# PULL OUT OF TATA NANO FROM SINGUR- MAY BE A JOURNEY FROM NOW-OR-NEVER NPV TO FLEXIBLE, UNCERTAIN REAL OPTION PATH

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## Abstract

*It was Stewart Myers who pioneered the concept that financial investments generate real options and also coined the term real options in 1977. While many proponents of real options like Copeland and Antikarov (2001) and Trigeorgis (1995) etc. are critical of NPV analysis. That is why, they claim that in coming 10 years, real options will replace NPV as the central paradigm for investment decisions and it would dominate the capital budgeting process in next decade. Traditional NPV will no longer last in present highly volatile and uncertain era. Firm must apply flexibility and take shelter under Real Option path and can avail the scope of enhancing the project worth and start invest at right time and after availing right information. Tata's Nano Story is nothing but a Holdup problem, further uncertainty and delay will enlarge the quasi-rent of it's ancillaries and in that way it will further reduce the production cost of Nano and enhance project NPV. Hence we can expect Tata's Nano will enter in the market when entire world car market and global economy will revive a-little and Commitment of Ratan Tata about Rs.1 lakh Nano car will be strategically feasible. In the process of project evaluation, the real option approach to Capex decision making can contribute for a significant amount. In this paper both Black & Scholes and Binomial method of real option are discussed. In principle, both of them allow the financial analyst to overcome the constraint on expected values inherent in the traditional DCF method. A real life application of this-- evaluating a R&D project is a good example which shows the power of the real options approach. This paper analyses the Tata-Nano case by using real option mechanism.*
***Key Words:*** *Real Options, NPV, Flexibility, Uncertainty, Hold-Up problem.*

## Introduction

## History of real option:

The trade of options on real assets is much older than transactions involving money. In 1728 Genesis told the story of Joseph, who recommended to the Pharaoh that he invested heavily in grain after learning about the pharaoh's dreams. Joseph recognized this is to be the best path into the future: exercising the option & buying all available grain now & during the coming seven productive years in order to save it for the 7 years of famine in the Egypt. The risk Joseph & his contemporaries faced in Egypt was to die of starvation. The real option available to them was to hedge against that risk by saving grain. The exercise price to be paid was the creation of appropriate storage containers to store the grain.

Copeland and Antikarov (2001) even attributed on of the earliest options to Aristotle's tale of Thales. By entering into an option agreement with the owner of olive presses at a fixed price, Thales was able to make a fortune in sub-leasing the presses to other users at much higher prices when the olive harvest turned out to be bountiful beyond expectations. However, it was in financial markets of the early twentieth century that option trading flourished.

It was Stewart Myers who pioneered the concept that financial investments generate real options and also coined the term real options in 1977. His work stimulated intense discussion, & the early 1980's doubts regarding the applicability of traditional DCF for investment decisions related to risky projects increasingly surfaced. Using the analogy with options on financial assets, investment flexibility is often called a real option (Dixit & Pindyck, 94 & Trigeorgis,95 & 96). Real options are options on real assets that can be defined simply as opportunities to change consists of rights but obligations to take some action in future (Dixit & Pindyck,95, Luehrman,97). Using option pricing models, it is possible to quantify these opportunities & to indicate when these options should be optimally exercised. The role of real options analysis is to quantify how much opportunities are worth today. Like financial options, real option can be divided into call & put options.

Luehrman (98) suggests a metaphor: Think of options as a different way to manage a garden. Once the gardener has committed the garden space to tomato seedlings, the decision is irreversible. There is a considerable uncertainty about climate, weeds, predators, & so on. Perhaps the most significant issue is when to pick the tomatoes. The purely passive gardener shows up on the last day of the growing season & picks the ripe ones to eat. The active gardener would visit the garden more frequently to cultivate it. As the tomatoes become perfectly ripe, the gardener would pick them immediately: if they were rotten, the gardener would not bother picking them. Between those extremes is a more difficult decision: Some could be picked now but would be better with another week on the vine, while some are not yet edible & definitely remain. Luehrman states, "In option terminology, active gardeners are doing are doing more than merely making exercise decisions. They are monitoring the options, looking for ways to influence the underlying variables that determine option value and ultimately outcomes."

## Classification:

The following list of common real options & sample scenarios is adopted from "Real Options: Managing strategic investment in an Uncertain World" by Amran & Kulatalika,98.

1. **Waiting-to-invest options:** The value of waiting to build a factory, say, until better market information comes along may exceed the value of immediate expansion. The purchase of an off-shore lease can choose when, if at all, to develop property.
2. **Growth options:** An entry investment may create opportunities to pursue valuable follow-on projects.
3. **Flexibility options:** An option to reallocate resources or switch has value. For example building 2 plants instead of 1 to serve markets on 2 continents creates the option of switching production from one plant to the other.
4. **Exit or Abandonment options:** The option to walk away from a project in response to new information increases the value of the project. These options are particularly for large capital intensive projects such as nuclear plants, airlines & railways. These are also important for projects involving new products involving new products where their acceptance in the market is uncertain.

5. **Learning options:** An initial investment creates better information about a market opportunity & whether more capacity should be built out.
6. **Temporary-stop or shut down options:** For projects with production facilities, it may not be optimal to operate a plant for a given period if revenues will not cover variable costs. For example if the price of oil falls below the cost of extraction, it may be optimal to temporarily shut down the oil well until the oil price recovers.

Following are the determinants of Option Value (for a Call Option):

1. **Stock price (S):** The higher the price of the underlying stock, the greater the option's intrinsic value is.
2. **Exercise price (K):** The higher the exercise price, the lower the intrinsic value is.
3. **Interest rates ($R_f$):** The higher the interest rates, the more valuable the call option is.
4. **Volatility of the stock price (σ):** The more volatile the stock price, the more valuable the option is.
5. **Time to maturity (T):** Call options increase in value the more time there is remaining to maturity.

**Real options: Link between Investment & Black & Scholes Inputs:**

| Investment | Symbol | Real Option |
|---|---|---|
| PV of project free cash flow | S | Stock Price |
| Outlay to acquire project assets | K | Exercise Price |
| Time the decision can be deferred | T | Time to expiration |
| Time value of money | R | Risk free rate |
| Risk of project assets | σ | Risk of returns |

The analogy between financial options & corporate investments that create future opportunities is both intuitively appealing & increasingly well accepted (Timothy A. Luehrman, 98). In coming 10 years, real options will replace NPV as the central paradigm for investment decisions and it would dominate the capital budgeting process in next decade (Copeland & Antikarov, 2001). In NPV, operating flexibility, valuable follow-on investment projects are ignored. Many investments have uncertain payoffs that are best valued on Option Approach. NPV deals with risk-adjusted discount factor, which is very much questionable.
While many proponents of real options like Copeland and Antikarov (2001) and Trigeorgis (1995) etc. are critical of NPV analysis, it is not necessarily NPV analysis that is fault per se, but rather the improper use of it in many cases. One can use NPV analysis 'correctly' if all options (invest, do not invest, delay, etc.) are known at the start of the project such that they all can be evaluated. This is why decision trees were developed. The benefit of real options analysis is that it incorporates volatility, whereas decision trees (which rely on NPV analysis) only compute expected values.
Here is a numerical example in the same line. For a Rs100 lakhs investment, then there is a 50% chance of earning of 50 lakhs/year for 4 years & 50% chance of earning nothing per year. NPV of average cash flow = (20), (Negative NPV, Reject the project).

Now if Rs10 lakhs investment is followed by additional Rs90 lakhs investment, only if it can be find out that it can be earned Rs50 lakhs/year for the next 4 years (50% likely). NPV of cash flow, including option = 22 (Positive NPV, Accept the project).
35 years after the debut of the famous Black-Scholes formula, & 31 years after Myers coined the term, real options has yet to catch on at most companies. In 2000, Bain & Co. conducted a survey of 451 senior executives across more than 30 industries regarding their use of 25 management tools. Just 9% used real options, which ranked bottom of the list. Another survey report says only 11.4% CFOs used real option as a capital budgeting tool, compared with 85.1% sensitivity analysis & 66.8% for scenario analysis. As for basic capital budgeting tools, NPV topped the list (Ryan's study, 2002).
"It took decades for NPV to become widely accepted in practice," points out Triantis. "Real option is an even more sophisticated tool. It's going to take few decades as well as to be well integrated in corporations."

## Real Concerns:

Will real options take root? Why companies have been show to adopt this valuation technique? Reason can be finding out in the following comments made by Van Putten & MacMillan (2004): "For all their theoretical attractiveness as a way to value growth projects, real options have had a difficult time catching on with managers. CFOs tell us that real options overestimate the value of uncertain projects, encouraging companies to over-invest in them. In the worst case, they grant excessively ambitious managers a license to gamble with shareholder's money."
Although the general concept of real options is clear, their specific benefits for individual investment decisions are not. Options are still an obscure mathematical tool & the partial differential equation at the core of the option pricing model leaves management with a blank face. The complexity of the stochastic calculus prevents practitioners to see the new decision space created by real options & to move inside this space at ease (Favato, Mills & Weinstein, 2005).
Real option is a black box. The sophisticated mathematics of real options & the consequent lack of transparency & simplicity are real concerns. The quest for statistical precision reached its paradox in 2002, when Mun observed that in the limits, results obtained with the use of fancy binomial lattices tended to approach those derived from the Black & Scholes Model. To prove that, he performed a 10000 simulation test, making approximately 5*109 nodal calculations. This draining task was equivalent to 299 Excel spreadsheets or 4.6 GB of computer memory.
Real option discounts management realities. Is the strength of real options also its Achilles' heal? Critics say that because real options don't expire according to contract as financial options do, managers can't be counted on to pull the plug on a project when they should.
Real options is sometimes a little like an extreme sport- people look at it & say – "Wow, that's really neat," say Triantis, "It's fun to watch, but when you actually sit down & try to do it yourself, it's not so easy."

## Valuing a project using the Black-Scholes option pricing formula: A simple example of the option to expand:

ABC Corporations is considering replacing each of its existing six widget machine with new ones. The new machines cost Rs1000 each & have a 5 year life. The management has estimated the expected cash flows, These flows are defined as the incremental cash flow of replacing a single old machine by a new machine & include the after tax savings from introducing new machine, the tax shield on incremental depreciation from replacing an old by a new machine & the sale of the old machine. It is important to emphasize that the management does not know the exact realization of these annual cash flows, but knows only their means. The expected cash flows for the new machines are given below:

| | **A** | **B** | **C** | **D** | **E** | **F** |
|---|---|---|---|---|---|---|
| Year | 0 | 1 | 2 | 3 | 4 | 5 |
| CF of single machine | -1000 | 220 | 300 | 400 | 200 | 150 |

The financial analyst working on the replacement project has estimated a cost of capital for the project of 12%. Using these expected cash flows & a cost of capital of 12% for the project. The analyst has concluded that the replacement of a single old machine by a new machine is unprofitable, since the NPV is negative (-- 67.48).

Now comes the (real options) twist. The line manager in charge of the widget line says:"I want to try one of the new machines for a year & learn the true realization of its cash flows. At the end of the year, if the experiment is on the line with the new machine, if I do not try one of the new machines, I will never know their true cash flows."

Does this change my previously negative conclusion about replacing a single machine? The answer is 'yes'. To see this, I now realize that what I have is a package:

- Replacing a single machine today: This has a NPV of –67.48.
- The option of replacing 5 more machine in 1 year: Then I view each such option as a call option on an asset which has current value of: S = 932.52
- A variance of 40% & an exercise price K = 1000. Of course, these call options can be exercised only if I purchase the first machine now, in effect the real options model will be pricing the learning costs.
- Suppose that the Black & Scholes option-pricing model (1973) can price this call option, say if the risk free rate is 6%.]

**The option to expand**

| year | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| CF | -1000 | 220 | 300 | 400 | 200 | 150 |

Discount rate: 12, Risk free rate: 6%, No. of machine bought next year: 5

B-S option pricing formula

| | | |
|---|---|---|
| S | PV of Cash Inflows | 932.52 |
| K | Exercise price= Machine cost | 1000 |
| $R_f$ | Risk free rate | 6% |
| T | Time to maturity of option in years | 1 |
| σ | Volatility | 40% |
| $D_1$ | $(In(S/K) + (R_f+0.5\ \sigma^2)T)/\ \sigma*T^{1/2}$ | 0.1753 |
| $D_2$ | $D_1\ -\ \sigma*T^{1/2}$ | -0.2247 |
| $N(D_1)$ | | 0.5696 |
| $N(D_2)$ | | 0.4111 |

Option Value = $S*N\ (D_1) – K*e^{—R}{}_fT*N\ (D_2)$ = 143.98

Hence, value of the whole project = NPV of the first machine + 5 options to acquire = --67.48 + 5*143.98 = 652.39.

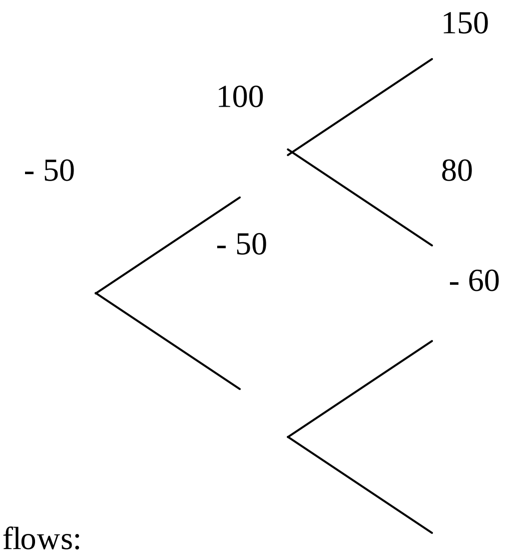
Thus, buying one machine today & in the process, acquiring the option to purchase 5 more machine in one year is a worthwhile project. One critical element here is the volatility ( i.e.

lower the uncertainty), the less worthwhile this project is. The relation between the B & S value of the project & its standard deviation is as follows:

| **volatility** | **0%** | **1%** | **4.75%** | **10%** | **20%** | **30%** | **40%** | **50%** | **60%** | **70%** |
|---|---|---|---|---|---|---|---|---|---|---|
| Project value | --67.48 | -63.5 | 0 | 97.2 | 283 | 468.4 | 652.4 | 834.6 | 1014.6 | 1191.8 |

## Binomial models & the abandonment options:

Another way to view real options is to use a binomial model, 1st introduced by Cox, Ross & Rubinstein (79), which represents the cash flows of a project as points on a lattice. Consider the following project:




Project Cash flows:
Year 0 1 2

In order to value the project, we use the state prices from option pricing. The state price $q_u$ is the price today of \$1 to be paid in succeeding period in up state, & similarly for $q_d$ in the down state.
$q_u$ = price today for 1\$ in up state in 1 period
$q_d$ = price today for 1\$ in down state in 1 period

State prices are calculated by solving the system of linear equation:
$1 = q_u*u_u + q_d*u_d$
$1/(1+R_f) = q_u + q_d$
Solution of this system of equation is
$q_u = (1+ R_f – u_d)/(1+R_f)*(u_u—u_d)$ $q_d = (u_u – 1 -- R_f ) / (1+R_f) *(u_u – u_d)$

## Pricing of an Abandonment option: Market data

Expected market return: 12%, Sigma of market return: 30%, Risk-free rate: 6%.
One-period Up & down of market:
Up: = $u_u$= EXP (Exp market return + Sigma of market return) = 1.521962
Down: = $u_d$ = EXP (Exp market return -- Sigma of market return) = 0.83527

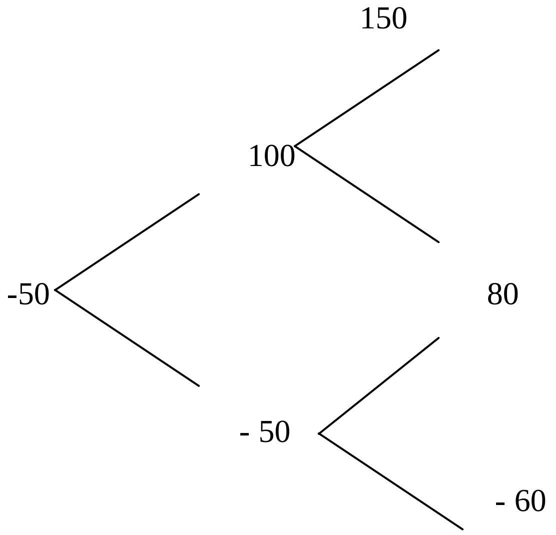
## State prices

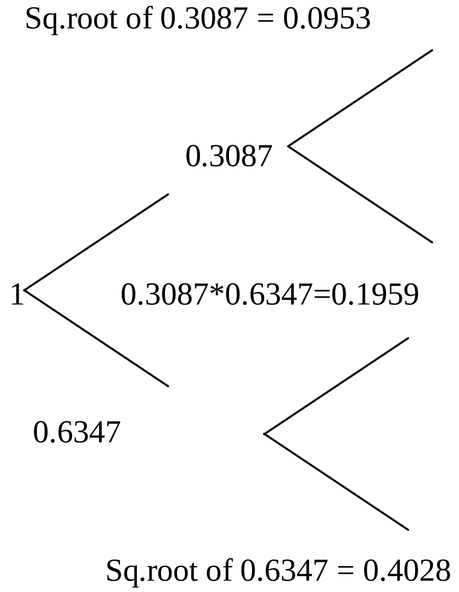
$q_u = (1 + R_f - u_d) / (1 + R_f) * (u_u - u_d) = 0.3087$

$q_d = (u_u - 1 -- R_f) / (1 + R_f) * (u_u - u_d) = 0.6347$

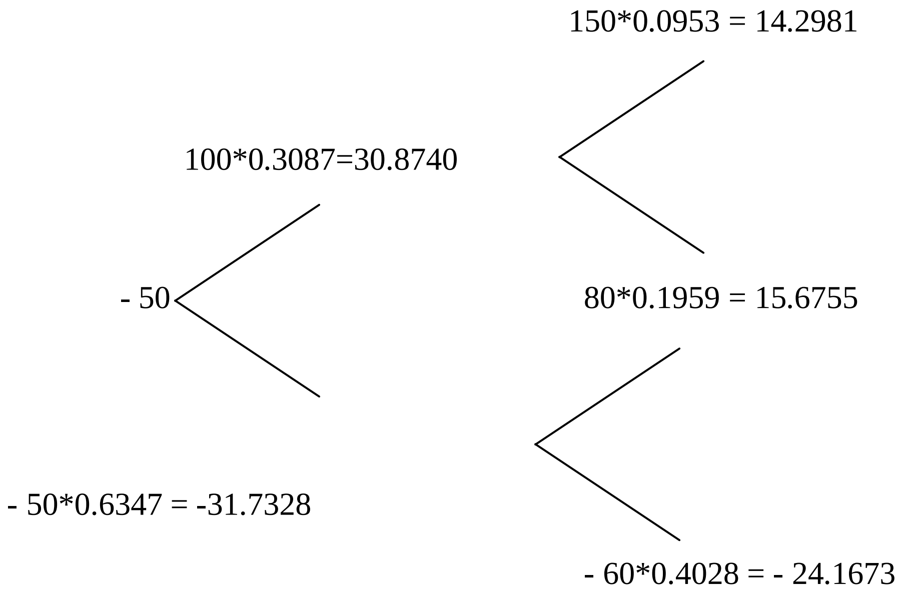
**Project cash flows** **State dependent present value**

**factors**




**State-by-state present value:**

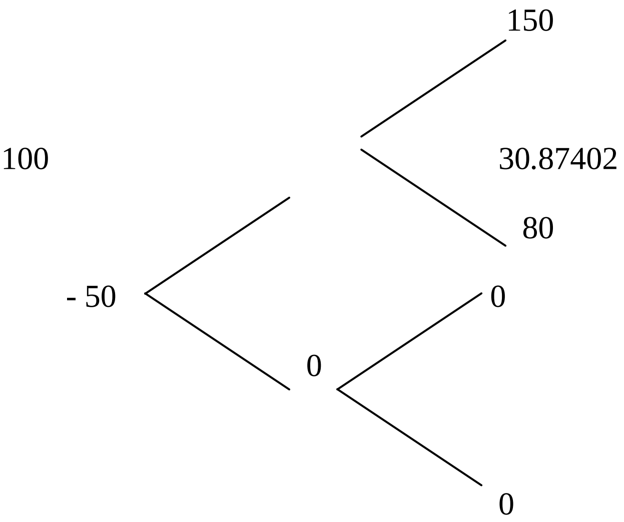


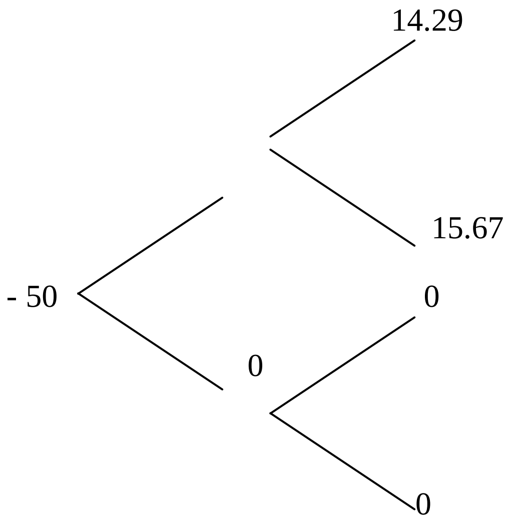

## Net Present Value=NPV

= --50+30.8740 +14.2981+15.6755 +15.6755–31.7328–24.1673 = --29.38

Now suppose, that we can abandon the project at state 1 if its cash flow threatens to be –50, Hence option to abandon the project enhances its value.

**Cash flows with abandonment** **PV with abandonment**

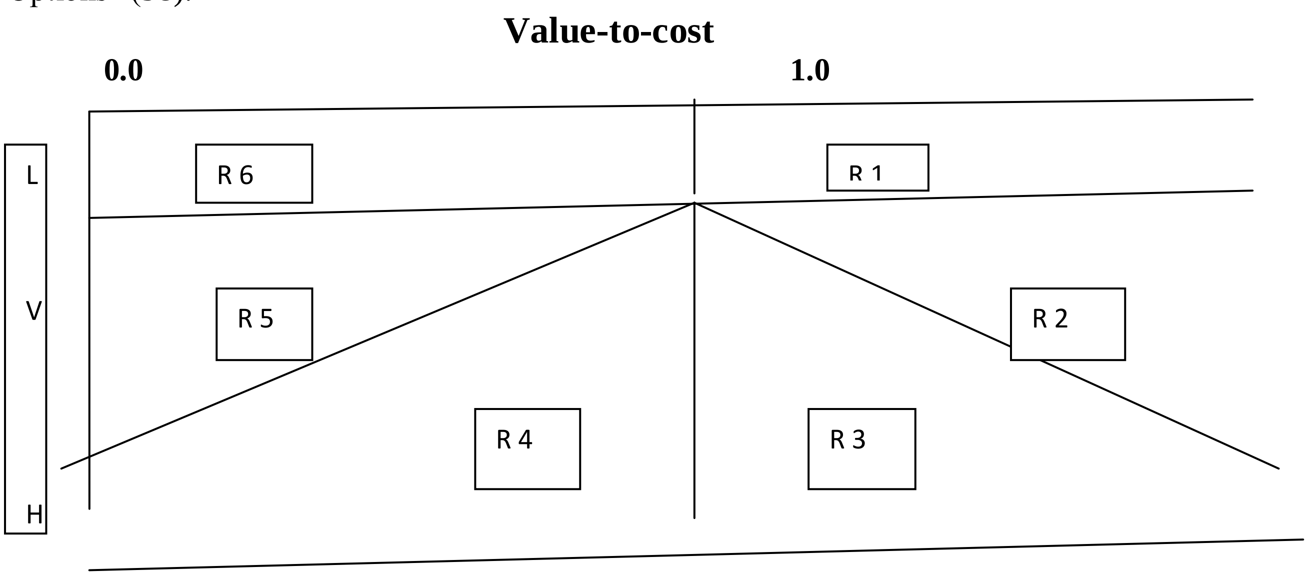



**PV with abandonment =** --50 + 30.87402 + 14.29 +15.67 = **10.**

## Singur-Non Nano Case Vs. Luehrman's Tomato Garden:

Timothy A. Luehrman compared managing a portfolio of strategic options with growing a garden of tomatoes in an unpredictable climate in his paper "Strategy as a Portfolio of Real Options" (98).




**V = Volatility (L= Low, H = High) = Std. Deviation √time & Value-to-cost = $NPV_q$=Stock price/PV of Exercise price in Black & Scoles option pricing formula. Horizontal axis of the above figure measures value-to-cost & vertical axis signifies volatility. R1 to R6 is defined in the following table.**

**The Tomato Garden:**

| Region | Tomatoes | Value-to-cost | Volatility | Remarks |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| R1 | ripe | >1 | Low | Invest now |
| R2 | Imperfect But edible | >1 | Low-to-high | May be now |
| R3 | Inedible But very promising | >1 | Low-to-high | Probably later |
| R4 | Less promising Green tomatoes | <1 | Low-to-high | May be later |
| R5 | Late blossoms & Small green tomatoes | <1 | Low-to-high | Probably never |
| R6 | rotten | <1 | Low | Invest never |

Here we can locate our Singur project in the Tomato garden either in region 4 (may be later) or region 5 (probably never) where ---

1. value-to cost (NPVq ) : <1
2. Volatility (s.d.√t) : Low-to- high

Hence it can shift to region 3 (probably later) if $NPV_q$ becomes >1 or by increasing project worth or by decreasing project cost.

As an example of what we learn from the tomato garden, consider six hypothetical projects that are entirely unrelated to one another. Following table shows the Statistics for six independent projects labeled A through F. Six projects have different time and volatility profiles & hence different values for their value-to-cost & volatility matrix. Each is located in the different region in Timothy's Tomato Garden & hence each is having a different decision point.

| **Variable** | **A** | **B** | **C** | **D** | **E** | **F** |
|---|---|---|---|---|---|---|
| S = Stock price | 100 | 100 | 100 | 100 | 100 | 100 |
| X = Exercise price | 90 | 90 | 110 | 110 | 110 | 110 |
| t = time in years | 0.0 | 2 | 0.00 | 0.5 | 1.0 | 2.0 |
| Std. Deviation p.a. | 0.3 | 0.3 | 0.30 | 0.2 | 0.30 | 0.40 |
| $R_f$= risk-free-rate of return (%) | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| NPVq = Value-to-cost | 1.111 | 1.248 | 0.909 | 0.936 | 0.964 | 1.021 |
| Std. Deviation √t | 0.00 | 0.424 | 0.00 | 0.141 | 0.30 | 0.566 |
| Call value | 10 | 27.23 | 0.00 | 3.06 | 10.42 | 23.24 |
| S -- X | 10 | 10 | --10 | --10 | --10 | --10 |
| Region | R1 | R2 | R6 | R5 | R4 | R3 |
| Decision | Now | May be now | never | Probably never | May be later | Probably later |

**Vital Statistics for 6 projects using Tomato Garden Concept (All are in million Rs.)**
**Examples of increasing project value by delaying the project:**

Project X has 2 phases. You may invest in the First, in both, or in neither. The first phase requires an investment of Rs.100m now. 1 year later, X will deliver either 120m or 80m, with equal probability. At that time, you can invest an additional 100m for phase II. One year later phase II pays out either 20% more or less than phase I (equally likely). (10%hurdle rate)

| Phase | Payoff | Probability | Outflow | Worth | NPV |
|---|---|---|---|---|---|
| I | 120<br>80 | 0.5<br>0.5 | 100 | 90.9 | --9.1$_{t=0}$ |
| II | 144<br>96<br>64 | 0.25<br>0.5<br>0.25 | 100 | 90.9 | --9.1$_{t=1}$ |
| II | | | | | --8.3$_{t=0}$ |
| Total | | | | | --17.4$_{t=0}$ |
| Wait II<br>Total | | | | | Increases<br>--4.9$_{t=0}$ |

Project Y has exactly the same structure as earlier but different cash flows. For Rs.100m invested today, Y delivers in Phase I either 140 or 60 with euqal probability. Phase II requires an additional 100m investment & delivers either 40% more or 40% less than phase I did. Project Y has the same structure as Project X & same expected cash flows. If we could not wait both have the same value. But Y has higher variance (s.d. for X = 0.18 & for Y = 0.34). If we can wait to decide about phase II the higher variance of Y makes the phase II growth option worth more for Y than X. Because of the higher growth option value, the project as a whole is more valuable. The total NPV of project Y is 3.3 (more than project X). Hence from the above example, it is cleared that sometimes project worth can be increased by waiting & by incorporating more volatility and uncertainty. We can apply this concept for the case of Tata's Singur Nano Project also.

## Singur--- A journey from traditional NPV to Real Option:

The NPV rule is easy, but it makes the false assumption that the investment is either reversible or that it cannot be delayed. Hence according to now-or never there is hardly any hope for Singur. Option value has important implications for managers as they think about their investment decisions. It is often highly desirable to delay an investment decision and wait for more information about market conditions, even though a standard analysis indicates that the investment is economical right now. That may be the case for Singur-Nano also.

## Singur- The Tata Nano story:

It may be recalled that in March'06, Tata Motors had announced their intension of establishing an automobile plant at Singur, WB & the company decided to roll out, by 08, a small & cheap car 'Nano' priced at US$2000 with a capacity of 250000 vehicles p.a. with flexibility to raise it to 350000 p.a. targeting both the foreign & domestic markets.

As West Bengal did not have adequate high quality suppliers they thought it appropriate to invite ancillary units to invest alongside with the Tata Motors. These included well known & reputed multinational & Indian companies like Bosch, Behr, Gabriel, Exide, Caparo, Kinetic, Sona, Subros, Rico, Rasandik, Lumax, Tata Ryerson, Tata Auto Components etc.
In March'07, the West Bengal government entered into an agreement with Tata Motors on the proposed plant. It has been alleged that as the Tatas were offered several concessions by the government, both the parties felt shy of disclosing the same. A total of 997.11 acres of land spread across mouzas in singur, district Hooghly, has been acquired by WBIDC & handed over to Tata. Almost 23 ancillaries units had nearly completed the construction work on the project site. Mr. Ratan Tata, the Chairman of the Tata Group of Companies, made a press statement on August 22, 08 expressing his willingness to 'pull out' of the Singur project. In response to such an unwarranted statement, it has been pointed out by Mr. Ravindra Kumar that the Tata project management team has done little to address the social impact of the investment.
On 2nd Sep'08, Tata Motors has communicated through an official release that the company was evaluating alternative options for manufacturing Nano car & the detailed plan to relocate the plant & machinery to an alternative site is under preperation irrespective of an unprecedented initiative taken by Sri Gopal Krishna Gandhi, The Honorable Governor of West Bengal for resolving the crisis.

## Here it can be explored the probable reasons for this pull out:

This pull out threat is a strategic move to negotiate further concession from competing states like Ford's Amazon project in Brazil (1999). Another reason cited in Hanson Gordon's analysis (2001) aptly explains the political motives of the government of West Bengal in siding with the Tatas in this controversial project. From day one, the Singur project has remained controversial mainly on land issues (Report of project on socio-economic profile of affected area for TATA small car project at Singur, done by IBS research center, Kolkata, 2008).
Between March 2006 when the Nano project was announced and September 2008 when they pulled out from Singur, many new developments have been noticed in the Tata Group in particular and in the world economy in general. The costly take over of Corus, Jaguar et al and $19 million damages to Ambani's Telecom Company have put substantial strain on the financial health of the Tata group of companies. Moreover, major fluctuations in the value of dollar have raised the question mark on the viability of the project at the committed $2000 pre-launch price of Nano. Any delay in the project implementation due to reasons "beyond their control", would justify a rise in the price of the car.
A question mark should be raised regarding the demand & success of Nano in this current economic crisis, huge melt down & the time when all car manufacturers are reducing the production due to heavy recession in the market. Tata Motors would ask for SEZ status for Singur project.
Tata management has failed to understand the emotional attachment of rural people to land. Confidence on their professional acumen might have acted as a barrier & did not allow the top Tata management to learn from previous controversial projects like Chilka Aquatic Firm, Gopalpur Steel project, Kalinga Nagar Project, Bangladesh Project, Dharma Port etc. almost all with state or central govt.
A brief analysis of the controversial ventures reveals that all these Tata initiatives suffered from the same drawback of 'doing little to address the social impact of the investment'. It is claimed that one of the major changes that Mr. Ratan Tata had bought about in the Tata house

after he succeeded J R D Tata in mid 80s, was the group attitude towards government. Till then the government role was treated as a regulator only. In the changed situation, they decided to involve the government as their business partner. This symbolic relationship between the state and the large capital had worked successfully throughout the $19^{th}$ & most decades of $20^{th}$ century. The same model will not work in the $21^{st}$ century when it is expected that the voluntary & not for profit characters of civil society organizations (CSOs) & NGOs would play an important role in steering the course of society. CSOs achieve a high level of social influence by cultural leadership. In this changed situation, any big or small corporate house cannot afford to ignore CSOs (Yaziji,2004). Failure to scan macro environment properly led to the downfall of many large multinationals, including East India Company. Mr. Ratan Tata may take note of this.

## Singur- Nano project – A path towards Real Options: Strategic Commitment:

The strategic effect of a commitment is positive when the commitment alters market condition, demand, competitor's behavior in ways that are advantageous to the firm making the commitment. These strategic effects are often rooted in inflexibility. Because, strategic commitments are almost always made under conditions of uncertainty about market conditions, costs, pricing, economy, demand, competitors goal etc. This may be happened in case of Singur, where the early commitment of Rs.1 lakh Nano Car might be created of flexibility & uncertainty.

## Flexibility gives rise to what are called Real Options:

Now the Tata Motors has the opportunity to customize a decision to information about the market that will be available in the future. Here a real option arises, as Tatas are intentionally delaying the investment in Nano project and awaiting for new information about its profitability.

The above issue can be easily explained by taking a simple hypothetical example. Say (Hypothetical Figure) Tata Group has invested Rs.2000 cr. in their Nano project for entering small car market. Given the uncertainties about how the market will accept the new product, the firm forecasts 2 scenarios:

High Acceptance (p=0.5): Investment will have a PV of Rs.6000 cr.
Low Acceptance (p =0.5): Investment will have a PV of Rs.1000 cr.
Expected NPV = 0.5(6000 + 1000) – 2000 = 1500

But suppose, by waiting a year or so, Tata can learn for certain which scenario will arise. If they will wait & Nano turns out to have a high level of market acceptance, they should invest otherwise not.

Then Exp. NPV = (0.5*4000 + 0.5*0)/1.10 = 1818.2 (10% Discount rate)

Therefore, from now-or never choice if Nano project can have flexibility to delay & gain additional information, the incremental value of real option is Rs.318.2 cr. in the present hypothetical figures. In particular, by waiting, they can tailor their decision making to the underlying circumstances & avoid a significant investment mistake ( i.e. investing in a new plant when demand is low in worldwide recession or a revival strategy of Type II error of R.K. Shah & J. Stiglitz(86), accepting a project when it should be rejected.). That may be the reason still we don't know about the coming of Nano car even if from their newly located site

of Gujarat. Flexibility analysis incorporates uncertainty into positioning & sustainability. As shown earlier, flexibility gives the firm option value.
Ghemawat (91) points out that a key determinant of option value is learn-to-burn ratio. This is the ratio of learn rate- the rate at which firm receives new information that allows it to adjust its strategic choices & the Burn rate – the rate at which the firm invests in the sunk assets to support the strategy. A high learn-to-burn ratio implies that a strategic choice has a high degree of flexibility & uncertainty. In case of Tata's Nano car project is also having a high learn-to-burn ratio. That is why so far at their Singur site, they are hardly having a significant investment before their pull out. Ghemawat argues that many commitment-intensive choices have the potential for high learn-to-burn ratios, but realizing this potential requires careful management. Experimentation (Singur) & Pilot Programmes(Gujarat) are ways that Tata can increase its learn-to-burn ratio & also increase the Nano's uncertainty, flexibility in making commitment-intensive choice or option & ultimately which will further enhance project worth.

## Why Tata's Nano can be said as a Hold up Problem?

For explaining this let me introduce some of the concepts used in Strategic Economy ( Coase, 1937).
**Transactions Costs:** Include the time & expense of negotiating, writing & enforcing contracts. They arise when one or more parties to a transaction can act opportunistically.
**Relationship-Specific Assets:** It is an investment made to support a given transaction. Hence it can not be redeployed to another transaction without some sacrifice like reducing it's productivity or some extra cost in adapting the asset to the new transaction.
**Fundamental Transformation:** Once the parties invest in relation specific assets, the relationship changes from a large numbers bidding situation to a small numbers bargaining situation (Williamson, 85).
**Rents & Quasi-Rents:** I will explain these through a numerical example about a hypothetical transaction in Tata's Nano Project at Singur.

Let Caparo Engg.Contemplates building a factory to produce cup holders for Tata Singur Nano project. The factory can make up to 1 million holder's p.a., @ of variable cost Rs. V p.u. Caparo finances the construction of their factory with a mortgauge from BOB that requires a payment of of Rs.P.
Total cost p.a. for Caparo (even they do not do business with Tata) = Rs.C
Total production & financial cost of Caparo p.a. = Rs C + 1000000v
Now after the situation held after Sep, 08 i.e. pull out decision of Tata from Singur, Caparo can have the bail-out option. They can sell to other automobile manufacturers or jobbers with suitable modification & a lower price (Say $p_m$ p.u. & $p_m > v$) & $C > 1000000(p_m – v)$
Hence, it would not make sense for you to build the holders factory if they do not expect to sell to Tata. A portion of their investment is specific to their relationship with Tata.
Relationship Specific Investment (RSI) is the unrecovered investment if any ancillary unit can not do business with the firm as per earlier contract. RSI = $C – 1000000 (p_m --v)$
Rent: Holders price p.u. if Tata will make business= $p_t$ ($p_t > p_m$)
Hence Rent is benefit of Caparo if everything goes as it is. It is nothing but economic profit or NPV.
Rent = $1000000(p_t – v) – C$

Quasi-Rent: It is the difference between the profit they get from selling to Tata & the profit they get from their next best option if they can not make business with Tata & forced to sell to jobbers.

Quasi Rent = $1000000(p_t - v) - C - [1000000(p_m - v) - C]$

$= 1000000(p_t - p_m)$

## Holdup Problem:

The expression “hold up problem” was coined by Victor Goldberg (76). When a firm invests in a relationship-specific asset, quasi-rent cannot be zero, it must be positive. If the quasi-rent is large, a firm stands to lose a lot. This opens the possibility that its trading partner could exploit this large quasi-rent, through Holdup. Tata holds up its ancillary partners by attempting to renegotiate the terms of earlier deals. Tata Motors can make profit by holding up its trading partners when contracts are incomplete (thereby permitting breach) & when the deal generates quasi-rents for its trading partners. Holdup is highly tempting when contracts are highly incomplete, so that proving breach of contract is difficult. The potential for holdup raises the cost of market transaction by making contract negotiations more difficult & renegotiation more frequent by inducing parties to invest in safeguard to improve post-contractual bargaining positions, by engendering distrust, and by leading to underinvestment in relation specific assets.

If $p_t = 12$, $p_m = 4$, $v = 3$, $C = 7000000$

Caparo’s rent = (12-3)1000000 – 7000000 = 2000000 p.a.

Caparo’s quasi-rent = (12-4)1000000 = 8000000 p.a.

If Tata renegotiates the contract down to Rs.8p.u. Tata will increase its profits by Rs.4million p.a. & it will have transferred half of Caparo’s quasi-rents to itself. Now after the holdup has occurred, Caparo will realize that they are now making a profit of (8-3) * 1000000— 7000000 = --2000000, they will make loss, but they have to continue in this trap & that will enhance the possibility of Tata’s in making more profit or reducing cost of production .

## Conclusions:

According to Timothy Luehrman’s Tomato Garden, Tata’s Nano project may be at Region 3 or 4 i.e. Probably Later or Maybe Later & Singur project can be located at Region 5 or Probably Never. In this current global melt down & economic slump, delaying the project by any means is the best possible option, which ultimately increases project worth, where land issues at Singur and Opposition from Trinomul Congress could have helped them in delaying. Traditional NPV ‘Now-or-Never” will no longer last in present highly volatile and uncertain era. Firm must apply flexibility and take shelter under Real Option path and can avail the scope of enhancing the project worth and start invest at right time and after availing right information.

Tata’s Nano Story is nothing but a Holdup problem, further uncertainty and delay will enlarge the quasi-rent of it’s ancillaries and in that way it will further reduce the production cost of Nano and enhance project NPV.

Hence we can expect Tata’s Nano will enter in the market when entire world car market and global economy will revive a-little and Commitment of Ratan Tata about Rs.1 lakh Nano car will be strategically feasible.

In the process of project evaluation, the real option approach to Capex decision making can contribute for a significant amount. In this paper both Black & Scholes and Binomial method of real option are discussed. In principle, both of them allow the financial analyst to overcome the constraint on expected values inherent in the traditional DCF method. A real life application of this-- evaluating a R&D project is a good example which shows the power of the real options approach.

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