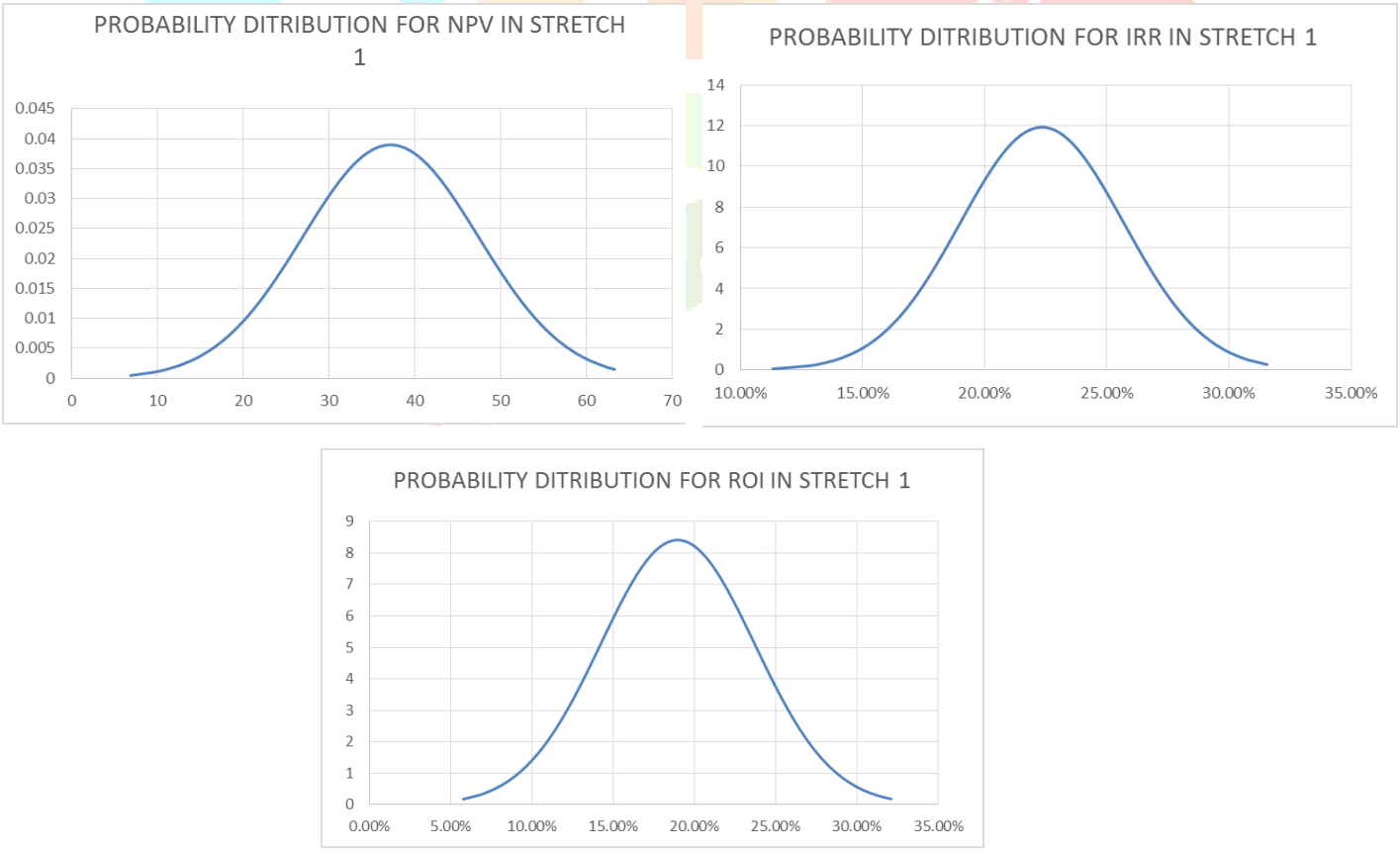

Figure 4: Normal distribution curve for-(a)NPV (b)IRR and (c)ROI

XI. INVESTMENT MODEL RESULTS

11.1 DCF Analysis and Monte Carlo Simulation Analysis (With risk)

Table 6:Investment Model (DCF and MCS)

Investment model -Stretch 1						
Profit under different situation						
DCF Returns	*NPV* : 43.71		*IRR:* 25.23%		*ROI:* 24.69%	
Minimum profit targeted	NPV: 40.72		*ROI:* 23.00%			
Incorporating Risk (Monte Carlo Analysis)						
	Min	**Most likely**	**Max**	**Std. deviation**	**%**	
NPV	6.13	36.95	63.91	10.20	27.60%	
IRR	10.95%	22.33%	31.85%	0.034426	15.41%	
ROI	8.25%	21.75%	37.03%	0.055182	25.37%	
Risk Premium To be taken						
Premium (per unit)	**NPV to be recovered**	**Type 1**	**Type 2**	**Type 3**	**Type 4**	**Type 5**
DCF returns(43.41 Cr)	6.76	0.0074	0.0093	0.0105	0.0120	0.0132
Minimum Profit target(40.72Cr)	3.76	0.0041	0.0052	0.0058	0.0067	0.0074

11.2 Inferences-

1. With duration as 6 years the Investment at Dwarka Expressway Residential projects in stretch 1 will give an NPV of 43.71 with discount rate @ 7% and an IRR of 25.23%.
2. Developer's targeted profit (Return on investment) is 23.00% and NPV targeted is 40.72 Cr.
3. With the incorporated risk, the most likely Return on Investment through Monte Carlo simulation is 21.75%, NPV is 36.95 and IRR is 22.33%. The optimistic and pessimistic values of ROI, IRR and NPV are also given in the table 5 above.
4. To adjust the risk, the premium would be collected from the flat owners assuming 90% absorption rate of total flats so the risk premium would be collected as shown in Table 5 above.

a) NPV to be recovered for DCF returns at 43.71 Cr comes out to be 6.76 Cr, and a premium per unit has to be adjusted.
b) NPV to be recovered for min profit target at 40.72 Cr comes out to be 3.76 Cr, premium per unit has to be adjusted.

Note: In similar process like stretch 1, DCF analysis and Monte Carlo analysis of rest of the two stretches are also done. Table 6 below shows a comparison of results of all the three stretches.

Table 7: Comparison of results for investment models for different stretches

Comparison of Investment Model of 3 Stretches				
		Stretch 1	**Stretch 2**	**Stretch 3**
No of flats		650	680	720
Total Investment (Cr)		268.07 Cr	226.77 Cr	341.77 Cr
DCF return				
NPV (Cr)		43.71	36.98	75.26
IRR (%)		25.23%	22.48%	29.28%
ROI (%)		24.69%	21.46%	25.82%
Incorporating Risk (Monte Carlo Analysis)				
IRR (%)	Pessimistic (%)	10.95%	8.26%	7.37%
	Most likely (%)	22.33%	18.18%	24.15%
	Optimistic (%)	31.85%	27.19%	36.87%
	Std. deviation (%)	15.41%	19.99%	22.90%
ROI (%)	Pessimistic (%)	8.25%	5.48%	3.30%
	Most likely (%)	21.75%	19.36%	24.15%
	Optimistic (%)	37.03%	34.71%	45.67%
	Std. deviation (%)	25.37%	29.06%	37.69%
NPV	Pessimistic (%)	6.13	2.72	0.63
	Most likely (%)	36.95	30.48	56.14
	Optimistic (%)	63.91	57.88	110.05
	Std. deviation %	27.60%	34.92%	38.91%

XII. RESULTS AND DISCUSSION

Table 6 above shows the following inferences-
1. IRR for stretch 1 is 25.23%, for stretch 2 is 22.48%, for stretch 3 is 29.28%, so stretch 3 is giving the highest return
2. In case of NPV and ROI also Stretch **3 > Stretch 1 > Stretch 2** So stretch 3 is giving the highest return
3. The standard deviation for NPV for stretch 1 is 27.60%%, for stretch 2 is 34.92%, for stretch 3 is 38.91%, so **Stretch 3> Stretch 2 > Stretch 1.** Hence the deviation from most likely value in least in Stretch 1.
4. To manage the risk premium is to be taken from the flat owners, so to achieve the risk free return rate the premium for Stretch 1 is 0.0601, Stretch 2 is 0.0515, and Stretch 3 is 0.1057. This is showing the risk premium is highest in Stretch 3. So investment in Stretch 3 is very risky.
5. Now investing in Stretch 3 gives good return but the risk is highest, Stretch 2 gives the least return but risk is moderate, Stretch 1 gives the moderate return but the risk is least. **So investing in Stretch 1 will be beneficial**

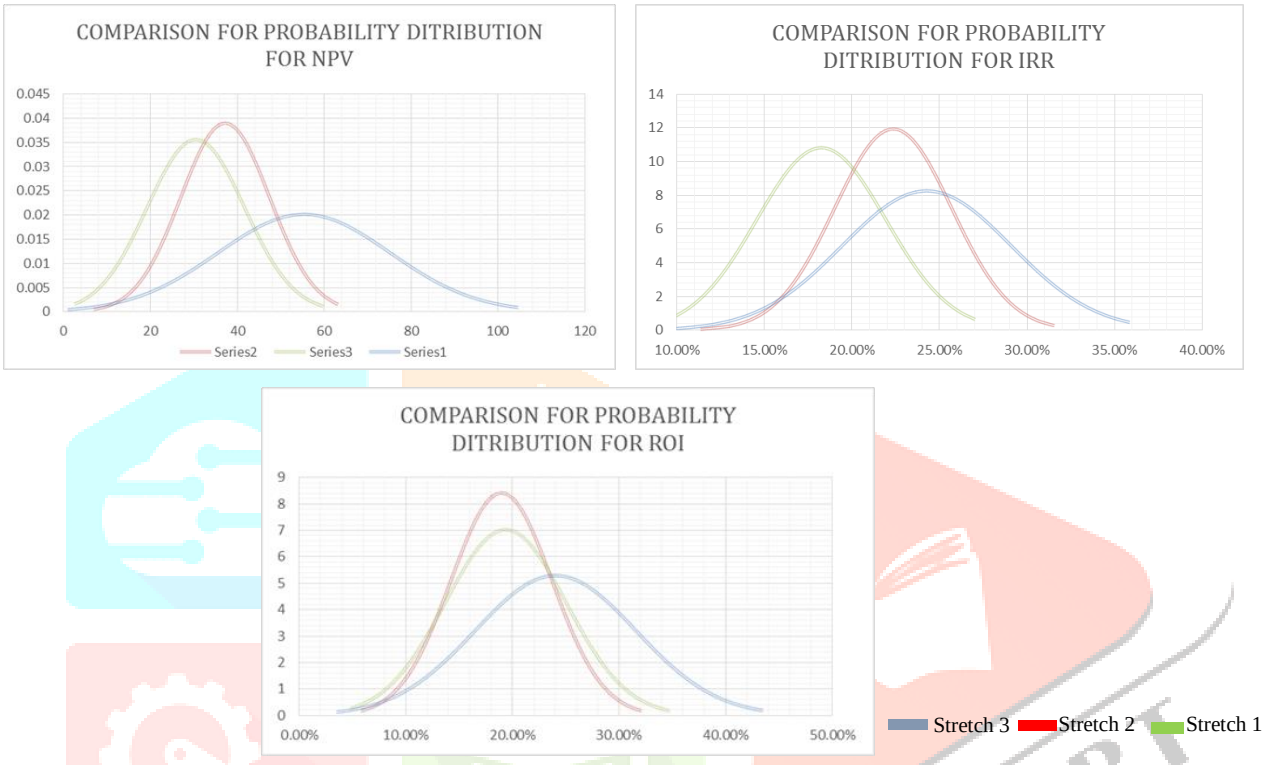

Figure 5: Comparison for probabilty distribution for-(a)NPV, (b) IRR, (c)ROI

12.1 Observations (NPV, IRR, ROI)-

1. The Highest value NPV, IRR and ROI for different stretches are Stretch 3> Stretch 2 > Stretch 1
2. The Standard deviation is Stretch 3> Stretch 2 > Stretch 1
3. Now as per the risk Stretch 3> Stretch 2 > Stretch 1 as probability for most likely NPV varies accordingly.

12.2 Inference-

1) Now investing in Stretch 3 gives good return but the risk is highest, Stretch 2 gives the least return but risk is moderate, Stretch 1 gives the moderate return but the risk is least. **So investing in Stretch 1 will be beneficial**
2) If any investor is trying to invest in all the three stretches his investment should be 50% for stretch 1, 25% for stretch 2 and 25% for stretch 3.

12.3 Inference for future applications-

1. It can be noticed that a project with least risks and optimum return should be undertaken by the developer as compared to a project with higher returns and higher risks. This is applicable for all the projects. More standard deviation in probabilistic model indicates higher risks.
2. Therefore, for any project, comparison between IRR, ROI, and NPV (along with their pessimistic, optimistic and most likely value) will give a fair and reasonable reason to choose where to invest for optimum results.

12.4 Method Used, Its Advantages and Limitations

Advantages:
1. DCF model has certain limitations when it comes to uncertainties as it does not includes risks and uncertainties. This Study uses a tool, Monte Carlo simulation (MCS) that simulates the DCF- model with random risks values multiple times. It used certain quantified risks (which were identified in the case study) as input variables with ranges of possible values (through case studies, historical trend analysis, primary and secondary sources) to be used in the forecasting model.
2. MCS model incorporates variation in market value on DCF model which gives a more realistic forecasting model.

3. The other advantageous strategy taken up in the calculation framework of the DCF and Monte Carlo model is input variables like absorption rate of configurations, selling pattern according to the existing real estate market in Dwarka Expressway.
4. It sets relation between capital expenses and return within an optimum time span (taken as 6 years) for optimum return (which is one of main considerations of an effective DCF Model)
5. Selling price (as per market), loan drawn and repayment schedule for optimum results have been considered. This model can be applied on other projects after studying the market scenarios and its input variables.
6. Stages of sales is worked out as per strategies of new investment models of renowned builders, which prefer to sell majority of its completed and to be completed projects which are at an advance stage of construction instead of selling off a plan.
7. Risk is strategically divided among all configurations as risk premium as per market rate, which is surely a more reliable procedure.

Limitations:
1. The interest on loan depends upon banks and financial institutions and subjected to change as per their policies.
2. Construction cost and Price of flats may also vary as per project.
3. Forecasting model also depends on future development potential of the property, which if not foreseen correctly may lead to uncertainties. For e.g., Dwarka expressway has future development potentials so it is possible to forecast its sales possibility, supply and absorption. A project unless thoroughly studied with respect to its location, demand and supply, unsold inventory, historical trend, investment may become risky.
4. Unknown- Unknown situations- Force Majeure, Pandemic (like covid-19), Black swan events can affect the sales structure, cause delay, increase the material cost, or reduce the demand and supply whatever the case may be.

12.5 Summary:
The biggest advantage of knowing these concepts is the up gradation of mindset when it comes to handling real estate problems. New possibilities open up when uncertainty becomes part of the analysis. There are endless possibilities with real option analyses and creative problem solvers will be the greatest benefactors.

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