

A Study Done To Identify The Capital And Operational Expenditure And Compare The Breakeven Points And Analyse The Same For A 1.5 T MRI And 3 T MRI For A Stand-Alone MRI Diagnostic Centre.

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I. Introduction

MRI scan is one of the key diagnostic component of healthcare sector. Many conditions require an MRI scan for conclusive diagnosis. But at the same time it is a very expensive equipment and has a high capital and operational expenditure. The key financial issues in setting up MRI scan centre are:

1. High cost of equipment.
2. Rapidly changing imaging technology which makes new models obsolete quickly
3. Requires big physical infrastructure setup
4. Costly maintenance of equipment.
5. Limited availability of skilled manpower for both operation and maintenance
6. High cost of associated employee salary
7. Power supply, procurement of supplies adds to cost
8. Long breakeven period
9. Heavy reliance on referrals from local doctors, hence the need for effort on “Business development” which further increases the cost and the time to reach breakeven point. As per a study, the share of total expenditures of diagnostic service providers on business development may be as high as 30% for high end diagnostics such as MRI and CT scans
10. Excessive competition initiates “MRI cost war” in the market which puts pressure on profit margins
11. Poor physical infrastructure in the existing healthcare and diagnostic centres make it difficult to get necessary clearances / licenses to start the centre

II. Objectives

- 1) To estimate the capital expenditure for establishing a stand-alone MRI diagnostic centre with 1.5T and 3T MRI machines.
- 2) To calculate the operational expenditure including fixed costs and variable costs for an MRI scan.
- 3) To do a break even analysis for the centre and comparative study of the same for 1.5 T and 3 T MRI.

III. Methodology

1. Files and Data regarding MRI equipment and purchase at Nizam’s Institute of Medical Sciences was collected and reviewed.
2. Telephonic interviews were conducted with Mr.Chandrasekhar – Siemens Sales Executive
3. Quotations of a Siemens MRI were collected.
4. The financials have been worked out considering them as standalone projects having a dedicated revenue and business model.
5. The following financial details were found out:
 - Capital Expenditure
 - Operational Expenditure
 - Fixed Costs
 - Variable costs
 - Depreciation

- Break Even
- 6. Current tariffs for 1.5 T and 3 T MRI prevalent in the market were found out.
- 7. Break even analysis was done individually for 1.5T MRI and 3T MRI

Observations:

Capital Expenditure

Cost of 1.5 T MRI

- 7 crores for Siemens MRI (Quotation already taken by the hospital for turnkey project)
- The warranty period and cost of CAMC and AMC have not been discussed.

Cost of 3 T MRI

This is the price of the 3T MRI purchased by NIMS hospital a few months ago.

- 13.7 Crores for Siemens MRI
- Siemens and GE qualified for the financial bid.
- L1 bidder was Siemens
- After negotiations, the following price was finalized: Rs13,70,975,00 for MagnetomSkyra with accessories and site preparation.
- Warranty: 3 years
- Agreed to supply peripheral angio coil and engine at free of cost.

CAMC and AMC charges after expiry of 3 yrs warranty (at NIMS)

• 4 th yr:	Rs 52,90,814	-----	1262062
• 5 th yr:	Rs 55,40,396	-----	1313827
• 6 th yr :	Rs 58,03,157	-----	1369206
• 7 th yr:	Rs 60,79,824	-----	1426829
• 8 th yr:	Rs 63,71,174	-----	1487334

The above AMC and CAMC prices are excluding Taxes.

Cost of Building construction (Since in the present project the building is owned and being constructed by the Proprietor himself)

Area required for MRI Suite:

MRI Suite Dimensions:

Recommendations for room dimensions vary by manufacturer, but the general minimums are:

- Scan Room: 21'-6" X 13'-4" with 8'-9" ceiling height (after shielding is installed)
- Equipment Room: 11'-0" X 11'-6" with 8'-0" ceiling height (after shielding)
- Control Room: 12' X 8' (this is typically ample room for workstation, desk/chair, and a bit of storage)

Additional areas required include:

- Patients waiting area
- Patient Changing room
- Bathrooms
- Reception area

- Considering the above data, the whole MRI suite needs roughly a minimum area of 3000 sft (approx) with a portion of common area apportioned.
- Cost of construction (@Rs 1600/sft) (which is the current minimum market standard): 1600 * 3000 = 48,00,000 Rs
- Cost of furniture and Air conditioners (ACs may or may not be a part of Suppliers turn key installation. This part should be clearly negotiated) = Rs 4,00,000

Table 1: Capital Cost

3 T MRI	13.7 crores
1.5 T MRI	7 crores
Construction	48 Lakhs
Cost of ACs and Furniture	8 lakhs

Total capital cost for 3T MRI: 14.26 crores
 Total capital cost for 1.5 T MRI: 7.56 crores

Operational cost per month

Table 2: Salaries (for 3 Shifts a day)

Post	Required no	Individual Salary/month	Total cost/ month
MRI technicians	3	30000	90,000
Radiologists (70 % apportioned)	3	1,20,000	2,52,000
Staff nurse	2	20000	40,000
Ward boys	3	14000	42,000
Security (20% apportioned)	2	15000	6000
Marketing	1	20000	20,000
Receptionist	1	20000	20,000
Administrative expenditure	-	-	30,000
	Total		5,00,000

Electricity Consumption

Based on data and studies available on the net, the load details of MRI have been calculated accordingly (there are no studies mentioning accurate data)

1.5 T MRI: Exposure Load @65 KWH and machine standby load @ 45 KWH

3 T MRI: Exposure load @100 KWH and machine standby load @ 55 KWH

The following were the results of costing of Electricity for a MRI scan in a Published study.

- Machine Hours
 - Capacity 3000
 - Actual use 2520
 - Idle time 480
- Procedure time
 - Exposure time (mins) 30 5
 - Machine Standby time (hours) 840
 - Total standby and idle time 1320
- Electricity bill for exposure time 1092000
- Electricity bill for Non-exposure time & Standby time 594000
- Machine standby time for other than use 75600
- Total electricity cost/scan Rs 450/ scan (approx)

Based on the above data the electricity consumption of 3T can be worked out to around a similar cost. Though the electricity consumption of 3 T MRI is high, the time consumed for each scan is similar thus negating the high consumption disadvantage. The monthly consumption of 3T MRI would be high but at the same time it would be in position to do more no of scans than 1.5 T MRI.

Depreciation:

The life cycle of an MRI has been worked out to 10 years. There are varying reports about this in the literature. With the changes in technology happening frequently, it is difficult to predict the accurate life cycle. It will supposedly be in the range of 7 – 10 years.

Considering a life cycle of 10 years, the depreciation of the MRI is worked out to 10% per year on a straight line method.

Redundant value is 5 % which amounts to 68.5 L for 3 T and 35 Lakhs for 1.5 T

Depreciation of 1.5 T MRI

- Capital cost – 7 crores
- Balance cost (- redundancy) = 6.65 crores
- Depreciation/yr – 66.5 lakhs.

Depreciation of 3 T MRI

- Capital cost -13.7crores
- Balnce cost (- redundancy) = 13.01 crores
- Depreciation/year – 1.3 crores

Depreciation of the Civil construction- 5 % of 48 L = 2.4 L

Depreciation of Office Furniture and ACs - 10 % of 8 L = 80,000

Total depreciation of 3 T = 1.33. crores/ annum

Total depreciation o 1.5 T= 69.7 L / annum

Maintenance:

MRI being a very technologically and cost intensive equipment, it is preferable to take CAMC or AMC (CAMC being the more preferable option) for the machine throughout its life cycle.

Cost of CAMC and AMC for 3 T MRI (data collected at NIMS Hospital)

Table 3: AMC and CAMC charges (after expiry of 3 yrs warranty) (at NIMS) (Excluding Taxes)

	AMC	CAMC
4 th yr	1262062	5290814
5 th yr	1313827	5540396
6 th yr	1369206	5803157
7 th yr	1426829	6079824
8 th yr	1487334	6371174

AMC and CAMC of equipment are generally around 10% of the equipment cost. In the above data, the cost of CAMC is around 5 % with the rate increasing every year.

Based on similar scale, the AMC and CAMC charges for 1.5 T MRI have been worked out.

Consumables cost:

- Contrast and its cost have not been considered in this study.
- MRI films and associated processing chemical (3 nos. films @ Rs.100/film) 300.00
- Report Envelopes (@ Rs.10/film) 10.00
- Direct Material per Scan 310.00

Insurance: Considering the high cost it is suggested to go for insurance of the equipment. The cost of insurance will vary and will depend on the policy and coverage. Insurance costs are not taken in this study.

Miscellaneous: These include laundry, linen, stationery, water consumption, telephone and internet.

Opportunity cost:

If opportunity cost is to be considered then it would be (Considering 8% interest)

3 T MRI – 1.12 crores / annum

1.5 T MRI – 56 lakhs / annum

But, opportunity cost has not been considered in this study.

Table 4: Operational Cost / month (for running the machine for 2 shifts)

	Total/ month
Salaries	500000
Electricity	450 / scan (approx)
Water	500
Equipment Maintenance (CAMC) (machine covered under 3 yrs warranty)	3 T -4.5 Lakhs (from 4 th year) 1.5 T -2.2 Lakhs (from 4 th Year)
Internet and phone	1000
Consumables (Film)	310 / test
Laundry	1000
Building Maintenance	1000
House Keeping	2000
Depreciation	1.5 T – 69.7. L /annum = 5.8 L / month 3 T – 1.33 crores / annum = 11.08 L / month

Total Fixed costs per month –

- Salaries: 5 Lakhs
- Depreciation 3 T – 11.08 Lakhs
1.5 T – 5.8 Lakhs
- Total – 3 T – 16.08 Lakhs
- Total – 1.5 T – 10.8 Lakhs
- Maintenance costs have not been considered as they are applicable after the end of third year.

Total variable costs per month

- Consumables: 310/ scan
- Variable electricity cost / scan: 450/ scan

- Referral amount - In the present market scenario, there is a referral amount of 20% which is given to the referring doctor. No referral amount will be paid to the in house patients. To balance them both, a referral amount of 10% is considered for both MRIs.

1.5 T - 800/ scan

3 T - 1000/ scan

Total – 1560/ 1.5 T scan

- 1760 / 3 T scan

Revenue Model

- Based on the charges of other centers in the city, cost of each session can be fixed at an average of 8000 per session for 1.5 T and 10000 for 3T(These are average prices as the cost of MRI varies from procedure to procedure)

Total no of shifts possible in a month

- No of shifts per day - 3 (total of 24 hours)
- Time taken for each scan (approx)
 - 40 mins avg for 1.5 T (including 10 mins of changeover time between various patients)
 - 30 mins avg for 3 T (including 10 mins of changeover time)
- Maximum no of scans possible per day
 - 1.5 T – 36 scans / day
 - 3 T – 48 scans / day
- Though each MRI machine requires a cooling off period of 3 - 4 hrs per day (varies from model to model), it has not been taken into consideration here as reaching 100% is not practically possible.
- Maximum sessions possible per month is
 - 36 * 30 days = 1080 sessions for 1.5 T
 - 48 * 30 days = 1440 sessions for 3 T
- Maximum revenue per month (at 100 % occupancy) for 1.5 T = 1080 * 8000 = 86,40,000 Maximum revenue per month (at 100% occ) for 3 T MRI = 1440 * 10000 = 1,44,00,000

Table 5: Maximum Revenue (gross revenue) possible at various occupancy rates (in lakhs)

Occupancy usage	1.5 T	3 T
100%	86.4	144
90%	77.76	129.6
80%	69.12	115.2
70%	60.48	100.8
60%	51.84	86.4
50%	43.2	72
40%	34.5	57.6
30%	25.92	43.2
20%	17.28	28.8

Break Even analysis for 1.5 T

- Break even has been calculated for the first 3 years.
- The equipment is covered under warranty for the first 3 years.
- Maintenance charges would be applicable after that period leading to a rise in operational costs.

Fixed Cost – 10.8 L

Variable cost – 1310 / scan

Gross revenue per session = Rs8000

Contribution margin per session (Net revenue per session) = 8000 – 1310 = 6690

Calculation of Breakeven point

$$\text{Breakeven point in units} = \frac{\text{Fixed costs}}{\text{Sales price per unit} - \text{Variable cost per unit}}$$

Breakeven point in terms of money = Sales price per unit * Breakeven point in units

Breakeven point in units = 1080000 / (8000 – 1310)

= 1080000 / 6690

= 161.4 units / month.

161.4 scans of MRI have to be done per month to meet the breakeven point.

5.38 scans have to be done per day to reach breakeven.

Breakeven point in Rs = 161.4 * 8000 = Rs 12,91,200 / month

12.91 Lakhs of Rupees should be generated per month to meet the breakeven point for 1.5 T MRI.

Break even analysis for 3 Tesla

Fixed Cost – 16,08,000

Variable cost – 1510 / scan

Gross revenue per session = Rs 10,000

Contribution margin per session (Net revenue per session) = 10000 – 1510 = 8490

Calculation of Breakeven point

$$\text{Breakeven point in units} = \frac{\text{Fixed costs}}{\text{Sales price per unit} - \text{Variable cost per unit}}$$

Breakeven point in terms of money = Sales price per unit * Breakeven point in units

$$\begin{aligned} \text{Breakeven point in units} &= 16,08,000 / (10000 - 1510) \\ &= 16,08,000 / 8490 \\ &= 189.3 \text{ units / month.} \end{aligned}$$

189.3 scans of MRI have to be done per month to meet the breakeven point.

6.31 scans have to be done per day to reach breakeven.

Breakeven point in Rs = 189.3 * 10000 = Rs 18,93,000 / month

18.93 Lakhs of Rupees should be generated per month to meet the breakeven point for 3 T MRI

Occupancy usage required to meet breakeven:

1.5 T MRI

➤ Max scans /day – 1080

➤ Breakeven – 161.4 = 14.94 %

3 T MRI

Max scans per day – 1440

Breakeven – 189.3 = 13.14 %

Fig 1: Breakeven units/ month Comparison

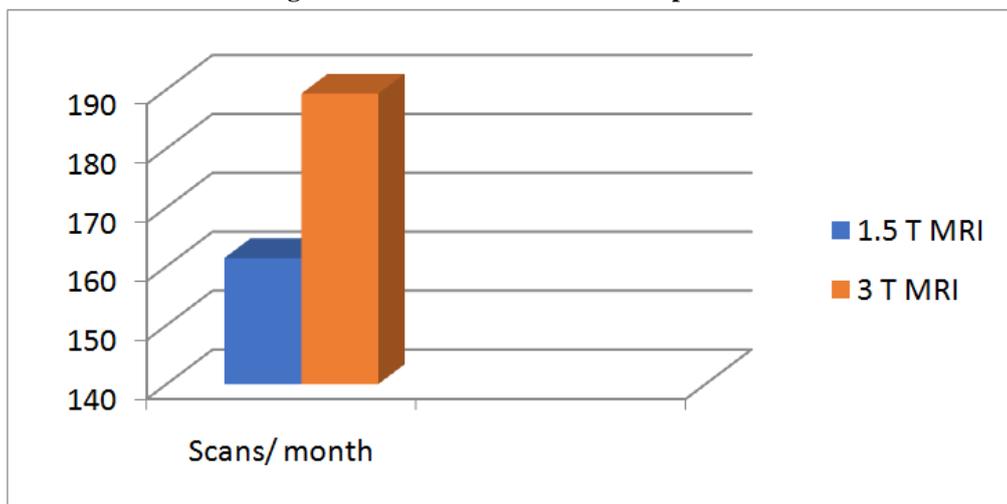
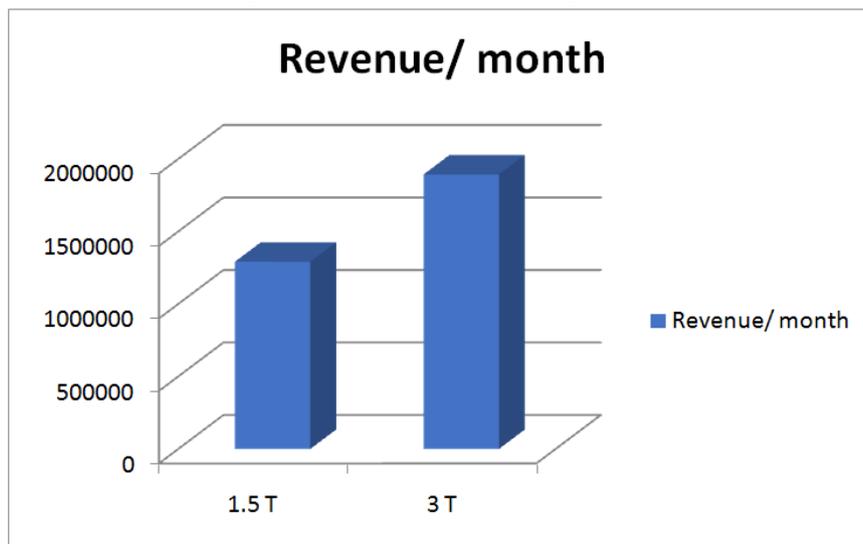


Fig 2: Breakeven revenue comparison



IV. Conclusion

A decision to purchase an MRI and also the decision between 1.5T and 3T should be well planned and well thought out as MRI is a capital intensive expenditure and has a break even point.

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