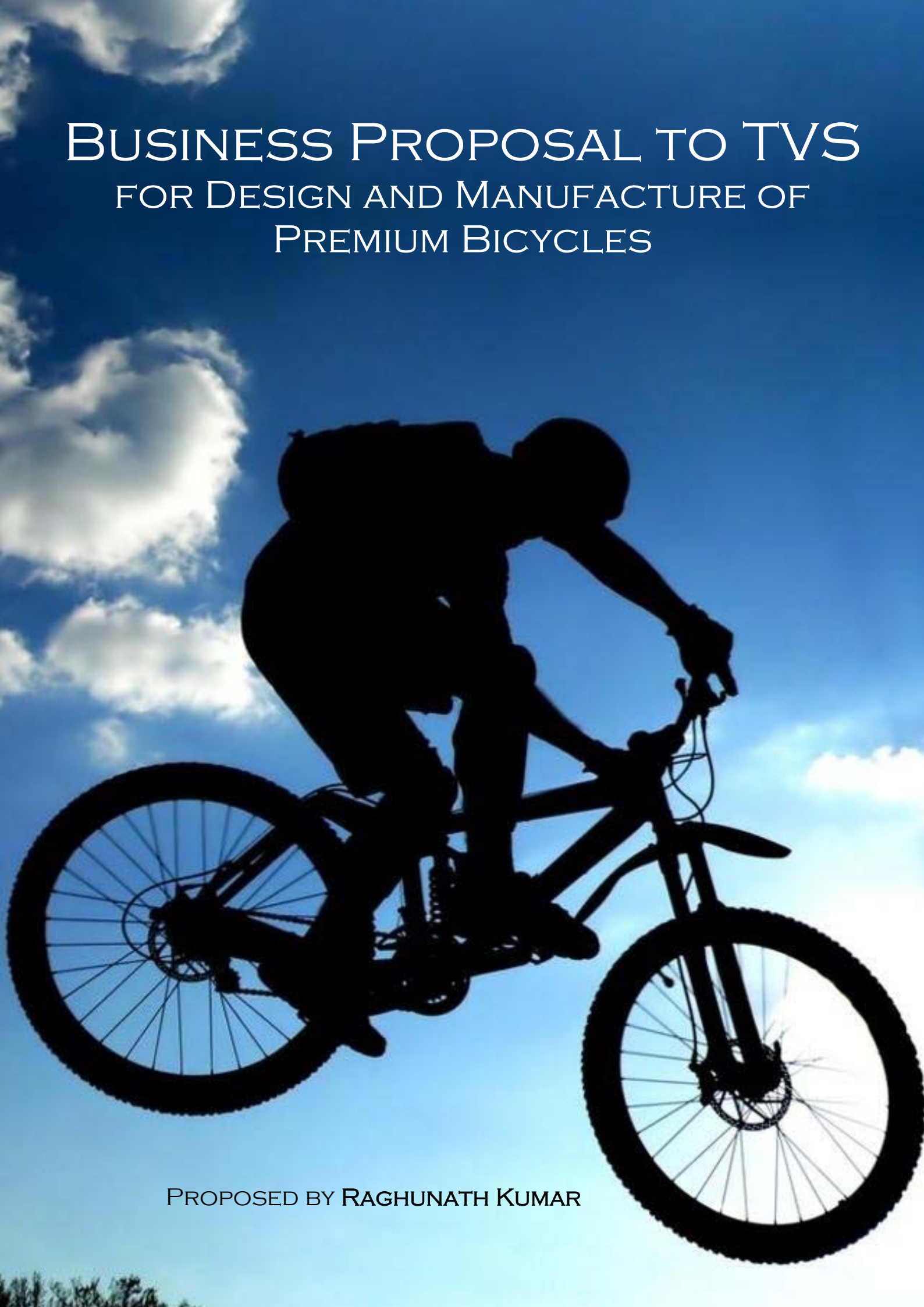
Business Proposal to TVS

for Design and Manufacture of Premium Bicycles



Proposed by **Raghunath Kumar**

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About the Author:

Mr. Raghunath Kumar is working with TVS Motor Company since 2007. He completed his Dual-Degree course (B.Tech + M.Tech) from IIT Madras. He is interested in patents and other IPRs as a professional hobby. He was also trained on Indian and European patent acts. He has high interest in cycling. His interest in bicycles started when he made his first long trip on bicycle for 180km. He was ranked among the top 0.5%, 0.6%, and 0.09% in 2001, and 2002 in some of the engineering entrance examinations attempted by some of India's finest students. He has 8 patent applications filed during his tenure in TVS on various application areas. He has mainly worked as a control algorithm developer & embedded software engineer for ABS project for motorcycles by (AEG) TVSM and plays a crucial role in his team.

The author can be contacted at raghu.elec@gmail.com for more information.

Author can also be reached at the mobile number +91-74110-RAGHU (+91-74110-72448)

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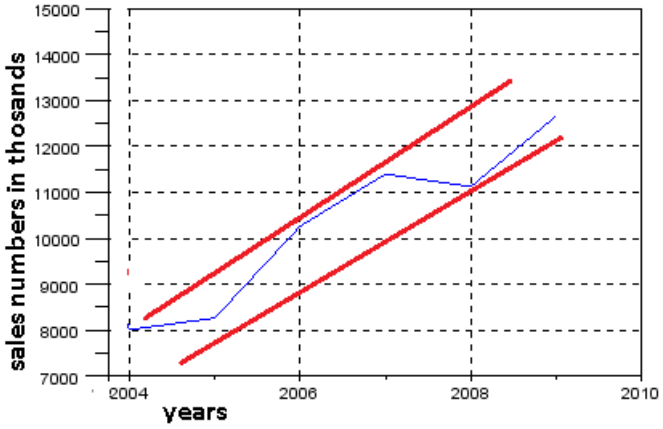
1. Executive Summary

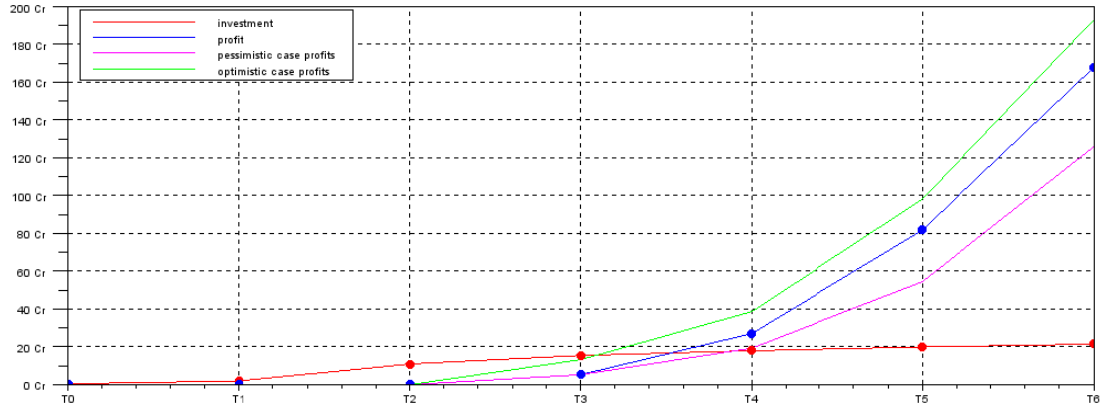
Bicycle industry in India is growing at around 10% P.A. during 2004-2010. Total bicycle market for India reached a sales value of 1,26,55,000 units (estimated value of around INR 5,700 Cr) for the year 2009-2010. Premium bicycle sales account for up to 15% of the total bicycle sales for the year 2009-10. Premium bicycle market is expected to grow at a rate higher than total bicycle market. Below figure shows the growth of total bicycle sales in Indian market.



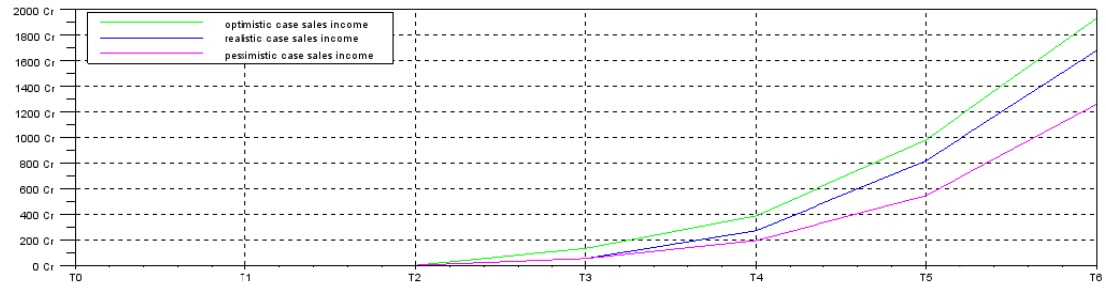
Hero, TI, Atlas, Avon dominate the domestic bicycle market. There are several non-Indian premium bicycle manufacturers selling in India. Some of the well known brands are Merida, TREK, Firefox, Schwinn, Giant, and KHS. But single player dominance is not assumed. Premium bicycles are popular among educated and affording segment of city population for their reliability, appeal, low maintenance, low weight, and ruggedness. Increasing petrol prices may also push people into buying premium bicycles when they can afford. Increasing purchasing power also encourages more people into buying premium bicycles for leisure activities.

It is proposed to launch few models of premium bicycles from 2 to 3 years of start of the project. TVS, having product ranges spanning from electric vehicles, hybrid vehicles, mopeds, scooters, motorcycles and auto-rickshaws, can certainly look into investing in a hugely profitable segment such as premium bicycles. It is proposed to start with three segments namely road bikes, hybrid bikes, and mountain bikes (MTBs) and later expand to further narrow segments. TVS may utilise existing test facilities, software resources and part of know-how about mechanical design, thereby reducing corresponding huge investments. TVS may use its experience of creating existing motorcycle dealer and service network, in setting up a good network for bicycle sales.

Customer needs and market demands were assessed with opinions from amateur bike riders, and market research progressed to an extent possible for the author as an individual. Two business cases are proposed of which BC1 corresponds to a total investment requirement including development, manufacturing and sales expenses of around INR 20 Cr in 5 years from start of the project, and break-even is expected to occur in less than 2 years of sales in realistic case. In this case TVS can generate a turnover of around INR 1,700 Cr, and gross profits of around INR 170 Cr in 4 years from start of sales. Profits calculated are with modest profit margins of 10%, whereas expected profit margins for some of manufacturers vary between 20% and 25%. Plot below shows the breakeven point changing for variation in market share. More details can be obtained from the later parts of this report.



Plot below shows the sales income variation with respect to market share variation. More details can be obtained from the later parts of this report.



Premium bicycles sold in Indian showrooms have very wide price band, ranging from INR 8,000 to INR 4,50,000. It is expected to focus on premium bicycles within the narrow price band of INR 8,000 to INR 24,000. The bicycles in this band may otherwise be called as mass premium bicycles.

This specific market exploration will help TVS gain several competencies for lighter and stronger vehicle frame manufacturing. Proposed project also helps TVS in brand extension.

2. Present size and trend of market

Bicycle industry in India has shown an average annual growth of 9.65% during 2004-2010. The CAGR (Compound Annual Growth Rate) of 3.15% during 1993-2010 includes market dip of 12% P.A. during 2000-2004[image1, image2, image3, link3]. With the increase in fuel prices [image5], and environmental awareness among educated social groups, the market is expected to grow at even higher rate.

Two business cases [BC1, BC2] are proposed in which pessimistic case (negative market growth of 15% P.A.), realistic case (positive market growth of 10% P.A.) and optimistic case (positive market growth of 20%) are assumed. Annexure-III details more about business cases 1, and 2. It is to be noted that the pessimistic case considered in the Business Cases considers all the pessimistic conditions put together, and represents the worst case scenario. This scenario does not occur in real time, since the occurrence of single negative market condition will trigger readjustments of funds. This feedback event was not assumed in pessimistic case calculations. Any practical scenario will result in operating point for any projections, within the top and bottom limits specified by optimistic and pessimistic cases.

Data has been collected to reflect variation of price [image4] of bicycles with time, and the business cases also include pessimistic, realistic and optimistic cases (2%, 5% and 10% price growth respectively) for the future market price estimation.

Bicycle industry in India has two major segments:

a) Commodity bicycles: Typically seen bicycles and are focused at customers seeking low price, value for money bicycles. These are aimed at day to day usage and do not include extreme driving and usage conditions.
b) Premium bicycles: These bicycles are of special interest to sports enthusiasts, fitness enthusiasts, and adventurous category of bicycle users. These are also of interest to those who want to have low maintenance and rugged bicycles aimed at extreme usage.

It is estimated from few press releases and few other literatures that profit margins for premium bicycle manufacturers vary from 20% to 25%. However, for preparing the business cases, a modest profit margin range (8%, 10%, and 12%) is assumed for the three cases.

Premium bicycles are mostly with aluminium alloy frames with parts from several international manufacturers. Very few performance bikes with steel frames are manufactured for various reasons. Another narrow segment of performance bicycles uses carbon fibre frame for a very high strength-to-weight ratio. There is also a narrow segment of electric assisted premium bicycles.

Majority of the bikes (performance bicycles) available in India are aluminium alloy framed bikes. Hero Cycles has announced its plans to launch carbon fibre frames for its forthcoming products.

3. Customer segmentation and buying behaviour

Few surveys are conducted over several forums and through direct interaction with amateur bike riders to obtain information about their life style and interests. Entire customer segment is not completely probed yet. However the survey results closely depict the overall customer behaviours.

Performance bike buyers use their bikes for leisure and adventure activities in addition to daily errands. They buy the bikes for fun and in some cases use as an alternative daily commutation mode to work place. These bikes are not bought to earn daily bread. Buyers are concerned about the after sales service of bikes and spare parts availability.

Prospective buyers have sufficient money income to purchase at least one of the following

- High-end mobile phone/smart phone
- High-end Laptop
- SLR camera
- Car
- Motorcycle (150CC+)

Prospective buyers also have sufficient money and time to do at least one of the following activities once in 6 months duration

- Trekking
- Photography trips
- Nature walks

- Adventure sports
- Touring for fun for more than 200 km

Image17 from Annexure-I provides with a GDP per capita for purchasing power parity, which is a per capita value (in USD) of products purchased by Indian consumers. Growth rate is clearly seen which indicates that Indian purchasing power has been on rise.

At least one of the following is quoted as the reasons for purchasing the bike by owners

- Light physical exercise
- Office commutation
- Avoid traffic jams
- Weekend rides
- Intercity rides
- Environment awareness and eco friendliness
- Better recognition on road (to be centre of attraction)
- Availability of surplus money
- Influence of friends/colleagues
- Promote healthy habits for their kids
- Kids' daily use
- Appreciation for the looks of bike
- Comfortable posture while riding
- Bike appropriate to one's body proportions
- Worry free usage over long run
- Ease of self serviceability
- Lighter weight
- Better attitude of sales people and occasional health tips related to biking
- Status symbol

Profile of targeted bike Consumer

Majority of premium bike consumers are typically young businessmen (25-40 Years) but exceptions do exist and groups of middle aged corporate professionals (35-50 years) can be seen doing extremely long rides.

4. Expectations from premium bicycles

   Expectations are including but not limited to following list (not in the preference order)

   - Good braking and handling
   - Better quality parts
   - Better fit and finish
   - Longer useful life
   - Better service and space parts availability
   - Better engineered parts
   - Long distance ride optimisations
   - Rugged frame and parts
   - Rough use tolerance
   - Lower weight resulting in less fatigue
   - Easier gear shifting
   - Longer time gaps between services
   - Easy self service possibility
   - Lower friction parts
   - Better suspension for comfort
   - Better riding posture
   - Possibility of customisations in riding posture
   - Good looks and strong road appeal

5. Analysis of market shares and competition

   Exact data of individual competitors' market shares for premium bicycles are not available. However, the premium bike sales are around 15% of annual bicycle sales [link1] in India during 2009-10. Earlier segment share data is not available for premium bicycles. It is expected that this number started at close to 0% and reached 15% in the recent past only. The segment percentage of premium bicycles is expected to grow considering awareness among people and external factors that drive people to go for bicycles. People who can afford shall always purchase at least an entry level premium bicycle in order to differentiate oneself from ordinary bicycle users.

   There are up to 20 brands being sold in dealerships and few more are imported on demand. Some of the most heard bike brands are TREK, FIREFOX, GAINT, SCHWINN, RALEIGH, CANNONDALE, KHS, BTWIN, and HERCULES. It is expected that the market share for the

mentioned brands is almost same and constitute up to 90% of total premium bicycle share. Based on demand and the awareness among people, it is expected that the percentage of premium bikes in total bicycle sales may increase up to 25% by 2020. Domestic bicycle market is dominated by HERO CYCLES with up to 35% market share followed by TI (25%), AVON (20%), ATLAS (10%) and others [link4].

Majority of bikes seen on road are either hybrid bikes or MTBs. A significant portion of road bikes are also seen. Most of these bikes are sold via dealerships and very few are sold via company outlets. There is very limited reach for the direct company outlets and so are limited to very less cities.

6. Proposed **USP**s (not in preference order) and Attractive features

6.1. Hidden Cables – smoother looks:

Proposed is a secondary structural member parallel with the primary structural members, which covers the brake/gear cables from view. Cable entry/exit points inside this will be sealed artistically just enough to avoid dust accumulation. For serviceability reasons, the secondary structural member can be optionally fitted to slide into position and fixed to primary member via Allen screws. This also gives the bike better looks and avoids the hanging cables and hassles of managing them while riding and handling.

6.2. Low price for same quality and better service – high VFM:

Because of the advantages TVS has in terms of low initial investments, as proposed in sub-section 7.1, TVS can sell the same quality product as that of competitors for lower price for the same profit margin. Better service can be provided through methods in sub-sections 6.6 and 6.7. High VFM (Value For Money) is certainly what customers will be looking for. It is also proposed to implement part commonization for similar designs to make inventory costs lower.

6.3. Spare parts – Choice of E & U

It is proposed to have two grades of spares for each part – E for regular and U for rugged. Since all the customers do not need rugged parts all the time, they can use E grade parts for their daily use and U grade parts for special occasions. This also helps TVS avoid counterfeit products being fitted by customers on the bikes for cost reasons when they use the bikes for regular use.

6.4. N-to-1 spare parts availability:

Spare parts are made available at the dealers abundantly such that every N bicycles sold will have at least 1 spare part of each component of the bicycle. N can be derived from the failure rates and usage patterns. Assurance of spare parts availability is one of the key factors influencing purchase of premium bikes.

6.5. Trained servicemen and external repairmen:

TVS can train the servicemen at the dealers and also volunteering repairmen to excel at servicing. Training should include identification of problem through talking to customers and repairing/replacing with right kind of parts.

6.6. Knowledgeable, experienced and friendly salesmen – PIZZA HUT type customer treatment:

It is proposed that TVS has to follow such a godly treatment for customers exactly the way they want to be treated. This strategy has been proved with some restaurants. It is also expected that servicemen should be knowledgeable enough to guide the customers into buying the right category of bikes for their usage. It also helps to give few tips to customers from their experience. A mix of experienced bicycle riders and experienced salesmen with correct attitude is proposed.

6.7. Product/part replacement on high fault rating:

This scheme helps TVS acquire field vehicles with faults, and helps test engineers devise better test methods and to assume vehicle usage patterns more accurately. It is proposed to classify bike parts into categories – for example: normal, critical, supercritical, safety related, performance related. Rate each fault, and at the service station, consider cumulative sum of existing faults' ratings and depreciated value (with time) of repeated faults. If this value is more than a pre-set threshold, customer can be promised a replacement. During initial days of bike release into market, TVS can announce low rating threshold to acquire more field vehicles, and in later days this threshold can be pushed up. This same service can be interpolated to part level replacements.

6.8. Recyclable X%:

All the bikes designed by TVS will have DFR (design for recyclability) as a part of development process and also display a percentage number (X %) of recyclable portion

of the bike being sold. This X can be percentage of parts by number or percentage of weight of bicycle.

6.9. Bike customisations for ergonomics

All the bike manufactures in the market offer seat height adjustment alone as an option to customers in most cases. However, many customers feel that this is not sufficient. Since each rider is ergonomically comfortable in different positions of handle bar height, seat height, cranks length, brake lever & gear change lever positions, it is suggested that TVS has to provide a solution in one of the two methods. First is to have user select the orientation and dimensions of parts required before purchase from the available options. Second is to have few parts such as handle bar height and distance from seat, adjustable by the user at his/her will with simple tools. This also helps avoid customer dissatisfaction due to slightly mismatched bike size causing him/her few riding related issues.

6.10. Easy to service at the customer side

Many customers do not have sufficient tools to do self servicing at home or ride location apart from basic cleaning. It is proposed that TVS should provide easily serviceable parts for the designs and DFS (Design for Service) is included in the development phase. It is also proposed to provide parts such that very minimal tools are required for full bike servicing. Such tools may also be provided to the buyers at the time of purchase.

6.11. Interchangeable bike frame

Multiple options of frames with varying weights, gender specific changes, etc. are made available from time to time which are all compatible with similar family of bikes and customer can choose to purchase a frame alone when he/she needs a different frame without extra burden of purchasing all the additional parts.

6.12. Embedded LED indicators in the bike frame

Since bike riders are concerned about safety during night, they resort to various methods of illuminating themselves. We can provide an option to include LED mounts within the bike frame design and we can also include replaceable batteries in the non-load bearing frame member. LEDs can be wired from inside the frame, or frame has to

contain cable holders to stop the LED wires from hanging. Ideal case would be to use a construction such as in sub-section 6.1 for hiding all electrical connections.

6.13. Wide range of bike frame size options

Majority of the imported bikes in India are designed by European companies and they do consider Europeans' average heights and body proportions for determining range of frame sizes available. However, some of the not-so-tall Indian customers find it difficult to get their best size, and hence adjust with the lowest of what is available in the adult bikes range. We can provide the appropriate sizes for Indian users' requirements from the smallest to largest bike frames possible. Although this may be slightly contradicting with what was mentioned in 6.10, the best of these options can be selected based on market demands at the time of product release into market.

6.14. Flat free tires

Many riders have faced the problem of punctures when they are set out for their favourite ride. TVS can work with few suppliers for flat free tires [example: link6, link7, link8] to reduce costs on bulk supply. There is as much percentage of users favouring flat free tires in bikes as there is for tubeless tires in motorcycles.

6.15. Thermo-chromic, Glow-in-the-dark paint options

This feature has to do with paint job only. Glow in the dark paint is to cater to the needs of bikers travelling at night to increase their visibility. Thermo chromic paints change their colour based on their temperatures. This can be a feature to attract interested customers and can be presented as bike with changing colours as the day changes from morning to afternoon to evening. A layer of glossy coat may be followed to prevent these paints from being damaged.

6.16. Value added services

Many customers of interest to TVS favour value added services such as pickup for bike servicing. TVS service centres can offer such a service to all the buyers. TVS can also offer secure free/paid services for parking bikes for short/long term. TVS can offer delivering the bikes to office commuting customers who do not have favourable conditions to park vehicles at office or who want to travel only one way trip by bike, at the required destinations.

6.17. Flexible OLED frame cover options

These displays can be used to create graphics on the frame as required by the user, and also can be used for visibility purposes in the night. A dynamo system which is either hub mounted or externally attachable can charge an optional small rechargeable battery and also power the OLED display. TVS can work with its existing supplier network to find best OLED supplier/developer.

6.18. Flexible solar panels on exposed areas

These panels may be installed on the exposed areas of the frame to enable charging the onboard battery with the help of necessary electronics to enable the rider use the battery for lighting or other safety purposes.

7. Advantages & benefits, risks & threats and de-risking methodologies

7.1. Advantages

TVS can use its existing resources in several cases to reduce the additional investment required. Onetime expenses such as mechanical design & analysis softwares can be shared with the existing teams or time-multiplexed. Bike assembly line can be setup in the existing assembly plants since the man power and space requirements are low.

Although bicycle design and development requires different set of material knowledge and has load & usage requirements as compared to motorcycle development, TVS can utilise the know-how of several design related technologies learnt over time in motorcycle design to reduce efforts to in bicycle development. DFA, DFM, DFS methods in addition to DFR (design for recyclability) are to be taken care at design phase. TVS will be able to handle these with its prior experiences. TVS can use its prior experiences in promoting products for new segments gained from 3-Wheeler promotion. Sourcing some of the parts and sub assemblies from international suppliers and developing local vendors for the product requirements will not be difficult for TVS team. Vast experience in warranty parts handling and complaints reduction will help TVS get the best out of its experience.

Although TVS does not have any prior experience in handling aluminium alloys which are used in bicycle chassis manufacture, having been working in a parallel technology domain, TVS will be easily able identify specific engineering areas where assistance or consultation or

learning is required. Some of the prototype developing vendors can be consulted to find out whether they have any prior experience in handling such alloys.

Some of the facilities established in polymer lab at R&D should be helpful in understanding processing of carbon fibre frames and related techniques for near future use product range expansions. Electric assisted bikes for future product portfolio will have minimal additional effort required for design, as TVS already has an electronics design team. Existing relationship with several universities within India and abroad will help TVS locate the technology available easily and start work on the same. The goodwill developed with these institutions will help TVS avoid administrative delays in the technology development.

Because of wide spread dealer network, TVS will be able to exponentially spread its span of market and be able to explore new geographical locations thereby expanding the market itself.

Some of the international bike manufacturers are also including some electronics on some of their products such as electronic gear change assist, adaptive suspension, etc. If market demands it, TVS will have no problem working on the same in the lowest possible time as compared to competitors.

7.2. Benefits

With the help of performance bicycle segment, TVS can obtain brand extension. Since the market segment aimed at is educated and influential category in the society, there will be positive effect on brand strengthening and there are very less chances of brand value dilution. Strengthening brand value through brand extension can be seen with TATA Motors having high-end cars in their portfolio thereby influencing people into favouring their products.

A high end product in the similar category of products, always makes prospective buyers think of the engineering capabilities of the overall brand and favours higher sales.

As presented in the business cases[BC1, BC2], for one of the cases BC1 considering the worst case combination of all pessimistic conditions, TVS can still have breakeven in around 4 years of sales, and in the best case with increasing market, in less than 1 year of sales. In the

optimistic case, turnover of more than INR 4,300 Cr. and gross profit of around INR 250 Cr. can be achieved in 5 years from start of project, or 3 years from start of sales.

7.3. Risks

TVS will have to make an investment of 15 to 26 Cr rupees in a span of 5 years. Based on market conditions, the break even can occur in the worst case as late as 4 years. Severe unexpected market conditions may delay the breakeven further more. Partnering with an existing overseas manufacturer of unknown product quality to promote their products can either promote TVS brand value or destroy brand value before it is even created.

Working with consultants and experts for bicycle design is highly viable option but obtaining the right people to guide the designers is difficult and can be costly.

Manufacture of carbon fibre framed bikes shall require huge amount of investments in terms of ovens, and raw materials. These investments might take longer time to achieve breakeven sales.

Being a late entrant in the premium bicycle market, in order to get good market share TVS has to create and/or enter newly developing sub sections of the existing market. To create and enter new sub segments of bicycle market such as electric assist bikes in India, TVS has very high risk of never able to potentially capture the market created at the pace it grows, if the market competitors are aggressive. TVS may end up creating the market where rest of players benefit from the same. To enter sub segments with highly specialised, technically highly demanding, products such as carbon fibre frame manufacturing, TVS may have to invest a lot in R&D funds and time to successfully launch a product with in-house technology.

7.4. Threats

TVS is trying to enter a specific small segment of market where there are several multinational players with small market shares. Unless TVS leverages its brand value, and customer goodwill to promote its entry into the bikes market, it is difficult for prospective buyers to even consider TVS bikes for purchase. However, this situation is lighter than when TVS entered Indonesian motorcycle market, as an unknown brand, dominated with popular manufacturers.

7.5. De-risking methodologies

As mentioned in sub-section 7.4, TVS will have to make best use of its goodwill in the market to pursue customers. TVS has to work with suppliers collaboratively to arrive at products with highest profit margins and better quality at the design phase itself. Risk of competition reducing prices has to be addressed in all stages of project from design to testing by aiming at very high operating margins. Very high-end bikes requiring huge investments can be taken up once surplus funds have been accumulated via aluminium framed bikes' sales. Selection of appropriate channels for brand promotion has to be done effectively to face the downtrend in market, to have minimum impact.

It is proposed to use existing facilities of polymer labs within the company, and use prestigious academic educational institutions' aid in obtaining technology related to carbon fibre frames quickly and at lower cost.

Regarding the electric assist bicycles, it is proposed to conduct an extensive market survey on market requirements but to be ready with the product in case market is created by any other player in the market.

8. Recycling methodology

Should the government impose conditions on recycling the used bicycles at the end of their life, TVS should be ready to handle the same. It is highly possible that customers who purchase these bikes are aware of environmental effects of un-recycled waste dumped into waste yards. Hence, all the material used in the bikes should have efficient recycling strategy defined.

It is proposed to keep waste recycling in mind during design phase itself. Usage of easily recyclable materials, easily recyclable assemblies are to be done for the bike. Suppliers are also to be insisted on following DFR methodologies.

Recycling process and best method to recycle for each part and assembly in the bike has to be clearly defined at the time of design.

9. Product portfolio - present and future

It is proposed to have three product segments for bikes: road bikes, all terrain bikes (MTBs or mountain bikes) and hybrid bikes. Two models of each segment would be sufficient for the initial market entry and this portfolio provides basic choice to the customer. Design criteria has to be as tight as – MTBs with rider dropping from a height of 2meters during the ride should be stable, show no signs of damage and continue to give best performance- road bikes should be able to reach speeds as high as 80 kmph and be perfectly stable- Hybrid bikes are expected to have at least 75% of both features.
Kids' bicycles or otherwise called as juveniles are not of interest for this report. Depending on the market demands in the coming years, these segments can also be explored.

All the products aimed at the present market are with aluminium alloy frames to obtain lower weight compared to steel frames. Depending on the market demand, electric assist can be optionally provided on few later models. Electric assist may be provided as an option to the hybrid bike category in the future products. This option is market driven. A carbon fibre frame for all categories of bikes can be provided as an addition to the segment as a future addition.

Manufacturing of frames alone is also recommended since this segment caters to a lot of retail customers as well, in addition to exports.

It is recommended to start with equivalent products for competitors' products in order to gain considerable market presence and later work on emerging markets. If TVS starts by being aggressive towards sub segments of product which seem to be growing at high rate, there is high chance that TVS will not be able to cope up with the speed of already established market players who have abundant resources and funds.

In order to be profitable, it is recommended to micro segment the bicycle market and focus on products which are of interest to high income group customers and are willing to pay more for products with additional features and/or better specifications and/or better technology and/or better product recognition in the market.

10. Product demand – past, forecasts and justifications

As mentioned in the earlier sections present market demand for bicycles in India is around 12 million units for the FY 2009-10. Image6 from Annexure-I represents world bicycle production numbers as compared with world car production numbers from 1950 to 2007. As we can see, there has never been a long term dip in market for bicycles except for few corrections to the growth of bicycle sales numbers. The small dip in sales numbers around the year 1975 can be seen as a small correction to the sales numbers' jump in the past few years. Later, 1989 to 2000 has seen almost constant market with fluctuations not more than +/- 15% of average sales during that time. Bicycle market has seen tremendous growth from the year 2000. However, a slightly different market trend has been observed in the Indian bicycle market as seen in Image2 from Annexure-I. Market has dipped during 2000-2004 and then continued to increase.

Image7 from Annexure-I represents the sales forecast for three cases considered. The pessimistic case assumes that market numbers drop at 15% each year. This case is considered to represent worse market situations as faced between 2000 and 2004 with 12% dip in sales each year. The realistic case assumes that the growth rate as exists from 2004 onwards continues to exist. The optimistic case assumes that the market grows at even higher rate. This could be partly due to the rise in petrol prices or due to increased environmental awareness. A trend of fuel prices is represented in image5 of Annexure-I.

Link1 from Annexure-II presents that speciality bicycles constitute 15% of complete bicycle sales. We have assumed that percentage of premium bicycle sales in total bicycle sales is 12%, which account for products of interest to TVS. Some of the products excluded are juveniles, ultra luxury bicycles, electric assist bicycles, and foldable bicycles. Market history data on the fraction of premium bicycles in total bicycle sales is not available. Hence it is assumed that the fraction reached 12% over the past few years. This value is considered constant all through the years of future projection.

Market share forecast for TVS in premium bicycles is represented in Image9 of Annexure-I. This plot also presents the TVS 3Wheeler market share details from the year of start of sale.

Pessimistic case assumes market share growth very close to that of 3W sales. This is because, 3W customers have the vehicles bought for their life support. So, customers will be

highly reluctant to purchase products from new market entrants for the risk of high maintenance costs, and low knowledge of repair mechanics in the market about the product. Bikes are bought by the customers for leisure activities. 3W customers are affected by parameters such as fuel prices and the vehicle permits in the given cites. Bike customers have no such constraints. So the market share with worst market performance for bikes could be benchmarked by 3W sales market share, since that case very clearly represents highly constrained customers and market conditions.

Realistic case assumes slightly higher market share growth, and could be associated with the brand value leverage done by TVS. This represents a case where TVS is recognised as a familiar brand existing in the market and customers do not worry about warranty issues because of the goodwill existing in the market.

The optimistic case assumes even higher market share growth rate. This could be attributed to high brand reorganization for TVS and its product & services. In this case TVS products are uniquely identified for their USPs and are valued by customers. TVS is identified as a strong market player among other market players from outside India, and is identified as a technology promoter.

Although TVS is a late entrant into the bike market where there are already few market pioneers, it is assumed that TVS concentrates on new sub market segment creation in order to achieve high market shares. These include carbon fibre framed bikes (for which Indian manufacturers are just planning), electric assist bikes (for which market is yet to be created), and foldable & compact bikes. Realistic and optimistic cases assume that TVS also enters other premium bike categories such as juveniles and specialised bikes with time in order to capture better market shares from other segments too.

Profit margins are assumed for pessimistic, realistic and optimistic cases, to represent the variations of raw material cost and final product price reduction by competitors. It is estimated that premium bicycles are sold by manufacturers at an operating margin of around 20%, since most of these sales are based on brand value, and production costs are much lower compared to the technology component of the product. For the business cases, it is estimated that TVS will have margins ranging from 8% to 12% only considering that initial designs and processes will not be most cost effective.

Product prices forecast is presented in Image8 of Annexure-I. This value could be very well paralleled with inflation rate minus market competition effects. Market competition forces the profit margins reduce for each part and overall bike prices come down. This could be due to competitors reducing price of equivalent products that TVS offers. Pessimistic case assumes the price increase of around 2% over each year caused by huge effects of competition. Realistic case assumes price growth of around 5% which is assuming the nominal effects of competition over inflation. Optimistic case assumes 10% inflation un-corrected by market competition. Image16 from Annexure-I represents inflation of CPI for India.

Rest of the projections of TVS sales numbers and TVS profits are drawn from above assumptions only. Any kind of market conditions within the assumed range will result in sales ranging between best case and worst case of the projected future trends. However, the pessimistic case as assumed in the business cases is highly unlikely to occur since this case assumes sustained decline in the sales of premium bikes.

11. Promotional methodology

11.1. Initial free samples to experts

Most of the bike sales are promoted through word of mouth and opinion of fellow riders for the new customers. When it comes to the experienced, they usually tend to buy more than one bike, one for each purpose. Experts will be able to judge their requirements and products that are meeting them usually immediately. But, their Valuable feedback will not reach rest of the market on all the products they tested and tried.

In order to create good image among bike users, it is proposed to identify few influential riders and provide then with free samples of TVS bikes. Providing them on returnable basis may also help but may not fetch all the best results since the sense of ownership will never be built.

11.2. Few models for public use on request

TVS can allot few tens of bikes per a thousand of potential customers as demo bikes. These bikes will be available to anyone with an appropriate caution deposit and an ID proof with prior booking for free or nominal usage charge for a limited period of time.

Pickup locations of these bikes can be conveniently setup for users trying to go on long weekend rides. This helps develop goodwill among bike riders and promotes sales on long run if TVS bikes are substantially better than average competitors' bikes.

11.3. Test rides to customers before purchase

It is preferred to have a mini track or small enclosed space of at least 200m long for all customers to test and try all the bike models at selected dealerships. This gives the customers a feel of how each vehicle is different and makes them choose the best suited to them. The purpose of keeping this open to general public visiting dealerships is to encourage probable customers into trying out and encourage them to purchase.

11.4. Promoting green rides

It is proposed to organise few long rides via professional event management groups in order to create awareness among customers. This is parallel to long rides organised by Royal Enfield to Himalayas for its customers. TVS may optionally support such green rides in terms of funds or facilities.

12. Bicycle-premium bikes and similar markets and their demands

As with domestic bicycles and premium bicycles, several other market situations have been observed where a portfolio of products from wide range of manufacturers has a high price and high value product segment included.

Some of examples for this are "mobile phones – smart phones", "point and shoot Digital Cameras - DSLR cameras", " small cars – luxury cars", "laptops-mobile workstations".

Image17 from Annexure-I represents growth in Indian population's purchasing power. This can be observed with explosive increase in number of luxury products in use during the recent past. Some of these examples are luxury motorcycles, cars, smart phones, cameras, etc. Usually at least two luxury products are available with each purchaser.

As discussed in section 3 about purchasing behaviour of customer category, it may be noticed that some of the activities can be done while riding the bike too.

So, it may be safely assumed that a buyer of the performance bicycle may not have to spare time from his original activities.

This implies that the market share of the premium bicycle market will not be growing at the cost of market shares of other categories of products such as smart phones, SLR cameras, etc.

13. Break-even Points

Break even time durations for two business cases [BC1, BC2] are presented in image12, and image14 of Annexure-I. X-axis represents time in years from start of project. T2 (T0+2 years) is expected as start of sales, and T3 sees sales numbers rising from zero.

In each image, the point at which the investment curve joins the profits curve can be termed as breakeven point. Break even points are different for different market conditions and also for different investment requirements.

In the Image14 of Annexure-I, it may be observed that recurring expenses are too high to achieve breakeven for case with maximum investments being made when the market performance is at its worst.

It may be advisable in such cases to cut down royalty percentages for IP from consultants. Also, since the worst case assumes sales drop of 15% each year, persistence of such condition is highly unlikely and hence breakeven is inevitable at least in a distant future for the worst case.

Image 18 from Annexure I shows another way of looking at breakeven points where worst case market conditions do not exist. A set of three scenarios is created, which are derived from realistic case assumed in business cases presented. Keeping all other conditions same, only market share values are varied, in order to locate breakeven points. It can be clearly seen that the breakeven time is not effected severely.

In all the three scenarios, it may be observed that breakeven occurs within 2 years of start of sale of bikes into the market.

14. Exit strategy

In the event of TVS finding the bicycle business not so interesting in terms of future plans after complete or part of the investment has been made, there are several ways of coming out of the business. Since the investment is done in phases, an early exit only has effect on part of the investment commitment.

Investments on development process and critical knowledge acquisition can be recovered in-terms of charges on IPRs on the knowledge. Investment on manufacturing process is almost completely recoverable, since this investment accounts to all of capital expenditure. Investments on marketing and sales are least recoverable. However, goodwill and brand value created in the market shall definitely be a deciding factor in evaluating the total worth of the business at the time of sale.

TVS can very well sell the infrastructure, IPRs, brand value to new market entrants from outside India. Some of these manufacturers have only assembly units in India, and some import semi-assembled bicycles to be delivered to local dealers.

A business unit equipped with design, manufacture, and testing facilities for bikes, which is completely setup and running will be highly lucrative offer for international players as this could be their chance to establish Indian subsidiary with lowest efforts. TVS can choose to exit the business with profitable numbers in such cases.

Alternatively, TVS can offer its facilities to an international bicycle manufacturer intending to enter Indian market for manufacturing, and assembling. Resources will still be with TVS while earning income from the usage by others.

This helps TVS not forgo any money spent on such facilities, training and knowledge gaining. In such cases, TVS can offer its engineering and design services for companies in need by offering them design consultancy.

15. Conclusion

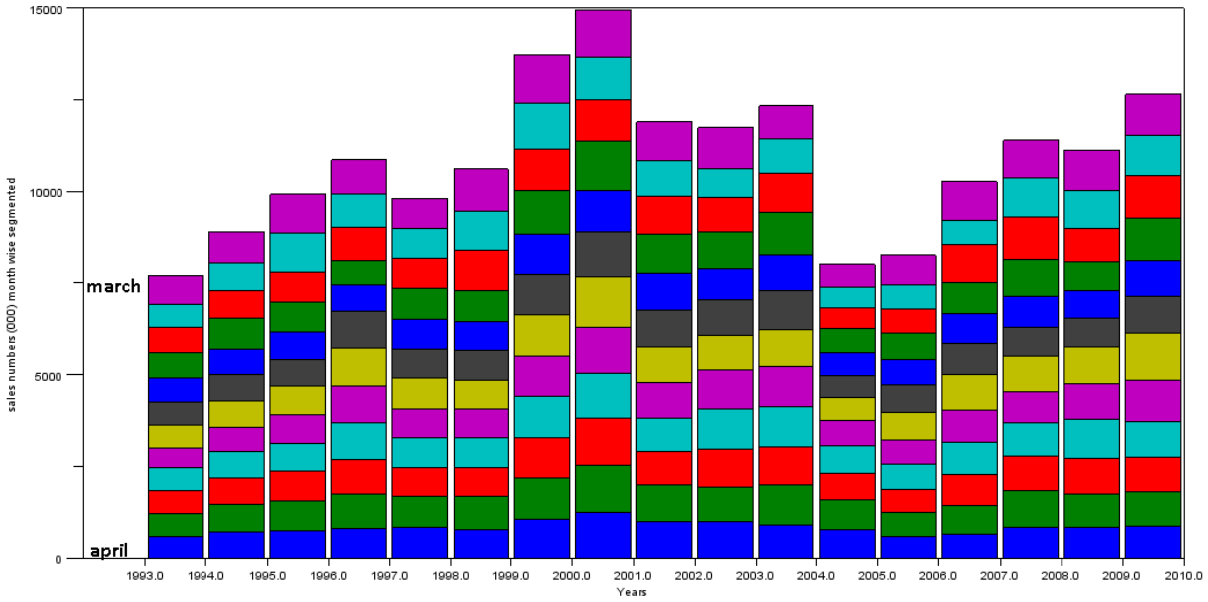
As mentioned in sections earlier, it can be seen that premium bicycles market is a highly profitable segment that TVS can surely think of investing in. As mentioned in section 13, and as displayed in images 12, 14, and 18 from annexure-I, it may be noticed that breakeven occurs under all realistic circumstances within reason. Realistic cases proposed in BC1, BC2 have breakeven sales happening in around 2 years of start of sales and provide gross profits up to INR 82 Cr.

Expanding into products of interest to high income group of society helps TVS in brand extension and also builds goodwill for any future expansions into other highly profitable markets for luxury products with strong engineering requirement.

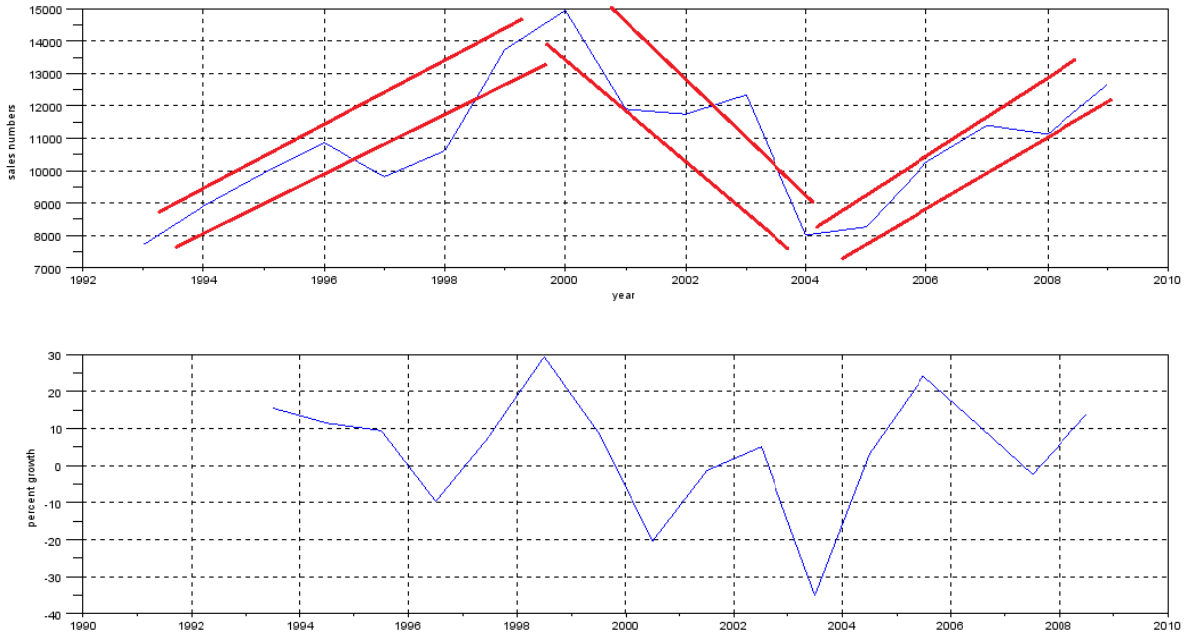
Technology and engineering knowledge gained via this project will help TVS explore new arenas in the product engineering, and this helps TVS to come up with products of better customer liking.

Overall, premium bicycles manufacture will be highly profitable for TVS and will pave way for future brand extensions into high value engineering products.

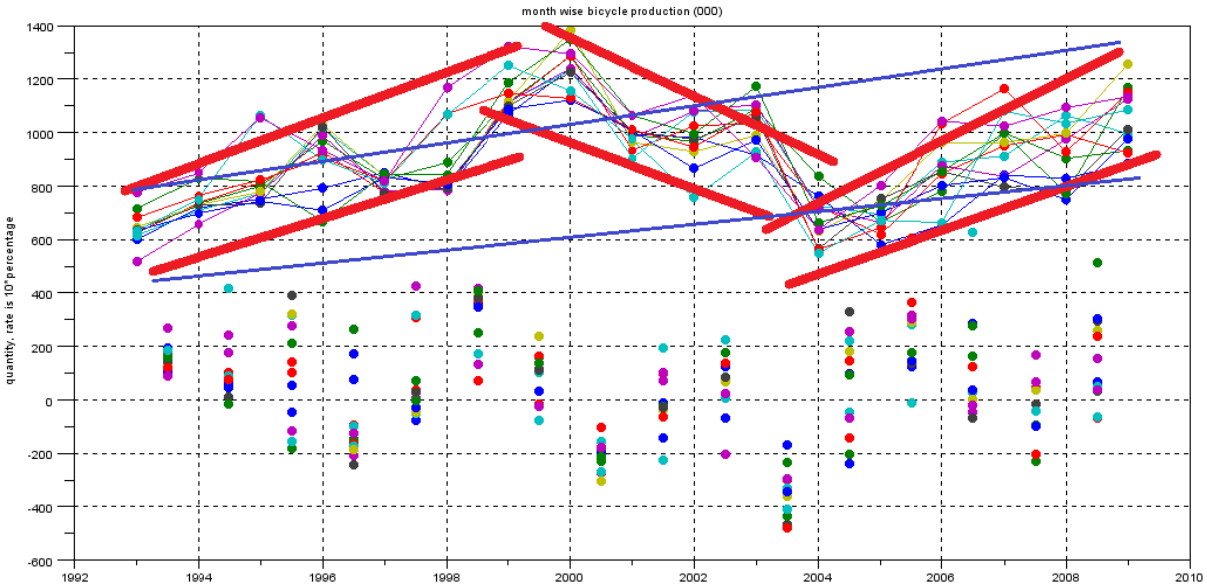
Annexure I



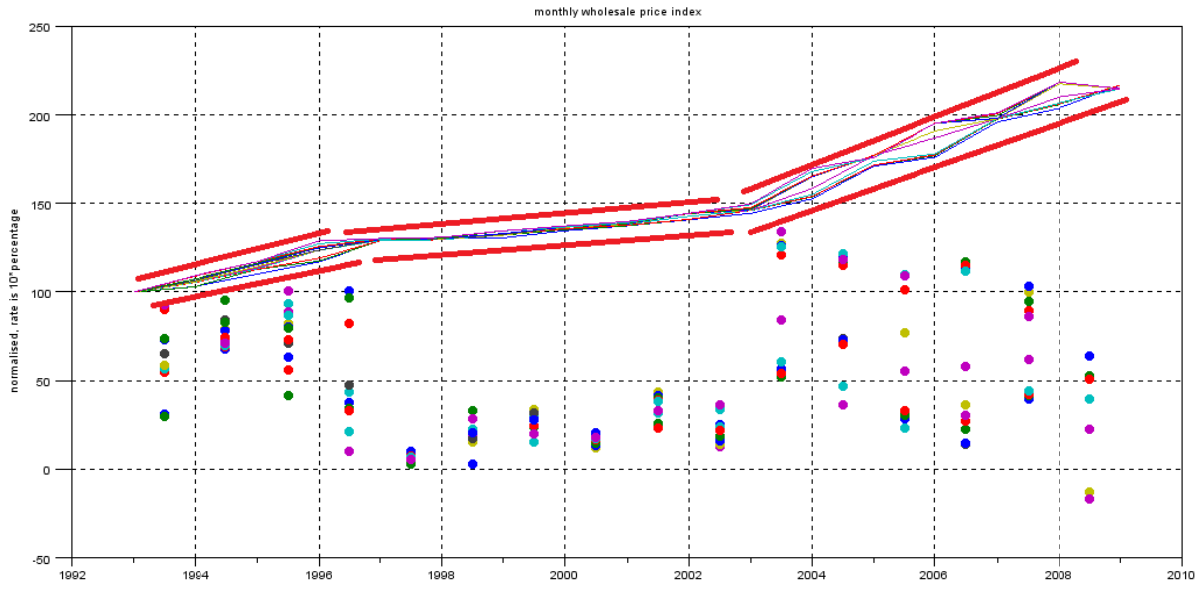
A1.1: monthly bike sales in thousands [image1]
Original data Source: Intecos-CIER.
Referred data Source: http://www.indiastat.com, last accessed on 01 September 2011
Compiled by Raghunath Kumar



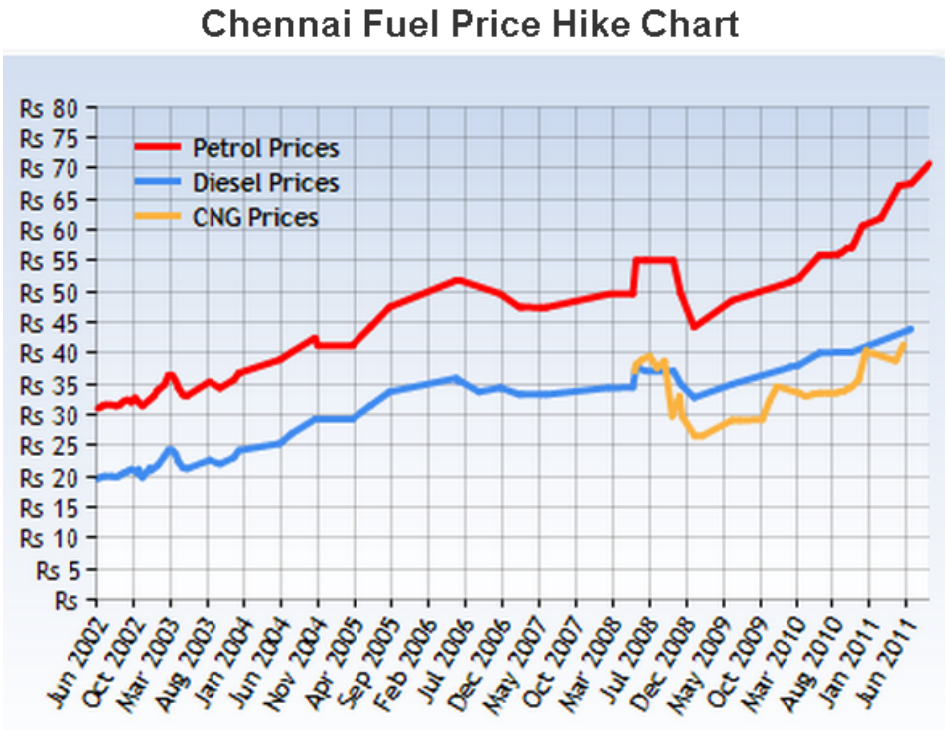
A1.2: annual bike sales'000 and Y-o-Y growth rates [image2]
Original data Source: Intecos-CIER.
Referred data Source: http://www.indiastat.com, last accessed on 01 September 2011
Compiled by Raghunath Kumar



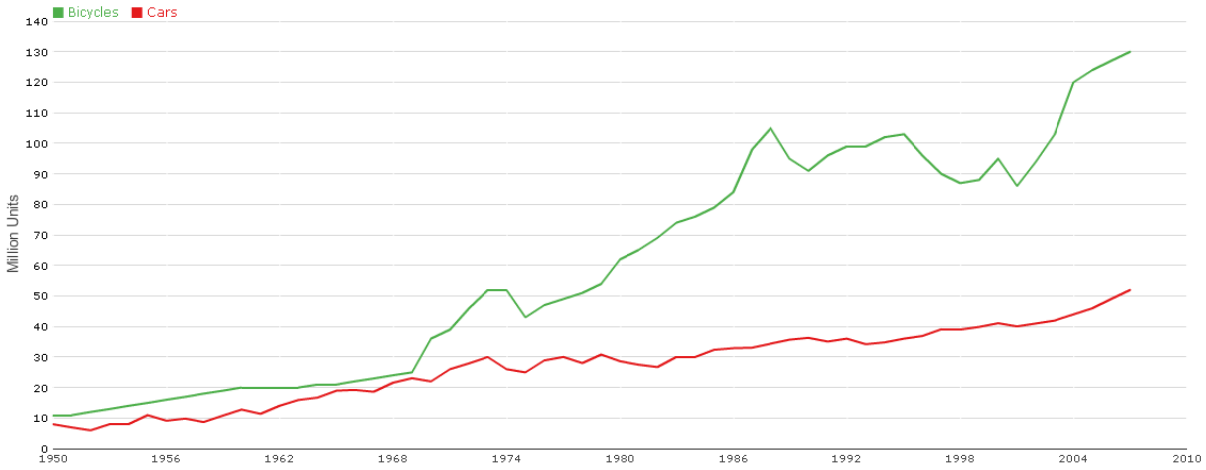
A1.3: sales figures for each month and corresponding change patterns in red and blue boundaries
Y-o-Y Growth rate*10 in coloured dots [image3]
Original data Source: Intecos-CIER.
Referred data Source: http://www.indiastat.com, last accessed on 01 September 2011
Compiled by Raghunath Kumar



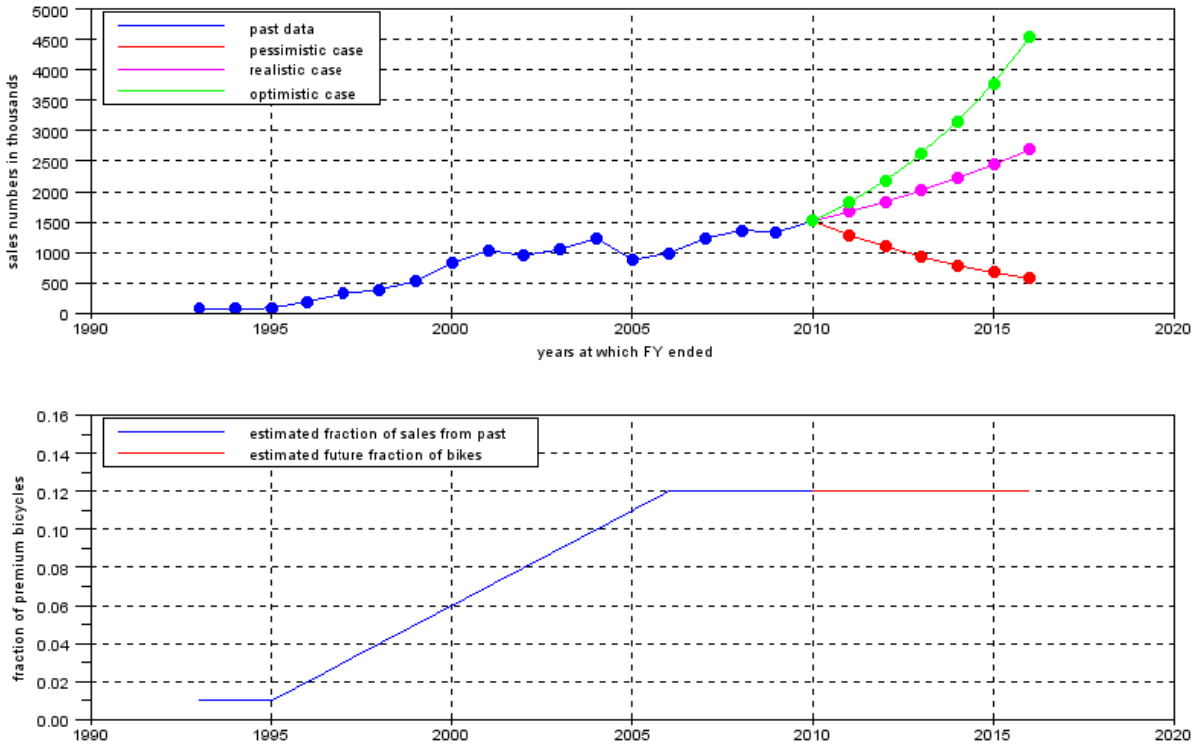
A1.4: sales price change index: price value normalised to 100,
Y-o-Y Price growth rate*10 in dots [image4]
Original data Source: Intecos-CIER.
Referred data Source: http://www.indiastat.com, last accessed on 01 September 2011
Compiled by Raghunath Kumar



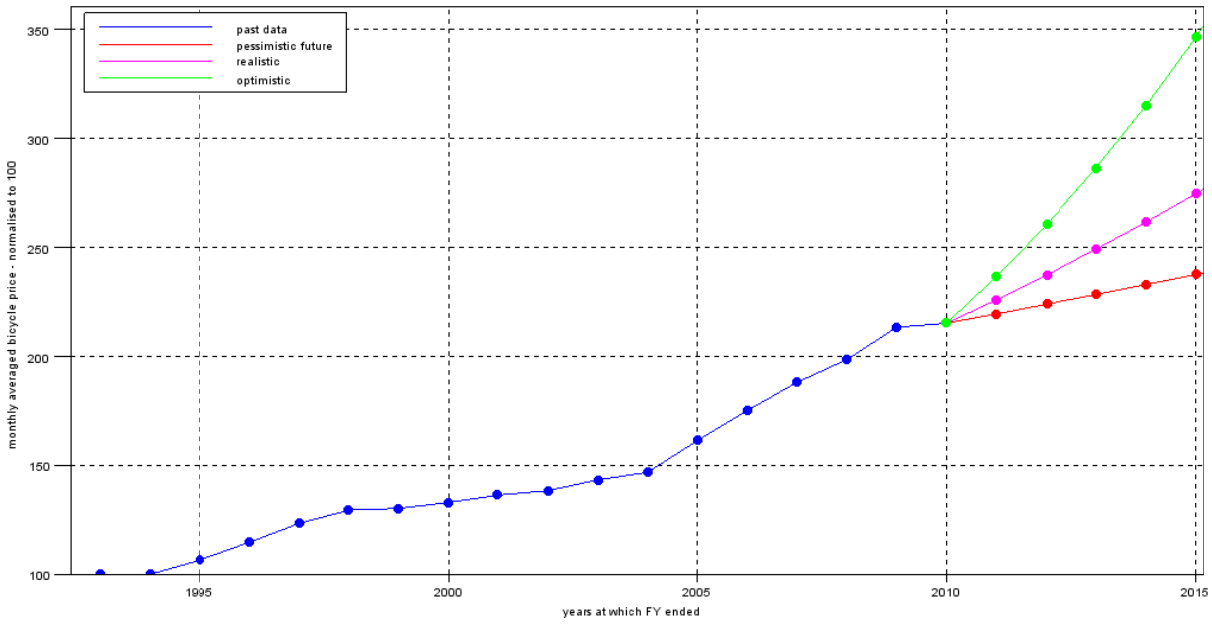
A1.5: price chart for various automobile fuels [image5]
Source: http://www.mypetrolprice.com/fuel-price-chart.aspx, last accessed on 20 September 2011



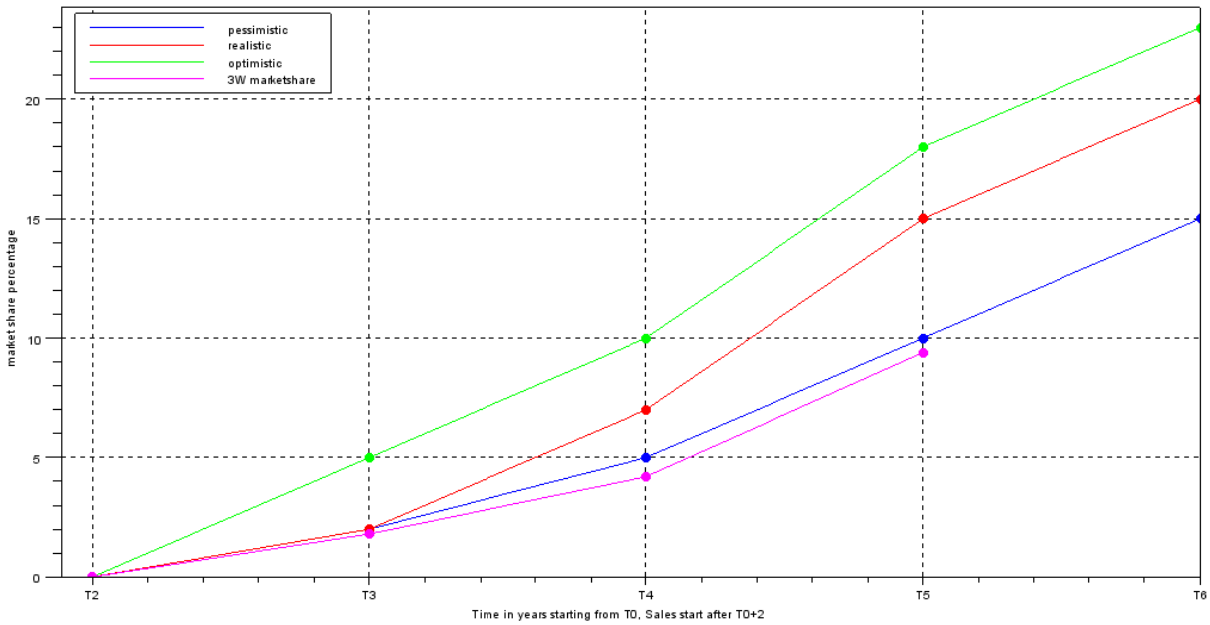
A1.6: world bicycle and automobile production during 1950-2007 [image6]
Source: http://chartsbin.com last accessed on 20 September 2011
Original source: Worldwatch Institute



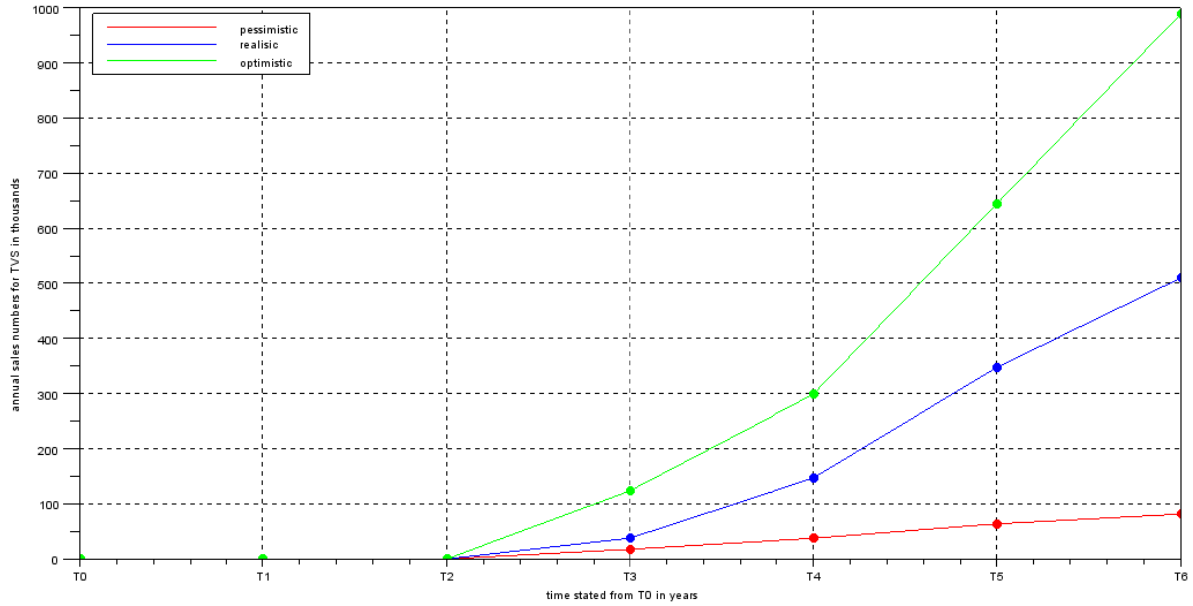
A1.7: Market forecasts about premium bike sales numbers for pessimistic, realistic, and optimistic market conditions [image7] second portion of image represents estimated and projected fractions of premium bikes in total bicycle sales
Data compiled by Raghunath Kumar



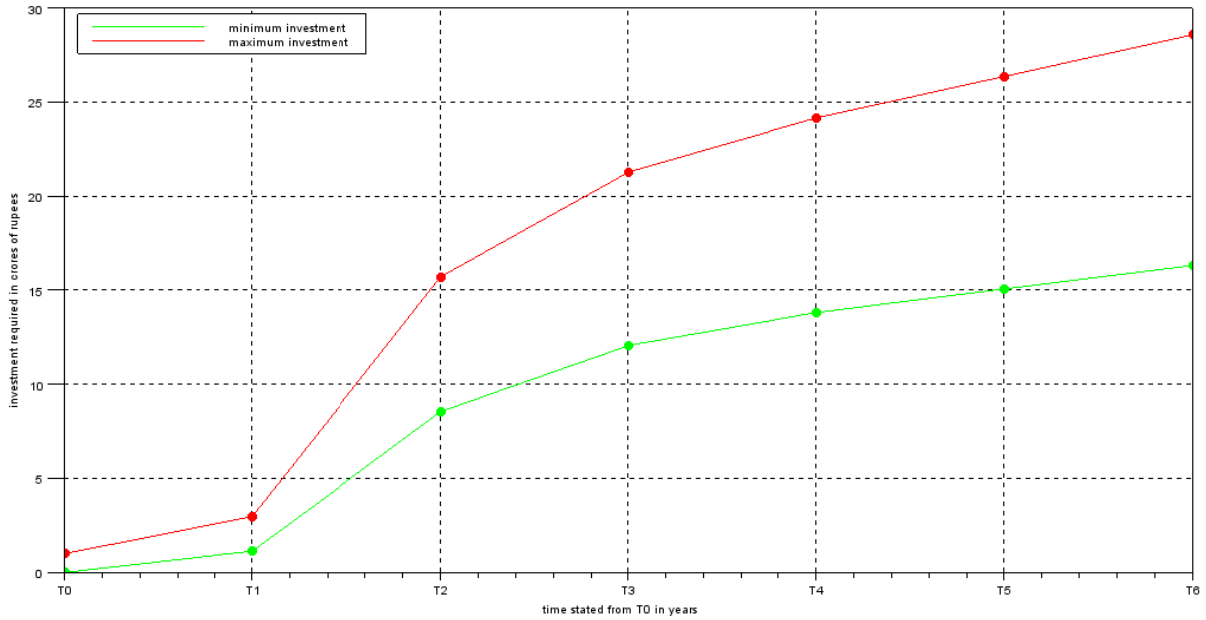
A1.8: Monthly averaged bicycle price forecasts about pessimistic, realistic, and optimistic market conditions [image8]
Data compiled by Raghunath Kumar



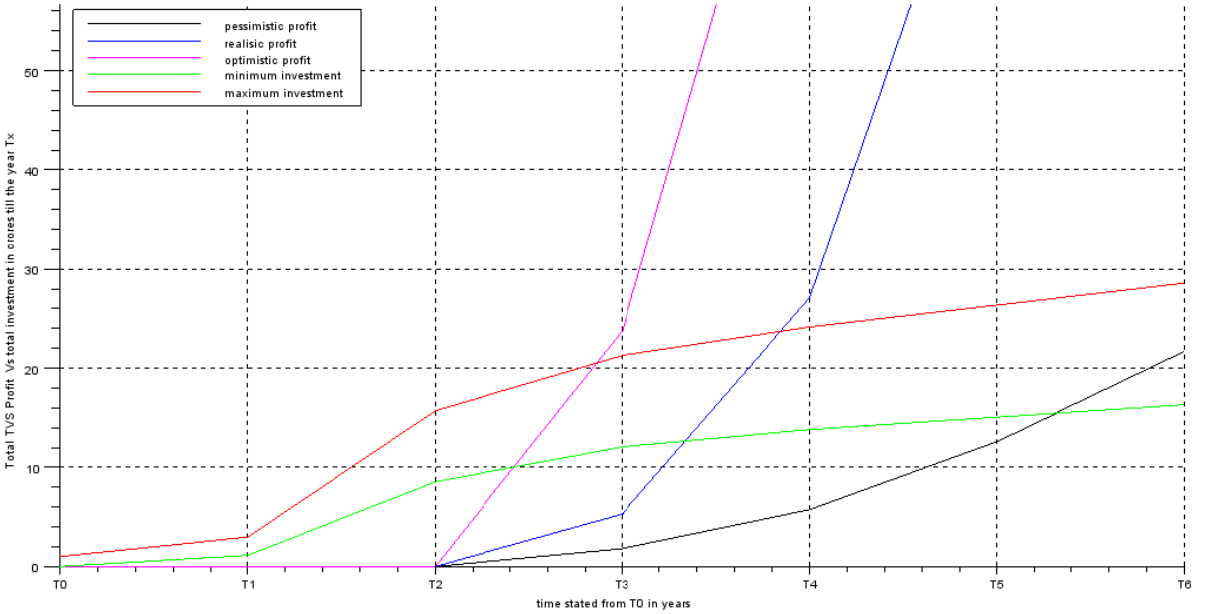
A1.9: Annual market share forecasts about pessimistic, realistic,
and optimistic market conditions [image9] compared with actual 3W market share after start of sales
Data compiled by Raghunath Kumar



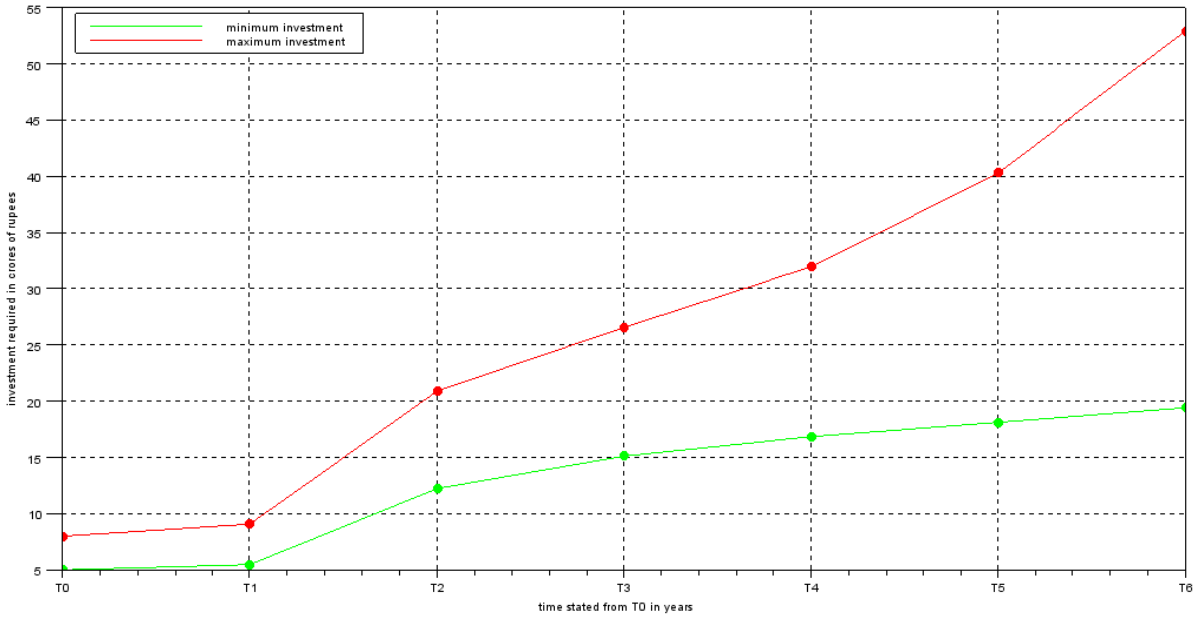
A1.10: Annual SALES forecasts about pessimistic, realistic, and optimistic market conditions [image10]
after start of sales
Data compiled by Raghunath Kumar



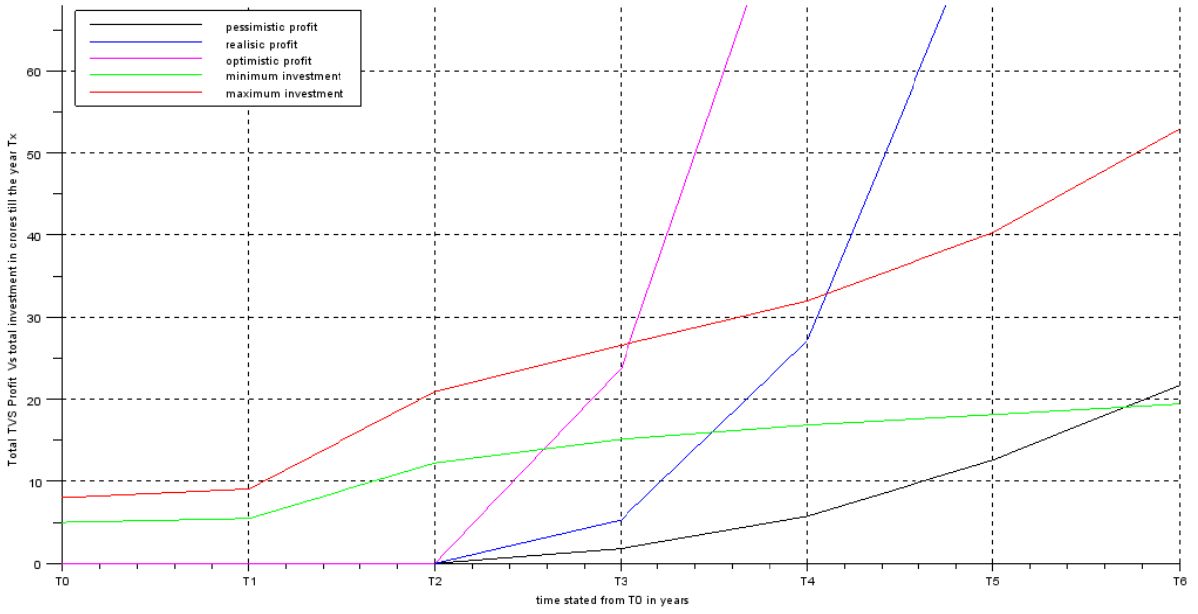
A1.11: investment requirements range for starting and progressing with the project [image11] for [BC1]
Data compiled by Raghunath Kumar



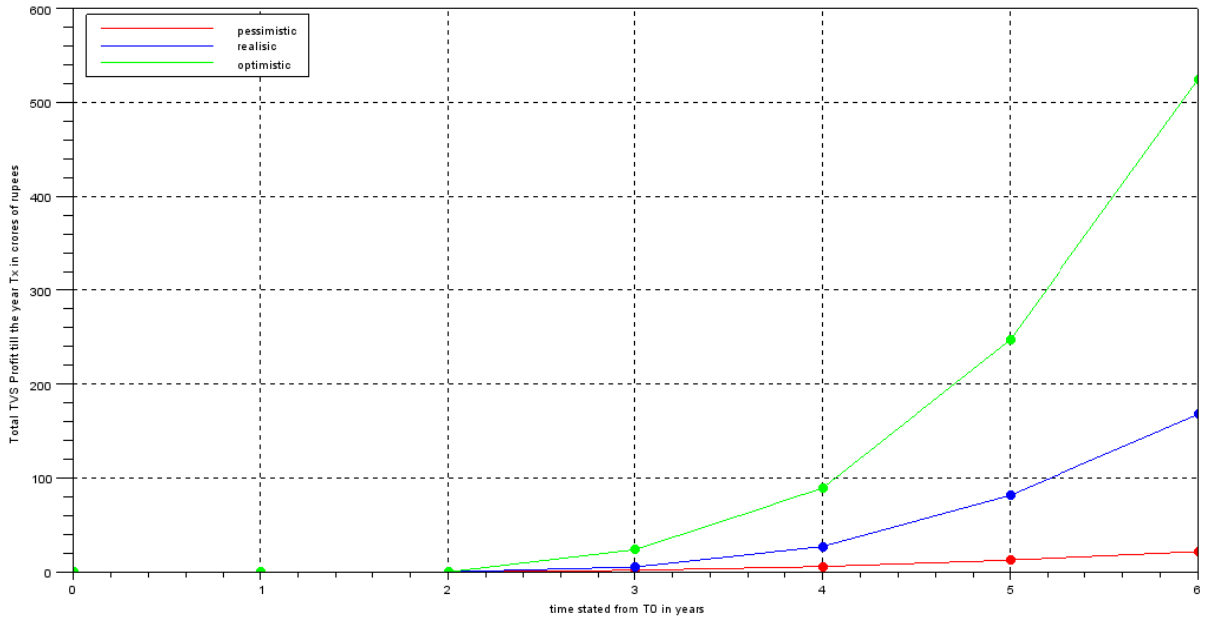
A1.12: cumulative investment requirements (Cr) range Vs cumulative profits (Cr) through sales [image12] for [BC1]
Data compiled by Raghunath Kumar



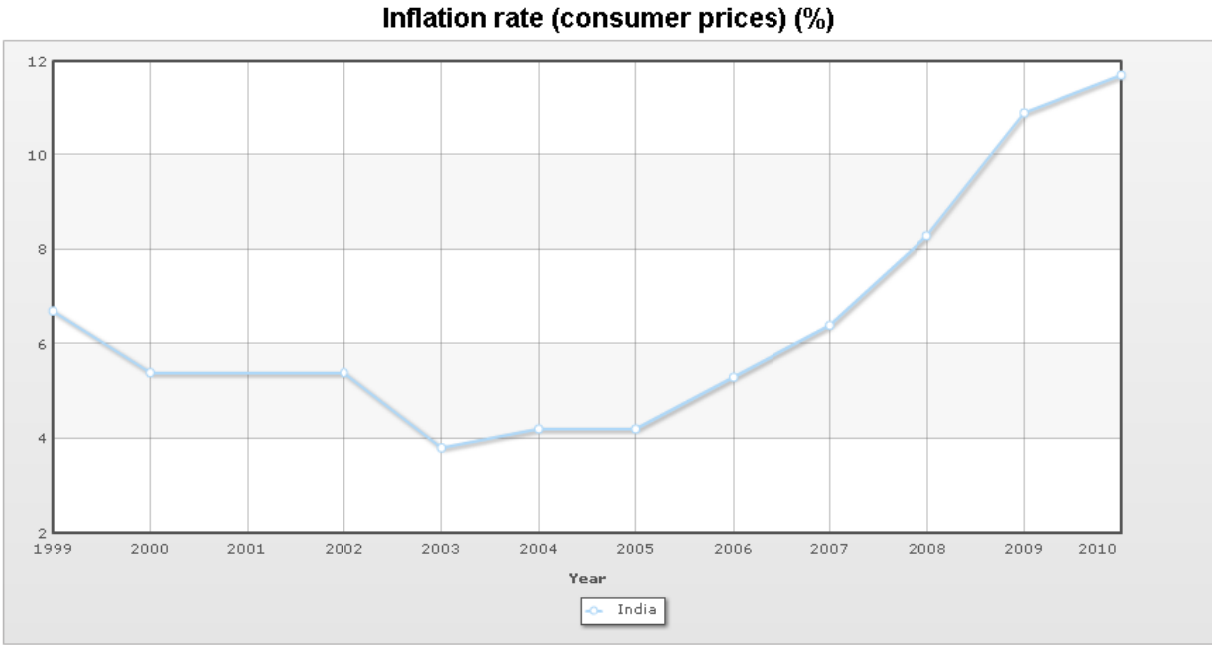
A1.13: investment requirements range for starting and progressing with the project [image13] for [BC2]
Data compiled by Raghunath Kumar



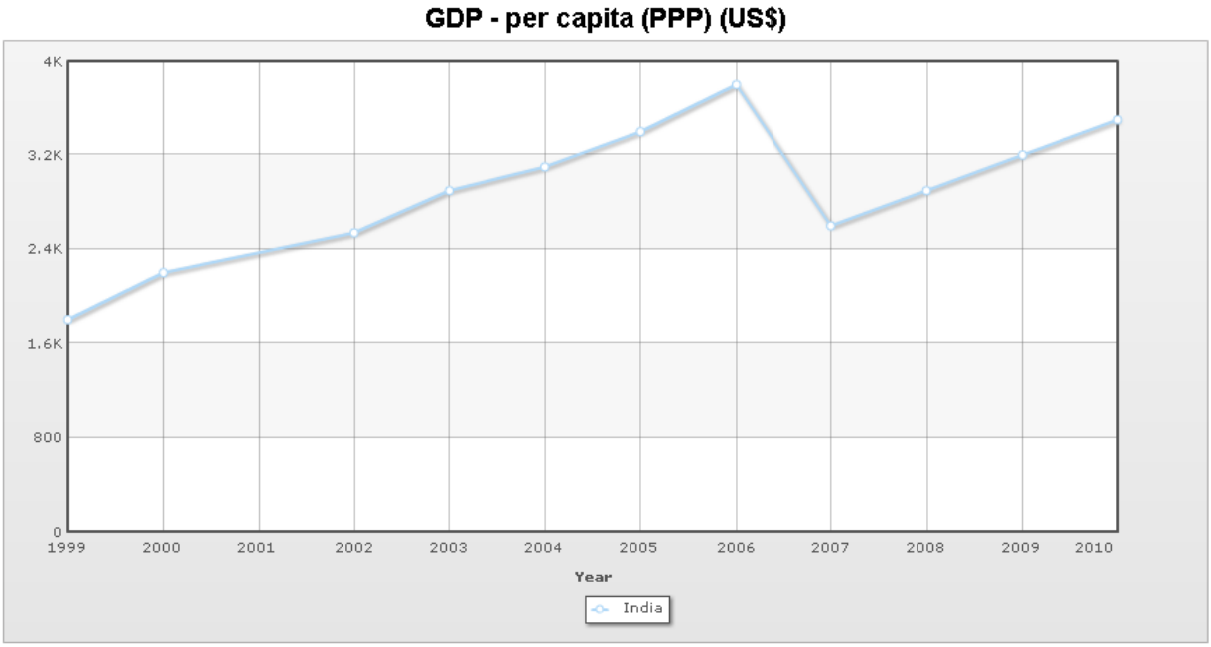
A1.14: cumulative investment requirements (Cr) range Vs cumulative profits (Cr) through sales [image14] for [BC2]
It may be observed that breakeven cannot be achieved for maximum expenses (consultant charging 0.5% of product price) with worst market conditions
Data compiled by Raghunath Kumar



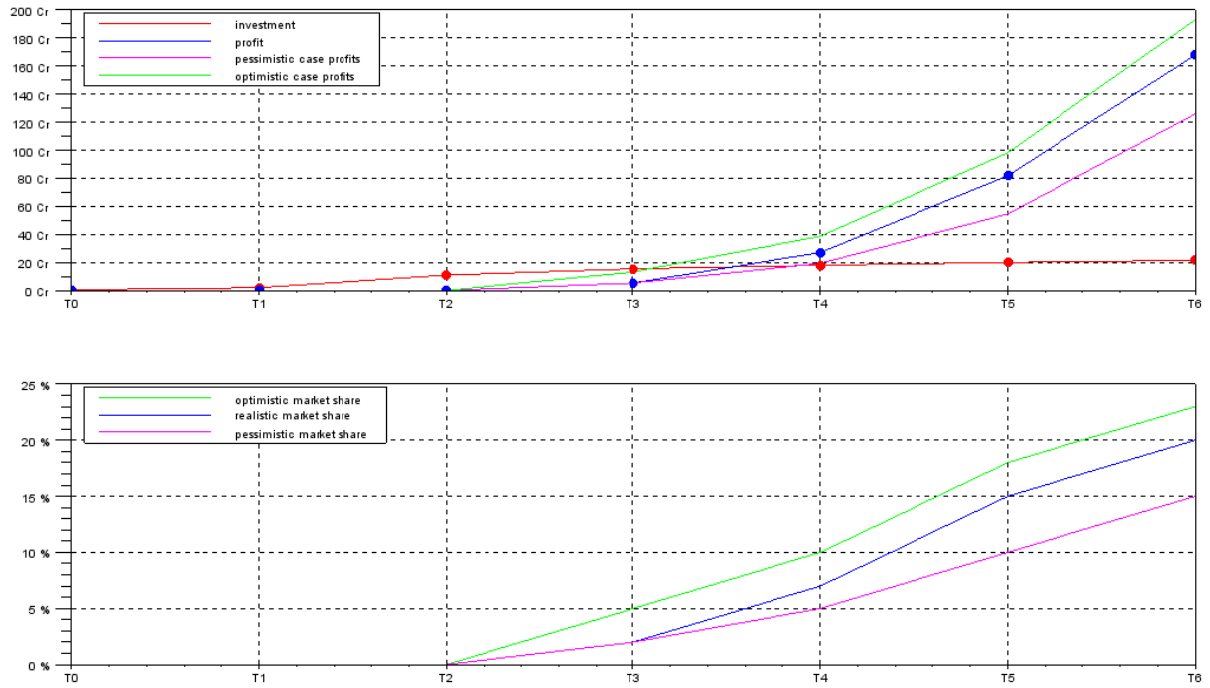
A1.15: Projected cumulative Profit in Cr for TVS through sales [image15]
Data compiled by Raghunath Kumar



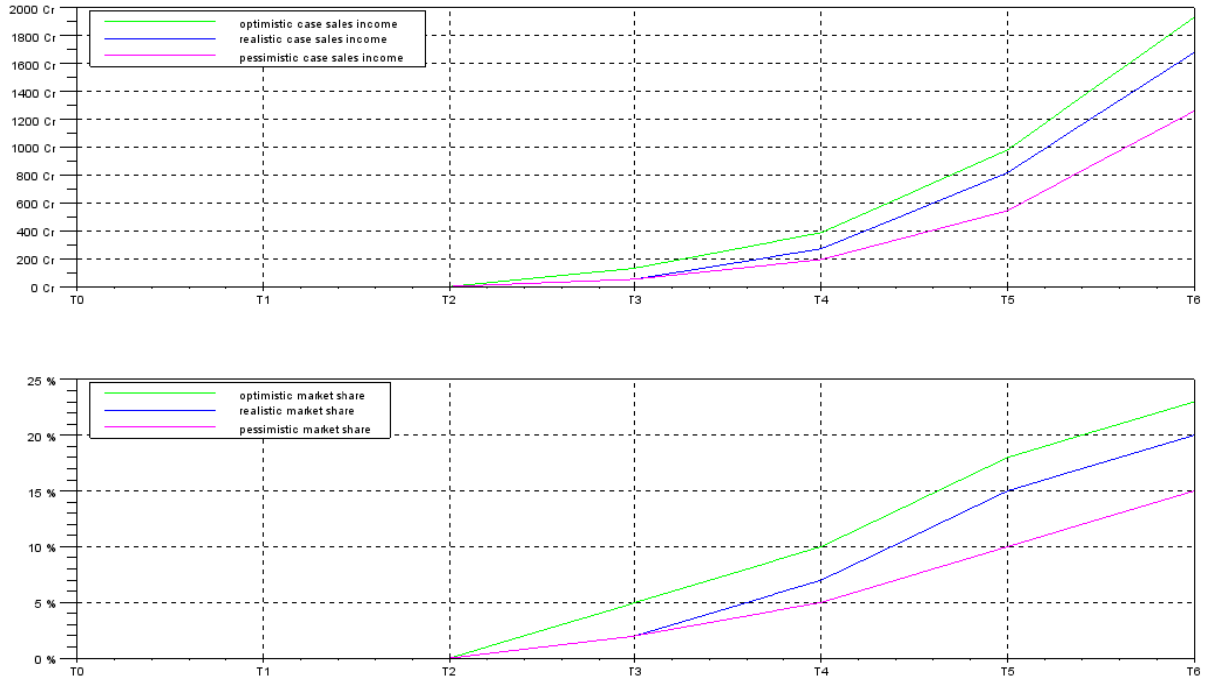
A1.16: India's inflation rate for Consumer Price Index [Image16]
Source: www.indexmundi.com last accessed on 27 September 2011
Original source: CIA world factbook



A1.17: GDP- purchasing power parity for India: this is the sum of values (in USD) of all products purchased by population, divided by population at July 1st of each year. [image17]
Source: www.indexmundi.com last accessed on 27 September 2011
Original source: CIA world factbook



A1.18: investment requirement, and profits represented in the same figure. Three cases from realistic market conditions are created with varying market shares. Changes in market shares in all three cases are depicted in the lower half of the figure. [image18]
Date compiled by Raghunath Kumar



A1.19: Sales income generated over time is shown in rupees on y axis. Second graph shows market shares assumed. The plots represent three conditions in which with rest of all parameters being same, market share fraction varies. (sensitivity analysis of sales income vs market share) [image19] Data compiled by Raghunath Kumar

Annexure II

A2.1: Bicycle category share [link1]

Product Variation	
Type	Share (%)
Product Technology	
Conventional	85
Hi-tech (Specials)	15

Original Source: Intecos-CIER.
Referred Source: http://www.indiastat.com, last accessed on 01 September 2011

A2.2: market share segmentation zone wise [link2]

Market Segmentation	
Type	Share (%)
North	36
East	26
West	17
South	21

Original Source: Intecos-CIER.
Referred Source: http://www.indiastat.com, last accessed on 01 September 2011

A2.3: annual sales data for Indian bicycles [link3]

FY	Sales numbers in thousands
1993-94	7712.31
1994-95	8907.21
1995-96	9926.05
1996-97	10862.96
1997-98	9813.4
1998-99	10615.4
1999-00	13733.7
2000-01	14945.4
2001-02	11898
2002-03	11744
2003-04	12341
2004-05	8013
2005-06	8267
2006-07	10266
2007-08	11397
2008-09	11124
2009-10	12655

Original Source: Intecos-CIER.
Referred Source: http://www.indiastat.com, last accessed on 01 September 2011
Compiled by Raghunath Kumar

A2.4: Market share of lead players for domestic bicycle market [link4]

Lead Players	
Company	Share (%)
Hero Cycles	32-38
Tube Investments	25-30
Atlas	20-25
Avon	10-15
Others	

Original Source: Intecos-CIER.
Referred Source: http://www.indiastat.com, last accessed on 01 September 2011

A2.5: http://www.bicyclepotential.org [link5], last accessed on 21 September 2011

A2.6: http://www.greentyre.co.uk [link6] last accessed on 22 September 2011-09-22

A2.7: http://www.hancox.co.uk/biketyres.html [link7] last accessed on 22 September 2011

A2.8: http://mrtuffy.com [link8] last accessed on 22 September 2011-09-22

Annexure III

A3.1 Business Case 1: [BC1]

This business case considers that technology consultation has been sought for initial know-how and fee is paid up front. TVS also employs designers and works on designs. TVS shares some of the software resources available, manpower available, test facilities available, assembly area available to reduce initial investment costs. A range of expenses ranging from X_min to X_max are considered, where X refers to the category of expense. Range of expenses to be incurred is indicated in the last page of the BC1 report. Report also assumes that the investments for certain resources are done in phases over few years depending on need.

For the sales data, a forecasted market share growth and forecasted market conditions are considered for three different conditions, namely pessimistic, realistic and optimistic. Gross profits for the project are calculated for all the three cases. Last page of BC1 report also contains the cumulative gross profit achieved by the project as compared to cumulative investments/expenses incurred.

A3.2 Business Case 2: [BC2]

This business case considers that technology consultation has been sought for project kick off and few designs have been bought too. TVS may be paying royalty to the consultant as a percentage of bike prices. TVS also employs designers and works on designs. TVS shares some of the software resources available, manpower available, test facilities available, assembly area available to reduce initial investment costs. A range of expenses ranging from X_min to X_max are considered, where X refers to the category of expense. Range of expenses to be incurred is indicated in the last page of the BC2 report. Report also assumes that the investments for certain resources are done in phases over few years depending on need.

For the sales data, a forecasted market share growth and forecasted market conditions are considered for three different conditions, namely pessimistic, realistic and optimistic. Gross profits for the project are calculated for all the three cases. Last page of BC1 report also contains the cumulative gross profit achieved by the project as compared to cumulative investments/expenses incurred.

A3.3 Project expenses considered

The following table lists the expenses considered during the business cases preparation.

This may not be a complete list and the numbers assumed are only indicative and may not represent the actual expenses. All the CTCs are given in per year numbers and other expenses are actual numbers.

Expenses	**Category**	**Amount (in crores)**	**Required during time**
Designers' CTC	Development	0.5	T0-T6
Tester' CTC	Development	0.4	T1-T6
Design SW investments	Development	0.3	T0
Assemblers' CTC	Manufacturing	0.15	T2-T6
Test RIG investments	Development	0.3	T1
Prototype investments	Manufacturing	1	T0-T3
Tooling investments	Manufacturing	7	T1-T3
Consultancy charges - one time and recurring	Development	2	T0-T3
Supplier identification investments	Manufacturing	1	T0-T4
Assemblers' training investment	Manufacturing	0.4	T2-T6
Assembly line setup investments	Manufacturing	2	T1-T4
Project management costs	Development	0.35	T0-T6
Marketing investment – one time and recurring	Marketing and sales	2+1	T1-T6

Following list shows the price split method estimated for the overall price of the bicycle

Some of the estimated costs incurred during production are considered and are discounted in the total price to TVS, inorder to obtain material price margin. This material price limit value may be used to calculate the price limits of individual components of the bike.

$$EXfactoryprice := AverageCostofBike$$

$$EXTVSPrice := \frac{EXfactoryprice}{1 + ProfitMarginFraction}$$

$$TVSPRODoverheadsPU := MANpowerPU + materialStoratePU + localMovementPU ... + AssemblylinemaintenancePU + machinerydepreciationPU ... + assembledUnitstorageNhandlingPU - InputTaxRebatePU ... + MiscOverheads$$

Production overheads

$$TVSrunningOverheadsPU := \frac{\left(\begin{array}{l} DesignCostRunningPACr + TestCostRunningCr ... \\ + ProjectManagementCostPACr ... \\ + AssemblyCostPACr ... \\ + MarketingRunningCr \end{array}\right)}{TVSAnnualProd}$$

Running overheads

$$TVSMaterialPrice := EXTVSPrice - TVSPRODoverheadsPU - TVSrunningOverheadsPU$$

$$EXShowroomprice := EXfactoryprice + DealerProfitMargin ... + \frac{\left(\begin{array}{l} TransportPricePU + staffsalaryPA + AdvertisementcostPA ... \\ + showroommaintenancecostPA + serviceequipmentdepreciationPA ... \\ + PackingchargesPA \end{array}\right)}{ShowroomSalesPA}$$

$$OnRoadPrice := EXShowroomprice + VAT + LocalTaxes + Surcharges$$

TVSMaterialPrice is split into cost several parts cost + taxes + transport

Parts cost is split into Tier1 supplier profit margin + raw material cost + processing expenses

note: All the above are only assumptions by the author and have not been verified with actual practice in the industry

Business Case details

In this plan, a one time consultancy charge is planned with no option of royalty.

Three cases of future are proposed, namely optimistic, realistic and pessimistic

critical factors determining future are defined under all these three conditions

salesTotalBikesT0 := 1000000 Permonth

PercentSaleHighBikes := 12

PriceGrowthRate_P := 1.02	PriceGrowthRate_R := 1.05	PriceGrowthRate_O := 1.1
MarketGrowthRate_P := 0.85	MarketGrowthRate_R := 1.1	MarketGrowthRate_O := 1.2
TVSMarketShareT0_P := 0	TVSMarketShareT0_R := 0	TVSMarketShareT0_O := 0
TVSMarketShareT1_P := 0	TVSMarketShareT1_R := 0	TVSMarketShareT1_O := 0
TVSMarketShareT2_P := 0	TVSMarketShareT2_R := 0	TVSMarketShareT2_O := 0
TVSMarketShareT3_P := 0.02	TVSMarketShareT3_R := 0.02	TVSMarketShareT3_O := 0.05
TVSMarketShareT4_P := 0.05	TVSMarketShareT4_R := 0.07	TVSMarketShareT4_O := 0.10
TVSMarketShareT5_P := 0.1	TVSMarketShareT5_R := 0.15	TVSMarketShareT5_O := 0.18
TVSMarketShareT6_P := 0.15	TVSMarketShareT6_R := 0.20	TVSMarketShareT6_O := 0.23

AverageCostofBikeT0 := 12000 OneCr := 10000000

AverageCostofBikeT1_P := AverageCostofBikeT0·PriceGrowthRate_P = 1.224×10^4

AverageCostofBikeT1_R := AverageCostofBikeT0·PriceGrowthRate_R = 1.26×10^4

AverageCostofBikeT1_O := AverageCostofBikeT0·PriceGrowthRate_O = 1.32×10^4

AverageCostofBikeT2_P := AverageCostofBikeT1_P·PriceGrowthRate_P = 1.248×10^4

AverageCostofBikeT2_R := AverageCostofBikeT1_R·PriceGrowthRate_R = 1.323×10^4

AverageCostofBikeT2_O := AverageCostofBikeT1_O·PriceGrowthRate_O = 1.452×10^4

AverageCostofBikeT3_P := AverageCostofBikeT2_P·PriceGrowthRate_P = 1.273×10^4

AverageCostofBikeT3_R := AverageCostofBikeT2_R·PriceGrowthRate_R = 1.389×10^4

AverageCostofBikeT3_O := AverageCostofBikeT2_O·PriceGrowthRate_O = 1.597×10^4

AverageCostofBikeT4_P := AverageCostofBikeT3_P·PriceGrowthRate_P = 1.299×10^4

AverageCostofBikeT4_R := AverageCostofBikeT3_R·PriceGrowthRate_R = 1.459×10^4

AverageCostofBikeT4_O := AverageCostofBikeT3_O·PriceGrowthRate_O = 1.757×10^4

AverageCostofBikeT5_P := AverageCostofBikeT4_P·PriceGrowthRate_P = 1.325×10^4

AverageCostofBikeT5_R := AverageCostofBikeT4_R·PriceGrowthRate_R = 1.532×10^4

AverageCostofBikeT5_O := AverageCostofBikeT4_O·PriceGrowthRate_O = 1.933×10^4

AverageCostofBikeT6_P := AverageCostofBikeT5_P·PriceGrowthRate_P = 1.351×10^4

AverageCostofBikeT6_R := AverageCostofBikeT5_R·PriceGrowthRate_R = 1.608×10^4

AverageCostofBikeT6_O := AverageCostofBikeT5_O·PriceGrowthRate_O = 2.126×10^4

ProfitMarginFraction_P := 0.08 ProfitMarginFraction_R := 0.1 ProfitMarginFraction_O := 0.12

DesignersCount := 5 TestersCount := 5

Designmonths := 36 Testingmonths := 24

DesignSWInvestmentCr_min := 0 DesignSWInvestmentCr_max := 1

DesignersChargePday_min := 1000 DesignersChargePday_max := 1500

TestersChargePday_min := 1000 TestersChargePday_max := 1500

AssemblerChargePday_min := 600 AssemblerChargePday_max := 1000

DesignResource := DesignersCount·Designmonths·25 = 4.5×10^3 man days

TestResource := TestersCount·Testingmonths·25 = 3×10^3 man days

$$\text{DesignCostInvestmentCr\_min} := \text{DesignResource}\cdot\frac{\text{DesignersChargePday\_min}}{\text{OneCr}} = 0.45$$

$$\text{DesignCostInvestmentCr\_max} := \text{DesignResource}\cdot\frac{\text{DesignersChargePday\_max}}{\text{OneCr}} = 0.675$$

$$\text{DesignCostRunningPACr\_min} := 2\cdot\frac{\text{DesignersChargePday\_min}\cdot 25\cdot 12}{\text{OneCr}} = 0.06$$

$$\text{DesignCostRunningPACr\_max} := 2\cdot\frac{\text{DesignersChargePday\_max}\cdot 25\cdot 12}{\text{OneCr}} = 0.09$$

$$\text{TestCostInvestmentCr\_min} := \text{TestResource}\cdot\frac{\text{TestersChargePday\_min}}{\text{OneCr}} = 0.3$$

$$\text{TestCostInvestmentCr\_max} := \text{TestResource}\cdot\frac{\text{TestersChargePday\_max}}{\text{OneCr}} = 0.45$$

$$\text{TestCostRunningCr\_min} := 10\cdot\frac{\text{TestersChargePday\_min}\cdot 25\cdot 12}{\text{OneCr}} = 0.3$$

$$\text{TestCostRunningCr\_max} := 10\cdot\frac{\text{TestersChargePday\_max}\cdot 25\cdot 12}{\text{OneCr}} = 0.45$$

TestRigInvestmentCr_min := 0 TestRigInvestmentCr_max := 0.5

PrototypeInvestmentCr_min := 0.5 PrototypeInvestmentCr_max := 1.5

ToolingInvestmentCr_min := 5 ToolingInvestmentCr_max := 8

ConsultancyChargesCr_min := 1.5 ConsultancyChargesCr_max := 2.0

SupplierIdentificationInvestmentCr_min := 0.5 SupplierIdentificationInvestmentCr_max := 1.5

AssemblersTrainingInvestmentCr_min := 0.25 AssemblersTrainingInvestmentCr_max := 0.5

AssemblingLineSetupInvestmentCr_min := 1.5 AssemblingLineSetupInvestmentCr_max := 2

$$\text{ProjectManagementCostPACr\_min} := (120000\cdot 0.5 + 100000\cdot 0.65 + 2\cdot 60000\cdot 0.9)\cdot\frac{12}{\text{OneCr}} = 0.28$$

$$\text{ProjectManagementCostPACr\_max} := (120000\cdot 0.6 + 2\cdot 100000\cdot 0.75 + 3\cdot 60000)\cdot\frac{12}{\text{OneCr}} = 0.482$$

MassprodCapPday_min := 100 MassprodCapPday_max := 1400

AssemblerUnitsPDay := 8 ShiftsPDAY := 2

$$\text{AssemblerStaffSrtength\_min} := \frac{\text{MassprodCapPday\_min}}{\text{AssemblerUnitsPDay}\cdot\text{ShiftsPDAY}} = 6.25$$

$$\text{AssemblerStaffSrtength\_max} := \frac{\text{MassprodCapPday\_max}}{\text{AssemblerUnitsPDay}\cdot\text{ShiftsPDAY}} = 87.5$$

$$\text{AssemblyCostPACr\_min} := \text{AssemblerStaffSrtength\_min}\cdot\frac{\text{AssemblerChargePday\_min}\cdot 25\cdot 12}{\text{OneCr}} = 0.113$$

$$\text{AssemblyCostPACr\_max} := \text{AssemblerStaffSrtength\_min}\cdot\frac{\text{AssemblerChargePday\_max}\cdot 25\cdot 12}{\text{OneCr}} = 0.188$$

MarketingInvestmentCr_min := 1.5 MarketingInvestmentCr_max := 2

MarketingRunningCr_min := 0.5 MarketingRunningCr_max := 1

$TVSinvestT0\_min := DesignSWInvestmentCr\_min = 0$ start time

$TVSinvestT0\_max := DesignSWInvestmentCr\_max = 1$

$TVSinvestT1\_min := DesignCostInvestmentCr\_min \cdot \frac{1}{3} + ConsultancyChargesCr\_min \cdot \frac{1}{3} \ldots = 1.13$

$+ PrototypeInvestmentCr\_min \cdot \frac{2}{10} + ProjectManagementCostPACr\_min \ldots$

$+ SupplierIdentificationInvestmentCr\_min \cdot \frac{2}{10}$

$TVSinvestT1\_max := DesignCostInvestmentCr\_max \cdot \frac{1}{3} + ConsultancyChargesCr\_max \cdot \frac{1}{3} \ldots = 1.974$

$+ PrototypeInvestmentCr\_max \cdot \frac{2}{10} + ProjectManagementCostPACr\_max \ldots$

$+ SupplierIdentificationInvestmentCr\_max \cdot \frac{2}{10}$

$TVSinvestT2\_min := DesignCostInvestmentCr\_min \cdot \frac{1}{3} + ConsultancyChargesCr\_min \cdot \frac{1}{3} \ldots = 7.417$

$+ TestCostInvestmentCr\_min \cdot \frac{1}{2} + TestRigInvestmentCr\_min \ldots$

$+ ProjectManagementCostPACr\_min \ldots$

$+ AssemblyCostPACr\_min \ldots$

$+ MarketingInvestmentCr\_min \cdot \frac{2}{3} \ldots$

$+ AssemblingLineSetupInvestmentCr\_min \cdot \frac{1}{3} \ldots$

$+ PrototypeInvestmentCr\_min \cdot \frac{6}{10} \ldots$

$+ AssemblersTrainingInvestmentCr\_min \cdot \frac{1}{2} \ldots$

$+ SupplierIdentificationInvestmentCr\_min \cdot \frac{6}{10} + ToolingInvestmentCr\_min \cdot \frac{8}{10}$

$TVSinvestT2\_max := DesignCostInvestmentCr\_max \cdot \frac{1}{3} + ConsultancyChargesCr\_max \cdot \frac{1}{3} \ldots = 12.737$

$+ TestCostInvestmentCr\_max \cdot \frac{1}{2} + TestRigInvestmentCr\_max \ldots$

$+ ProjectManagementCostPACr\_max \ldots$

$+ AssemblyCostPACr\_max \ldots$

$+ MarketingInvestmentCr\_max \cdot \frac{2}{3} \ldots$

$+ AssemblingLineSetupInvestmentCr\_max \cdot \frac{1}{3} \ldots$

$+ PrototypeInvestmentCr\_max \cdot \frac{6}{10} \ldots$

$+ AssemblersTrainingInvestmentCr\_max \cdot \frac{1}{2} \ldots$

$+ SupplierIdentificationInvestmentCr\_max \cdot \frac{6}{10} + ToolingInvestmentCr\_max \cdot \frac{8}{10}$

$$TVSinvestT3\_min := DesignCostInvestmentCr\_min \cdot \frac{1}{3} + ConsultancyChargesCr\_min \cdot \frac{1}{3} \ldots = 3.517$$
$$+ TestCostInvestmentCr\_min \cdot \frac{1}{2} + PrototypeInvestmentCr\_min \cdot \frac{2}{10} \ldots$$
$$+ ToolingInvestmentCr\_min \cdot \frac{2}{10} \ldots$$
$$+ AssemblersTrainingInvestmentCr\_min \cdot \frac{1}{2} \ldots$$
$$+ SupplierIdentificationInvestmentCr\_min \cdot \frac{2}{10} \ldots$$
$$+ AssemblingLineSetupInvestmentCr\_min \cdot \frac{1}{3} \ldots$$
$$+ ProjectManagementCostPACr\_min \ldots$$
$$+ AssemblyCostPACr\_min \ldots$$
$$+ MarketingInvestmentCr\_min \cdot \frac{1}{3}$$

$$TVSinvestT3\_max := DesignCostInvestmentCr\_max \cdot \frac{1}{3} + ConsultancyChargesCr\_max \cdot \frac{1}{3} \ldots = 5.57$$
$$+ TestCostInvestmentCr\_max \cdot \frac{1}{2} + PrototypeInvestmentCr\_max \cdot \frac{2}{10} \ldots$$
$$+ ToolingInvestmentCr\_max \cdot \frac{2}{10} \ldots$$
$$+ AssemblersTrainingInvestmentCr\_max \cdot \frac{1}{2} \ldots$$
$$+ SupplierIdentificationInvestmentCr\_max \cdot \frac{2}{10} \ldots$$
$$+ AssemblingLineSetupInvestmentCr\_max \cdot \frac{1}{3} \ldots$$
$$+ ProjectManagementCostPACr\_max \ldots$$
$$+ AssemblyCostPACr\_max \ldots$$
$$+ MarketingInvestmentCr\_max \cdot \frac{1}{3}$$

$$TVSinvestT4\_min := DesignCostRunningPACr\_min + TestCostRunningCr\_min \ldots = 1.752$$
$$+ ProjectManagementCostPACr\_min \ldots$$
$$+ AssemblyCostPACr\_min \ldots$$
$$+ MarketingRunningCr\_min \ldots$$
$$+ AssemblingLineSetupInvestmentCr\_min \cdot \frac{1}{3}$$

$$TVSinvestT4\_max := DesignCostRunningPACr\_max + TestCostRunningCr\_max \ldots = 2.877$$
$$+ ProjectManagementCostPACr\_max \ldots$$
$$+ AssemblyCostPACr\_max \ldots$$
$$+ MarketingRunningCr\_max \ldots$$
$$+ AssemblingLineSetupInvestmentCr\_max \cdot \frac{1}{3}$$

$$TVSinvestT5\_min := DesignCostRunningPACr\_min + TestCostRunningCr\_min \ldots = 1.252$$
$$+ ProjectManagementCostPACr\_min \ldots$$
$$+ AssemblyCostPACr\_min \ldots$$
$$+ MarketingRunningCr\_min$$

$$TVSinvestT5\_max := DesignCostRunningPACr\_max + TestCostRunningCr\_max \ldots = 2.21$$
$$+ ProjectManagementCostPACr\_max \ldots$$
$$+ AssemblyCostPACr\_max \ldots$$
$$+ MarketingRunningCr\_max$$

TVSinvestT6_min := DesignCostRunningPACr_min + TestCostRunningCr_min ... = 1.252
+ ProjectManagementCostPACr_min ...
+ AssemblyCostPACr_min ...
+ MarketingRunningCr_min

TVSinvestT6_max := DesignCostRunningPACr_max + TestCostRunningCr_max ... = 2.21
+ ProjectManagementCostPACr_max ...
+ AssemblyCostPACr_max ...
+ MarketingRunningCr_max

TVSrunningCostsCr_min := TVSinvestT5_min = 1.252 TVSrunningCostsCr_max := TVSinvestT5_max = 2.21

TotalTVSInvestmentT4Cr_min := TVSinvestT0_min + TVSinvestT1_min + TVSinvestT2_min ... = 13.816
+ TVSinvestT3_min + TVSinvestT4_min

TotalTVSInvestmentT4Cr_max := TVSinvestT0_max + TVSinvestT1_max + TVSinvestT2_max ... = 24.157
+ TVSinvestT3_max + TVSinvestT4_max

TotalTVSInvestmentT5Cr_min := TotalTVSInvestmentT4Cr_min + TVSinvestT5_min = 15.068

TotalTVSInvestmentT5Cr_max := TotalTVSInvestmentT4Cr_max + TVSinvestT5_max = 26.367

TotalTVSInvestmentT6Cr_min := TotalTVSInvestmentT5Cr_min + TVSinvestT6_min = 16.32

TotalTVSInvestmentT6Cr_max := TotalTVSInvestmentT5Cr_max + TVSinvestT6_max = 28.577

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- Assume that total sales presently (T0) are

$$SalesT0 := \frac{PercentSaleHighBikes}{100} \cdot salesTotalBikesT0 = 1.2 \times 10^5$$

Per month sales

$SalesT1\_P := SalesT0 \cdot MarketGrowthRate\_P = 1.02 \times 10^5$
$SalesT1\_R := SalesT0 \cdot MarketGrowthRate\_R = 1.32 \times 10^5$
$SalesT1\_O := SalesT0 \cdot MarketGrowthRate\_O = 1.44 \times 10^5$
$SalesT2\_P := SalesT1\_P \cdot MarketGrowthRate\_P = 8.67 \times 10^4$
$SalesT2\_R := SalesT1\_R \cdot MarketGrowthRate\_R = 1.452 \times 10^5$
$SalesT2\_O := SalesT1\_O \cdot MarketGrowthRate\_O = 1.728 \times 10^5$
$SalesT3\_P := SalesT2\_P \cdot MarketGrowthRate\_P = 7.37 \times 10^4$
$SalesT3\_R := SalesT2\_R \cdot MarketGrowthRate\_R = 1.597 \times 10^5$
$SalesT3\_O := SalesT2\_O \cdot MarketGrowthRate\_O = 2.074 \times 10^5$
$SalesT4\_P := SalesT3\_P \cdot MarketGrowthRate\_P = 6.264 \times 10^4$
$SalesT4\_R := SalesT3\_R \cdot MarketGrowthRate\_R = 1.757 \times 10^5$
$SalesT4\_O := SalesT3\_O \cdot MarketGrowthRate\_O = 2.488 \times 10^5$
$SalesT5\_P := SalesT4\_P \cdot MarketGrowthRate\_P = 5.324 \times 10^4$
$SalesT5\_R := SalesT4\_R \cdot MarketGrowthRate\_R = 1.933 \times 10^5$
$SalesT5\_O := SalesT4\_O \cdot MarketGrowthRate\_O = 2.986 \times 10^5$
$SalesT6\_P := SalesT5\_P \cdot MarketGrowthRate\_P = 4.526 \times 10^4$
$SalesT6\_R := SalesT5\_R \cdot MarketGrowthRate\_R = 2.126 \times 10^5$
$SalesT6\_O := SalesT5\_O \cdot MarketGrowthRate\_O = 3.583 \times 10^5$

SalesStartTime is after 2 years,i.e T2 onwards

$TVSSalesT0\_P := TVSMarketShareT0\_P \cdot SalesT0 \cdot 12 = 0$
$TVSSalesT0\_R := TVSMarketShareT0\_R \cdot SalesT0 \cdot 12 = 0$
$TVSSalesT0\_O := TVSMarketShareT0\_O \cdot SalesT0 \cdot 12 = 0$

Per annum sales

$TVSSalesT1\_P := TVSMarketShareT1\_P \cdot SalesT1\_P \cdot 12 = 0$

$TVSSalesT1\_R := TVSMarketShareT1\_R \cdot SalesT1\_R \cdot 12 = 0$

$TVSSalesT1\_O := TVSMarketShareT1\_O \cdot SalesT1\_O \cdot 12 = 0$

$TVSSalesT2\_P := TVSMarketShareT2\_P \cdot SalesT2\_P \cdot 12 = 0$

$TVSSalesT2\_R := TVSMarketShareT2\_R \cdot SalesT2\_R \cdot 12 = 0$

$TVSSalesT2\_O := TVSMarketShareT2\_O \cdot SalesT2\_O \cdot 12 = 0$

$TVSSalesT3\_P := TVSMarketShareT3\_P \cdot SalesT3\_P \cdot 12 = 1.769 \times 10^4$

$TVSSalesT3\_R := TVSMarketShareT3\_R \cdot SalesT3\_R \cdot 12 = 3.833 \times 10^4$

$TVSSalesT3\_O := TVSMarketShareT3\_O \cdot SalesT3\_O \cdot 12 = 1.244 \times 10^5$

$TVSSalesT4\_P := TVSMarketShareT4\_P \cdot SalesT4\_P \cdot 12 = 3.758 \times 10^4$

$TVSSalesT4\_R := TVSMarketShareT4\_R \cdot SalesT4\_R \cdot 12 = 1.476 \times 10^5$

$TVSSalesT4\_O := TVSMarketShareT4\_O \cdot SalesT4\_O \cdot 12 = 2.986 \times 10^5$

$TVSSalesT5\_P := TVSMarketShareT5\_P \cdot SalesT5\_P \cdot 12 = 6.389 \times 10^4$

$TVSSalesT5\_R := TVSMarketShareT5\_R \cdot SalesT5\_R \cdot 12 = 3.479 \times 10^5$

$TVSSalesT5\_O := TVSMarketShareT5\_O \cdot SalesT5\_O \cdot 12 = 6.45 \times 10^5$

$TVSSalesT6\_P := TVSMarketShareT6\_P \cdot SalesT6\_P \cdot 12 = 8.146 \times 10^4$

$TVSSalesT6\_R := TVSMarketShareT6\_R \cdot SalesT6\_R \cdot 12 = 5.102 \times 10^5$

$TVSSalesT6\_O := TVSMarketShareT6\_O \cdot SalesT6\_O \cdot 12 = 9.89 \times 10^5$

$TotalTVSSalesT3\_P := TVSSalesT0\_P + TVSSalesT1\_P + TVSSalesT2\_P \ldots + TVSSalesT3\_P = 1.769 \times 10^4$

$TotalTVSSalesT3\_R := TVSSalesT0\_R + TVSSalesT1\_R + TVSSalesT2\_R \ldots + TVSSalesT3\_R = 3.833 \times 10^4$

$TotalTVSSalesT3\_O := TVSSalesT0\_O + TVSSalesT1\_O + TVSSalesT2\_O \ldots + TVSSalesT3\_O = 1.244 \times 10^5$

$TotalTurnoverT3\_P := TotalTVSSalesT3\_P \cdot AverageCostofBikeT3\_P = 2.252 \times 10^8$

$TotalTurnoverT3\_R := TotalTVSSalesT3\_R \cdot AverageCostofBikeT3\_R = 5.325 \times 10^8$

$TotalTurnoverT3\_O := TotalTVSSalesT3\_O \cdot AverageCostofBikeT3\_O = 1.987 \times 10^9$

$$TotalTurnoverCrT3\_P := \frac{TotalTurnoverT3\_P}{OneCr} = 22.523$$

$$TotalTurnoverCrT3\_R := \frac{TotalTurnoverT3\_R}{OneCr} = 53.25$$

$$TotalTurnoverCrT3\_O := \frac{TotalTurnoverT3\_O}{OneCr} = 198.717$$

$TotalProfitCrT3\_P := TotalTurnoverCrT3\_P \cdot ProfitMarginFraction\_P = 1.802$ by the end of 3rd year

$TotalProfitCrT3\_R := TotalTurnoverCrT3\_R \cdot ProfitMarginFraction\_R = 5.325$

$TotalProfitCrT3\_O := TotalTurnoverCrT3\_O \cdot ProfitMarginFraction\_O = 23.846$

$TotalTVSSalesT4\_P := TVSSalesT0\_P + TVSSalesT1\_P + TVSSalesT2\_P \ldots + TVSSalesT3\_P + TVSSalesT4\_P = 5.527 \times 10^4$

$TotalTVSSalesT4\_R := TVSSalesT0\_R + TVSSalesT1\_R + TVSSalesT2\_R \ldots + TVSSalesT3\_R + TVSSalesT4\_R = 1.859 \times 10^5$

$$TotalTVSSalesT4\_O := TVSSalesT0\_O + TVSSalesT1\_O + TVSSalesT2\_O ... + TVSSalesT3\_O + TVSSalesT4\_O = 4.23 \times 10^5$$

$$TotalTurnoverT4\_P := TotalTVSSalesT4\_P \cdot AverageCostofBikeT4\_P = 7.179 \times 10^8$$

$$TotalTurnoverT4\_R := TotalTVSSalesT4\_R \cdot AverageCostofBikeT4\_R = 2.712 \times 10^9$$

$$TotalTurnoverT4\_O := TotalTVSSalesT4\_O \cdot AverageCostofBikeT4\_O = 7.432 \times 10^9$$

$$TotalTurnoverCrT4\_P := \frac{TotalTurnoverT4\_P}{OneCr} = 71.793$$

$$TotalTurnoverCrT4\_R := \frac{TotalTurnoverT4\_R}{OneCr} = 271.176$$

$$TotalTurnoverCrT4\_O := \frac{TotalTurnoverT4\_O}{OneCr} = 743.202$$

$$TotalProfitCrT4\_P := TotalTurnoverCrT4\_P \cdot ProfitMarginFraction\_P = 5.743$$

$$TotalProfitCrT4\_R := TotalTurnoverCrT4\_R \cdot ProfitMarginFraction\_R = 27.118$$

$$TotalProfitCrT4\_O := TotalTurnoverCrT4\_O \cdot ProfitMarginFraction\_O = 89.184$$

by the end of 4th year

$$TotalTVSSalesT5\_P := TotalTVSSalesT4\_P + TVSSalesT5\_P = 1.192 \times 10^5$$

$$TotalTVSSalesT5\_R := TotalTVSSalesT4\_R + TVSSalesT5\_R = 5.338 \times 10^5$$

$$TotalTVSSalesT5\_O := TotalTVSSalesT4\_O + TVSSalesT5\_O = 1.068 \times 10^6$$

$$TotalTurnoverT5\_P := TotalTVSSalesT5\_P \cdot AverageCostofBikeT5\_P = 1.579 \times 10^9$$

$$TotalTurnoverT5\_R := TotalTVSSalesT5\_R \cdot AverageCostofBikeT5\_R = 8.175 \times 10^9$$

$$TotalTurnoverT5\_O := TotalTVSSalesT5\_O \cdot AverageCostofBikeT5\_O = 2.064 \times 10^{10}$$

$$TotalTurnoverCrT5\_P := \frac{TotalTurnoverT5\_P}{OneCr} = 157.881$$

$$TotalTurnoverCrT5\_R := \frac{TotalTurnoverT5\_R}{OneCr} = 817.511$$

$$TotalTurnoverCrT5\_O := \frac{TotalTurnoverT5\_O}{OneCr} = 2.064 \times 10^3$$

$$TotalProfitCrT5\_P := TotalTurnoverCrT5\_P \cdot ProfitMarginFraction\_P = 12.63$$

$$TotalProfitCrT5\_R := TotalTurnoverCrT5\_R \cdot ProfitMarginFraction\_R = 81.751$$

$$TotalProfitCrT5\_O := TotalTurnoverCrT5\_O \cdot ProfitMarginFraction\_O = 247.681$$

by the end of 5th year

$$TotalTVSSalesT6\_P := TotalTVSSalesT5\_P + TVSSalesT6\_P = 2.006 \times 10^5$$

$$TotalTVSSalesT6\_R := TotalTVSSalesT5\_R + TVSSalesT6\_R = 1.044 \times 10^6$$

$$TotalTVSSalesT6\_O := TotalTVSSalesT5\_O + TVSSalesT6\_O = 2.057 \times 10^6$$

$$TotalTurnoverT6\_P := TotalTVSSalesT6\_P \cdot AverageCostofBikeT6\_P = 2.711 \times 10^9$$

$$TotalTurnoverT6\_R := TotalTVSSalesT6\_R \cdot AverageCostofBikeT6\_R = 1.679 \times 10^{10}$$

$$TotalTurnoverT6\_O := TotalTVSSalesT6\_O \cdot AverageCostofBikeT6\_O = 4.373 \times 10^{10}$$

$$TotalTurnoverCrT6\_P := \frac{TotalTurnoverT6\_P}{OneCr} = 271.129$$

$$TotalTurnoverCrT6\_R := \frac{TotalTurnoverT6\_R}{OneCr} = 1.679 \times 10^3$$

$$TotalTurnoverCrT6\_O := \frac{TotalTurnoverT6\_O}{OneCr} = 4.373 \times 10^3$$

TotalProfitCrT6_P := TotalTurnoverCrT6_P·ProfitMarginFraction_P = 21.69

TotalProfitCrT6_R := TotalTurnoverCrT6_R·ProfitMarginFraction_R = 167.886

TotalProfitCrT6_O := TotalTurnoverCrT6_O·ProfitMarginFraction_O = 524.736

Brief of the investments and profits

TotalTVSInvestmentT4Cr_min = 13.816 TotalTVSInvestmentT4Cr_max = 24.157

TotalTVSInvestmentT5Cr_min = 15.068 TotalTVSInvestmentT5Cr_max = 26.367

TotalTVSInvestmentT6Cr_min = 16.32 TotalTVSInvestmentT6Cr_max = 28.577

TotalProfitCrT3_P = 1.802	TotalProfitCrT3_R = 5.325	TotalProfitCrT3_O = 23.846
TotalProfitCrT4_P = 5.743	TotalProfitCrT4_R = 27.118	TotalProfitCrT4_O = 89.184
TotalProfitCrT5_P = 12.63	TotalProfitCrT5_R = 81.751	TotalProfitCrT5_O = 247.681
TotalProfitCrT6_P = 21.69	TotalProfitCrT6_R = 167.886	TotalProfitCrT6_O = 524.736

Business Case Details

In this plan, a one time IP charge is planned with an option of royalty which is a fraction of product price.

Three cases of future are proposed, namely optimistic, realistic and pessimistic

critical factors determining future are defined under all these three conditions

salesTotalBikesT0 := 1000000 Permonth OneCr := 10000000

PercentSaleHighBikes := 12

PriceGrowthRate_P := 1.02 PriceGrowthRate_R := 1.05 PriceGrowthRate_O := 1.1

MarketGrowthRate_P := 0.85 MarketGrowthRate_R := 1.1 MarketGrowthRate_O := 1.2

TVSMarketShareT0_P := 0 TVSMarketShareT0_R := 0 TVSMarketShareT0_O := 0

TVSMarketShareT1_P := 0 TVSMarketShareT1_R := 0 TVSMarketShareT1_O := 0

TVSMarketShareT2_P := 0 TVSMarketShareT2_R := 0 TVSMarketShareT2_O := 0

TVSMarketShareT3_P := 0.02 TVSMarketShareT3_R := 0.02 TVSMarketShareT3_O := 0.05

TVSMarketShareT4_P := 0.05 TVSMarketShareT4_R := 0.07 TVSMarketShareT4_O := 0.10

TVSMarketShareT5_P := 0.10 TVSMarketShareT5_R := 0.15 TVSMarketShareT5_O := 0.18

TVSMarketShareT6_P := 0.15 TVSMarketShareT6_R := 0.20 TVSMarketShareT6_O := 0.23

AverageCostofBikeT0 := 12000

AverageCostofBikeT1_P := AverageCostofBikeT0·PriceGrowthRate_P = 1.224×10^4

AverageCostofBikeT1_R := AverageCostofBikeT0·PriceGrowthRate_R = 1.26×10^4

AverageCostofBikeT1_O := AverageCostofBikeT0·PriceGrowthRate_O = 1.32×10^4

AverageCostofBikeT2_P := AverageCostofBikeT1_P·PriceGrowthRate_P = 1.248×10^4

AverageCostofBikeT2_R := AverageCostofBikeT1_R·PriceGrowthRate_R = 1.323×10^4

AverageCostofBikeT2_O := AverageCostofBikeT1_O·PriceGrowthRate_O = 1.452×10^4

AverageCostofBikeT3_P := AverageCostofBikeT2_P·PriceGrowthRate_P = 1.273×10^4

AverageCostofBikeT3_R := AverageCostofBikeT2_R·PriceGrowthRate_R = 1.389×10^4

AverageCostofBikeT3_O := AverageCostofBikeT2_O·PriceGrowthRate_O = 1.597×10^4

AverageCostofBikeT4_P := AverageCostofBikeT3_P·PriceGrowthRate_P = 1.299×10^4

AverageCostofBikeT4_R := AverageCostofBikeT3_R·PriceGrowthRate_R = 1.459×10^4

AverageCostofBikeT4_O := AverageCostofBikeT3_O·PriceGrowthRate_O = 1.757×10^4

AverageCostofBikeT5_P := AverageCostofBikeT4_P·PriceGrowthRate_P = 1.325×10^4

AverageCostofBikeT5_R := AverageCostofBikeT4_R·PriceGrowthRate_R = 1.532×10^4

AverageCostofBikeT5_O := AverageCostofBikeT4_O·PriceGrowthRate_O = 1.933×10^4

AverageCostofBikeT6_P := AverageCostofBikeT5_P·PriceGrowthRate_P = 1.351×10^4

AverageCostofBikeT6_R := AverageCostofBikeT5_R·PriceGrowthRate_R = 1.608×10^4

AverageCostofBikeT6_O := AverageCostofBikeT5_O·PriceGrowthRate_O = 2.126×10^4

ProfitMarginFraction_P := 0.08 ProfitMarginFraction_R := 0.1 ProfitMarginFraction_O := 0.12

Assume that total sales presently (T0) are

$$SalesT0 := \frac{PercentSaleHighBikes}{100} \cdot salesTotalBikesT0 = 1.2 \times 10^5$$

Per month sales

$$SalesT1\_P := SalesT0 \cdot MarketGrowthRate\_P = 1.02 \times 10^5$$
$$SalesT1\_R := SalesT0 \cdot MarketGrowthRate\_R = 1.32 \times 10^5$$
$$SalesT1\_O := SalesT0 \cdot MarketGrowthRate\_O = 1.44 \times 10^5$$
$$SalesT2\_P := SalesT1\_P \cdot MarketGrowthRate\_P = 8.67 \times 10^4$$
$$SalesT2\_R := SalesT1\_R \cdot MarketGrowthRate\_R = 1.452 \times 10^5$$
$$SalesT2\_O := SalesT1\_O \cdot MarketGrowthRate\_O = 1.728 \times 10^5$$
$$SalesT3\_P := SalesT2\_P \cdot MarketGrowthRate\_P = 7.37 \times 10^4$$
$$SalesT3\_R := SalesT2\_R \cdot MarketGrowthRate\_R = 1.597 \times 10^5$$
$$SalesT3\_O := SalesT2\_O \cdot MarketGrowthRate\_O = 2.074 \times 10^5$$
$$SalesT4\_P := SalesT3\_P \cdot MarketGrowthRate\_P = 6.264 \times 10^4$$
$$SalesT4\_R := SalesT3\_R \cdot MarketGrowthRate\_R = 1.757 \times 10^5$$
$$SalesT4\_O := SalesT3\_O \cdot MarketGrowthRate\_O = 2.488 \times 10^5$$
$$SalesT5\_P := SalesT4\_P \cdot MarketGrowthRate\_P = 5.324 \times 10^4$$
$$SalesT5\_R := SalesT4\_R \cdot MarketGrowthRate\_R = 1.933 \times 10^5$$
$$SalesT5\_O := SalesT4\_O \cdot MarketGrowthRate\_O = 2.986 \times 10^5$$
$$SalesT6\_P := SalesT5\_P \cdot MarketGrowthRate\_P = 4.526 \times 10^4$$
$$SalesT6\_R := SalesT5\_R \cdot MarketGrowthRate\_R = 2.126 \times 10^5$$
$$SalesT6\_O := SalesT5\_O \cdot MarketGrowthRate\_O = 3.583 \times 10^5$$

SalesStartTime is after 2 years,i.e T2 onwards

Per annum sales

$$TVSSalesT0\_P := TVSMarketShareT0\_P \cdot SalesT0 \cdot 12 = 0$$
$$TVSSalesT0\_R := TVSMarketShareT0\_R \cdot SalesT0 \cdot 12 = 0$$
$$TVSSalesT0\_O := TVSMarketShareT0\_O \cdot SalesT0 \cdot 12 = 0$$
$$TVSSalesT1\_P := TVSMarketShareT1\_P \cdot SalesT1\_P \cdot 12 = 0$$
$$TVSSalesT1\_R := TVSMarketShareT1\_R \cdot SalesT1\_R \cdot 12 = 0$$
$$TVSSalesT1\_O := TVSMarketShareT1\_O \cdot SalesT1\_O \cdot 12 = 0$$
$$TVSSalesT2\_P := TVSMarketShareT2\_P \cdot SalesT2\_P \cdot 12 = 0$$
$$TVSSalesT2\_R := TVSMarketShareT2\_R \cdot SalesT2\_R \cdot 12 = 0$$
$$TVSSalesT2\_O := TVSMarketShareT2\_O \cdot SalesT2\_O \cdot 12 = 0$$
$$TVSSalesT3\_P := TVSMarketShareT3\_P \cdot SalesT3\_P \cdot 12 = 1.769 \times 10^4$$
$$TVSSalesT3\_R := TVSMarketShareT3\_R \cdot SalesT3\_R \cdot 12 = 3.833 \times 10^4$$
$$TVSSalesT3\_O := TVSMarketShareT3\_O \cdot SalesT3\_O \cdot 12 = 1.244 \times 10^5$$

$$TVSSalesT4\_P := TVSMarketShareT4\_P \cdot SalesT4\_P \cdot 12 = 3.758 \times 10^4$$
$$TVSSalesT4\_R := TVSMarketShareT4\_R \cdot SalesT4\_R \cdot 12 = 1.476 \times 10^5$$
$$TVSSalesT4\_O := TVSMarketShareT4\_O \cdot SalesT4\_O \cdot 12 = 2.986 \times 10^5$$
$$TVSSalesT5\_P := TVSMarketShareT5\_P \cdot SalesT5\_P \cdot 12 = 6.389 \times 10^4$$
$$TVSSalesT5\_R := TVSMarketShareT5\_R \cdot SalesT5\_R \cdot 12 = 3.479 \times 10^5$$

$TVSSalesT5\_O := TVSMarketShareT5\_O \cdot SalesT5\_O \cdot 12 = 6.45 \times 10^5$

$TVSSalesT6\_P := TVSMarketShareT6\_P \cdot SalesT6\_P \cdot 12 = 8.146 \times 10^4$

$TVSSalesT6\_R := TVSMarketShareT6\_R \cdot SalesT6\_R \cdot 12 = 5.102 \times 10^5$

$TVSSalesT6\_O := TVSMarketShareT6\_O \cdot SalesT6\_O \cdot 12 = 9.89 \times 10^5$

$TotalTVSSalesT3\_P := TVSSalesT0\_P + TVSSalesT1\_P + TVSSalesT2\_P \ldots + TVSSalesT3\_P = 1.769 \times 10^4$

$TotalTVSSalesT3\_R := TVSSalesT0\_R + TVSSalesT1\_R + TVSSalesT2\_R \ldots + TVSSalesT3\_R = 3.833 \times 10^4$

$TotalTVSSalesT3\_O := TVSSalesT0\_O + TVSSalesT1\_O + TVSSalesT2\_O \ldots + TVSSalesT3\_O = 1.244 \times 10^5$

$TotalTurnoverT3\_P := TotalTVSSalesT3\_P \cdot AverageCostofBikeT3\_P = 2.252 \times 10^8$

$TotalTurnoverT3\_R := TotalTVSSalesT3\_R \cdot AverageCostofBikeT3\_R = 5.325 \times 10^8$

$TotalTurnoverT3\_O := TotalTVSSalesT3\_O \cdot AverageCostofBikeT3\_O = 1.987 \times 10^9$

$$TotalTurnoverCrT3\_P := \frac{TotalTurnoverT3\_P}{OneCr} = 22.523$$

$$TotalTurnoverCrT3\_R := \frac{TotalTurnoverT3\_R}{OneCr} = 53.25$$

$$TotalTurnoverCrT3\_O := \frac{TotalTurnoverT3\_O}{OneCr} = 198.717$$

$TotalProfitCrT3\_P := TotalTurnoverCrT3\_P \cdot ProfitMarginFraction\_P = 1.802$ by the end of 3rd year

$TotalProfitCrT3\_R := TotalTurnoverCrT3\_R \cdot ProfitMarginFraction\_R = 5.325$

$TotalProfitCrT3\_O := TotalTurnoverCrT3\_O \cdot ProfitMarginFraction\_O = 23.846$

$TotalTVSSalesT4\_P := TVSSalesT0\_P + TVSSalesT1\_P + TVSSalesT2\_P \ldots + TVSSalesT3\_P + TVSSalesT4\_P = 5.527 \times 10^4$

$TotalTVSSalesT4\_R := TVSSalesT0\_R + TVSSalesT1\_R + TVSSalesT2\_R \ldots + TVSSalesT3\_R + TVSSalesT4\_R = 1.859 \times 10^5$

$TotalTVSSalesT4\_O := TVSSalesT0\_O + TVSSalesT1\_O + TVSSalesT2\_O \ldots + TVSSalesT3\_O + TVSSalesT4\_O = 4.23 \times 10^5$

$TotalTurnoverT4\_P := TotalTVSSalesT4\_P \cdot AverageCostofBikeT4\_P = 7.179 \times 10^8$

$TotalTurnoverT4\_R := TotalTVSSalesT4\_R \cdot AverageCostofBikeT4\_R = 2.712 \times 10^9$

$TotalTurnoverT4\_O := TotalTVSSalesT4\_O \cdot AverageCostofBikeT4\_O = 7.432 \times 10^9$

$$TotalTurnoverCrT4\_P := \frac{TotalTurnoverT4\_P}{OneCr} = 71.793$$

$$TotalTurnoverCrT4\_R := \frac{TotalTurnoverT4\_R}{OneCr} = 271.176$$

$$TotalTurnoverCrT4\_O := \frac{TotalTurnoverT4\_O}{OneCr} = 743.202$$

$TotalProfitCrT4\_P := TotalTurnoverCrT4\_P \cdot ProfitMarginFraction\_P = 5.743$

$TotalProfitCrT4\_R := TotalTurnoverCrT4\_R \cdot ProfitMarginFraction\_R = 27.118$

$TotalProfitCrT4\_O := TotalTurnoverCrT4\_O \cdot ProfitMarginFraction\_O = 89.184$

by the end of 4th year

$TotalTVSSalesT5\_P := TotalTVSSalesT4\_P + TVSSalesT5\_P = 1.192 \times 10^{5}$

$TotalTVSSalesT5\_R := TotalTVSSalesT4\_R + TVSSalesT5\_R = 5.338 \times 10^{5}$

$TotalTVSSalesT5\_O := TotalTVSSalesT4\_O + TVSSalesT5\_O = 1.068 \times 10^{6}$

$TotalTurnoverT5\_P := TotalTVSSalesT5\_P \cdot AverageCostofBikeT5\_P = 1.579 \times 10^{9}$

$TotalTurnoverT5\_R := TotalTVSSalesT5\_R \cdot AverageCostofBikeT5\_R = 8.175 \times 10^{9}$

$TotalTurnoverT5\_O := TotalTVSSalesT5\_O \cdot AverageCostofBikeT5\_O = 2.064 \times 10^{10}$

$$TotalTurnoverCrT5\_P := \frac{TotalTurnoverT5\_P}{OneCr} = 157.881$$

$$TotalTurnoverCrT5\_R := \frac{TotalTurnoverT5\_R}{OneCr} = 817.511$$

$$TotalTurnoverCrT5\_O := \frac{TotalTurnoverT5\_O}{OneCr} = 2.064 \times 10^{3}$$

$TotalProfitCrT5\_P := TotalTurnoverCrT5\_P \cdot ProfitMarginFraction\_P = 12.63$

$TotalProfitCrT5\_R := TotalTurnoverCrT5\_R \cdot ProfitMarginFraction\_R = 81.751$

$TotalProfitCrT5\_O := TotalTurnoverCrT5\_O \cdot ProfitMarginFraction\_O = 247.681$

by the end of 5th year

$TotalTVSSalesT6\_P := TotalTVSSalesT5\_P + TVSSalesT6\_P = 2.006 \times 10^{5}$

$TotalTVSSalesT6\_R := TotalTVSSalesT5\_R + TVSSalesT6\_R = 1.044 \times 10^{6}$

$TotalTVSSalesT6\_O := TotalTVSSalesT5\_O + TVSSalesT6\_O = 2.057 \times 10^{6}$

$TotalTurnoverT6\_P := TotalTVSSalesT6\_P \cdot AverageCostofBikeT6\_P = 2.711 \times 10^{9}$

$TotalTurnoverT6\_R := TotalTVSSalesT6\_R \cdot AverageCostofBikeT6\_R = 1.679 \times 10^{10}$

$TotalTurnoverT6\_O := TotalTVSSalesT6\_O \cdot AverageCostofBikeT6\_O = 4.373 \times 10^{10}$

$$TotalTurnoverCrT6\_P := \frac{TotalTurnoverT6\_P}{OneCr} = 271.129$$

$$TotalTurnoverCrT6\_R := \frac{TotalTurnoverT6\_R}{OneCr} = 1.679 \times 10^{3}$$

$$TotalTurnoverCrT6\_O := \frac{TotalTurnoverT6\_O}{OneCr} = 4.373 \times 10^{3}$$

$TotalProfitCrT6\_P := TotalTurnoverCrT6\_P \cdot ProfitMarginFraction\_P = 21.69$

$TotalProfitCrT6\_R := TotalTurnoverCrT6\_R \cdot ProfitMarginFraction\_R = 167.886$

$TotalProfitCrT6\_O := TotalTurnoverCrT6\_O \cdot ProfitMarginFraction\_O = 524.736$

by the end of 6th year

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IPchargesOnetimeCr_min := 5 IPchargesOnetimeCr_max := 8

IPRoyaltyFraction_min := 0.001 IPRoyaltyFraction_max := 0.005

TestersCount := 5

Testingmonths := 24

TestersChargePday_min := 1000 TestersChargePday_max := 1500

AssemblerChargePday_min := 600 AssemblerChargePday_max := 1000

$$TestResource := TestersCount \cdot Testingmonths \cdot 25 = 3 \times 10^3 \text{ man days}$$

$$TestCostInvestmentCr_{min} := TestResource \cdot \frac{TestersChargePday_{min}}{OneCr} = 0.3$$

$$TestCostInvestmentCr_{max} := TestResource \cdot \frac{TestersChargePday_{max}}{OneCr} = 0.45$$

$$TestCostRunningCr_{min} := 10 \cdot \frac{TestersChargePday_{min} \cdot 25 \cdot 12}{OneCr} = 0.3$$

$$TestCostRunningCr_{max} := 10 \cdot \frac{TestersChargePday_{max} \cdot 25 \cdot 12}{OneCr} = 0.45$$

TestRigInvestmentCr_min := 0 TestRigInvestmentCr_max := 0.5

PrototypeInvestmentCr_min := 0.5 PrototypeInvestmentCr_max := 1.5

ToolingInvestmentCr_min := 5 ToolingInvestmentCr_max := 8

SupplierIdentificationInvestmentCr_min := 0.5 SupplierIdentificationInvestmentCr_max := 1.5

AssemblersTrainingInvestmentCr_min := 0.25 AssemblersTrainingInvestmentCr_max := 0.5

AssemblingLineSetupInvestmentCr_min := 1.5 AssemblingLineSetupInvestmentCr_max := 2

$$ProjectManagementCostPACr_{min} := (120000 \cdot 0.5 + 100000 \cdot 0.6 + 2 \cdot 60000 \cdot 0.9) \cdot \frac{12}{OneCr} = 0.274$$

$$ProjectManagementCostPACr_{max} := (120000 \cdot 0.6 + 2 \cdot 100000 \cdot 0.75 + 3 \cdot 60000 \cdot 0.95) \cdot \frac{12}{OneCr} = 0.472$$

MassprodCapPday_min := 100 MassprodCapPday_max := 1400

AssemblerUnitsPDay := 8 ShiftsPDAY := 2

$$AssemblerStaffSrtength_{min} := \frac{MassprodCapPday_{min}}{AssemblerUnitsPDay \cdot ShiftsPDAY} = 6.25$$

$$AssemblerStaffSrtength_{max} := \frac{MassprodCapPday_{max}}{AssemblerUnitsPDay \cdot ShiftsPDAY} = 87.5$$

$$AssemblyCostPACr_{min} := AssemblerStaffSrtength_{min} \cdot \frac{AssemblerChargePday_{min} \cdot 25 \cdot 12}{OneCr} = 0.113$$

$$AssemblyCostPACr_{max} := AssemblerStaffSrtength_{min} \cdot \frac{AssemblerChargePday_{max} \cdot 25 \cdot 12}{OneCr} = 0.188$$

MarketingInvestmentCr_min := 1.5 MarketingInvestmentCr_max := 2

MarketingRunningCr_min := 0.5 MarketingRunningCr_max := 1

TVSinvestT0_min := IPchargesOnetimeCr_min = 5

TVSinvestT0_max := IPchargesOnetimeCr_max = 8

start time

TVSinvestT1_min := PrototypeInvestmentCr_min·$\frac{2}{10}$ + ProjectManagementCostPACr_min ... = 0.474
+ TVSSalesT1_P·$\frac{\text{AverageCostofBikeT1\_P}}{\text{OneCr}}$·IPRoyaltyFraction_min ...
+ SupplierIdentificationInvestmentCr_min·$\frac{2}{10}$

TVSinvestT1_max := PrototypeInvestmentCr_max·$\frac{2}{10}$ + ProjectManagementCostPACr_max ... = 1.072
+ TVSSalesT1_O·$\frac{\text{AverageCostofBikeT1\_O}}{\text{OneCr}}$·IPRoyaltyFraction_max ...
+ SupplierIdentificationInvestmentCr_max·$\frac{2}{10}$

TVSinvestT2_min := TestCostInvestmentCr_min·$\frac{1}{2}$ + TestRigInvestmentCr_min ... = 6.761
+ ProjectManagementCostPACr_min ...
+ AssemblyCostPACr_min ...
+ MarketingInvestmentCr_min·$\frac{2}{3}$ ...
+ AssemblingLineSetupInvestmentCr_min·$\frac{1}{3}$ ...
+ PrototypeInvestmentCr_min·$\frac{6}{10}$ ...
+ TVSSalesT2_P·$\frac{\text{AverageCostofBikeT2\_P}}{\text{OneCr}}$·IPRoyaltyFraction_min ...
+ AssemblersTrainingInvestmentCr_min·$\frac{1}{2}$ ...
+ SupplierIdentificationInvestmentCr_min·$\frac{6}{10}$ + ToolingInvestmentCr_min·$\frac{8}{10}$

TVSinvestT2_max := TestCostInvestmentCr_max·$\frac{1}{2}$ + TestRigInvestmentCr_max ... = 11.834
+ ProjectManagementCostPACr_max ...
+ AssemblyCostPACr_max ...
+ MarketingInvestmentCr_max·$\frac{2}{3}$ ...
+ AssemblingLineSetupInvestmentCr_max·$\frac{1}{3}$ ...
+ PrototypeInvestmentCr_max·$\frac{6}{10}$ ...
+ TVSSalesT2_O·$\frac{\text{AverageCostofBikeT2\_O}}{\text{OneCr}}$·IPRoyaltyFraction_max ...
+ AssemblersTrainingInvestmentCr_max·$\frac{1}{2}$ ...
+ SupplierIdentificationInvestmentCr_max·$\frac{6}{10}$ + ToolingInvestmentCr_max·$\frac{8}{10}$

$$TVSinvestT3\_min := TestCostInvestmentCr\_min \cdot \frac{1}{2} + PrototypeInvestmentCr\_min \cdot \frac{2}{10} \ldots = 2.884$$
$$+ ToolingInvestmentCr\_min \cdot \frac{2}{10} \ldots$$
$$+ AssemblersTrainingInvestmentCr\_min \cdot \frac{1}{2} \ldots$$
$$+ SupplierIdentificationInvestmentCr\_min \cdot \frac{2}{10} \ldots$$
$$+ AssemblingLineSetupInvestmentCr\_min \cdot \frac{1}{3} \ldots$$
$$+ ProjectManagementCostPACr\_min \ldots$$
$$+ AssemblyCostPACr\_min \ldots$$
$$+ TVSSalesT3\_P \cdot \frac{AverageCostofBikeT3\_P}{OneCr} \cdot IPRoyaltyFraction\_min \ldots$$
$$+ MarketingInvestmentCr\_min \cdot \frac{1}{3}$$

$$TVSinvestT3\_max := TestCostInvestmentCr\_max \cdot \frac{1}{2} + PrototypeInvestmentCr\_max \cdot \frac{2}{10} \ldots = 5.661$$
$$+ ToolingInvestmentCr\_max \cdot \frac{2}{10} \ldots$$
$$+ AssemblersTrainingInvestmentCr\_max \cdot \frac{1}{2} \ldots$$
$$+ SupplierIdentificationInvestmentCr\_max \cdot \frac{2}{10} \ldots$$
$$+ AssemblingLineSetupInvestmentCr\_max \cdot \frac{1}{3} \ldots$$
$$+ ProjectManagementCostPACr\_max \ldots$$
$$+ AssemblyCostPACr\_max \ldots$$
$$+ TVSSalesT3\_O \cdot \frac{AverageCostofBikeT3\_O}{OneCr} \cdot IPRoyaltyFraction\_max \ldots$$
$$+ MarketingInvestmentCr\_max \cdot \frac{1}{3}$$

$$TVSinvestT4\_min := TestCostRunningCr\_min \ldots = 1.735$$
$$+ ProjectManagementCostPACr\_min \ldots$$
$$+ AssemblyCostPACr\_min \ldots$$
$$+ MarketingRunningCr\_min \ldots$$
$$+ TVSSalesT4\_P \cdot \frac{AverageCostofBikeT4\_P}{OneCr} \cdot IPRoyaltyFraction\_min \ldots$$
$$+ AssemblingLineSetupInvestmentCr\_min \cdot \frac{1}{3}$$

$$TVSinvestT4\_max := TestCostRunningCr\_max \ldots = 5.399$$
$$+ ProjectManagementCostPACr\_max \ldots$$
$$+ AssemblyCostPACr\_max \ldots$$
$$+ MarketingRunningCr\_max \ldots$$
$$+ TVSSalesT4\_O \cdot \frac{AverageCostofBikeT4\_O}{OneCr} \cdot IPRoyaltyFraction\_max \ldots$$
$$+ AssemblingLineSetupInvestmentCr\_max \cdot \frac{1}{3}$$

$$TVSinvestT5\_min := TestCostRunningCr\_min \ldots = 1.271$$
$$+ ProjectManagementCostPACr\_min \ldots$$
$$+ AssemblyCostPACr\_min \ldots$$
$$+ MarketingRunningCr\_min \ldots$$
$$+ TVSSalesT5\_P \cdot \frac{AverageCostofBikeT5\_P}{OneCr} \cdot IPRoyaltyFraction\_min$$

$$TVSinvestT5\_max := TestCostRunningCr\_max + ProjectManagementCostPACr\_max + AssemblyCostPACr\_max + MarketingRunningCr\_max + TVSSalesT5\_O \cdot \frac{AverageCostofBikeT5\_O}{OneCr} \cdot IPRoyaltyFraction\_max = 8.342$$

$$TVSinvestT6\_min := TestCostRunningCr\_min + ProjectManagementCostPACr\_min + AssemblyCostPACr\_min + MarketingRunningCr\_min + TVSSalesT6\_P \cdot \frac{AverageCostofBikeT6\_P}{OneCr} \cdot IPRoyaltyFraction\_min = 1.296$$

$$TVSinvestT6\_max := TestCostRunningCr\_max + ProjectManagementCostPACr\_max + AssemblyCostPACr\_max + MarketingRunningCr\_max + TVSSalesT6\_O \cdot \frac{AverageCostofBikeT6\_O}{OneCr} \cdot IPRoyaltyFraction\_max = 12.621$$

$$TotalTVSInvestmentT4Cr\_min := TVSinvestT0\_min + TVSinvestT1\_min + TVSinvestT2\_min + TVSinvestT3\_min + TVSinvestT4\_min$$

$$TotalTVSInvestmentT4Cr\_max := TVSinvestT0\_max + TVSinvestT1\_max + TVSinvestT2\_max + TVSinvestT3\_max + TVSinvestT4\_max$$

$$TotalTVSInvestmentT5Cr\_min := TotalTVSInvestmentT4Cr\_min + TVSinvestT5\_min$$

$$TotalTVSInvestmentT5Cr\_max := TotalTVSInvestmentT4Cr\_max + TVSinvestT5\_max$$

$$TotalTVSInvestmentT6Cr\_min := TotalTVSInvestmentT5Cr\_min + TVSinvestT6\_min$$

$$TotalTVSInvestmentT6Cr\_max := TotalTVSInvestmentT5Cr\_max + TVSinvestT6\_max$$

Brief of investment required and profits

$TotalTVSInvestmentT4Cr\_min = 16.853$ $TotalTVSInvestmentT4Cr\_max = 31.966$

$TotalTVSInvestmentT5Cr\_min = 18.124$ $TotalTVSInvestmentT5Cr\_max = 40.307$

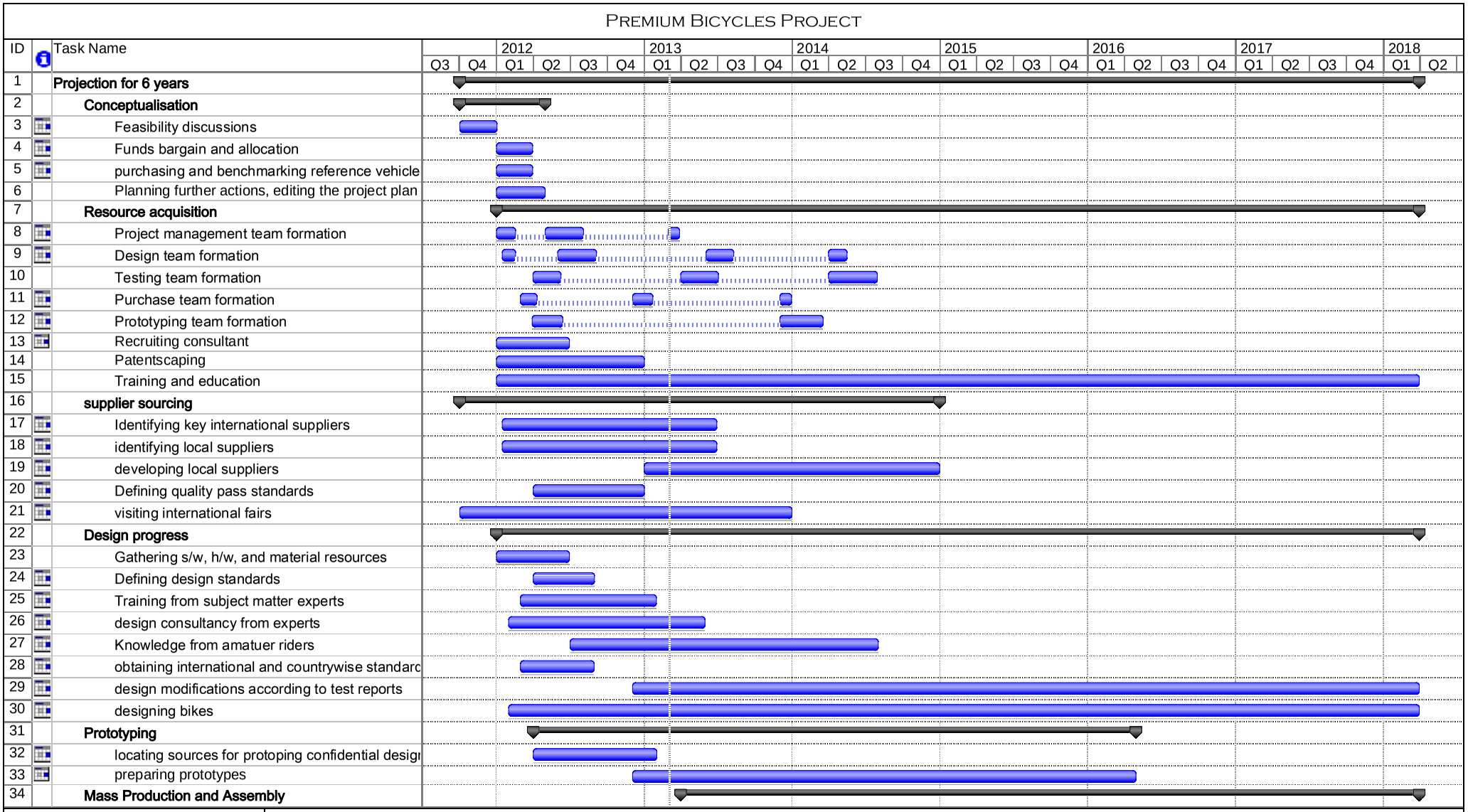
$TotalTVSInvestmentT6Cr\_min = 19.42$ $TotalTVSInvestmentT6Cr\_max = 52.928$

$TotalProfitCrT4\_P = 5.743$ $TotalProfitCrT4\_R = 27.118$ $TotalProfitCrT4\_O = 89.184$

$TotalProfitCrT5\_P = 12.63$ $TotalProfitCrT5\_R = 81.751$ $TotalProfitCrT5\_O = 247.681$

$TotalProfitCrT6\_P = 21.69$ $TotalProfitCrT6\_R = 167.886$ $TotalProfitCrT6\_O = 524.736$

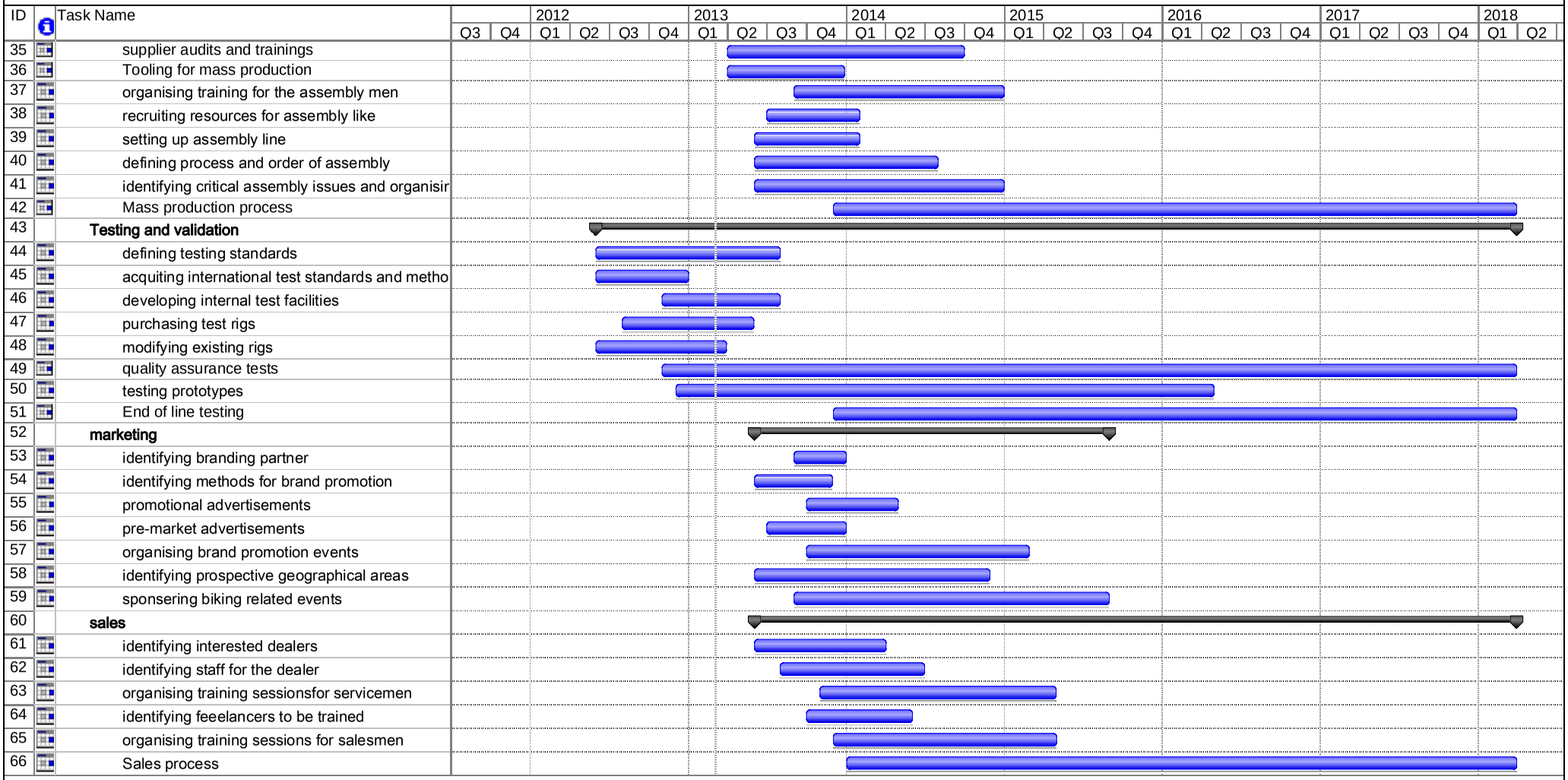
Premium Bicycles Project



Project: Premium Bicycles Project
Date: 03 March 2013

Task	Milestone	External Tasks
Split	Summary	External Milestone
Progress	Project Summary	Deadline

Premium Bicycles Project



Project: Premium Bicycles Project
Date: 03 March 2013

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline