Economics of Ophthalmic Equipment

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Need for economics understanding

A wide range of ophthalmic equipment is available for diagnosis and treatment of eye disorders. The clinical benefits of these ophthalmic equipments are well discussed and information on them is readily available in many publications. The decision to purchase the ophthalmic requires a better understanding of the clinical as well as economic benefits. Since many recently developed ophthalmic equipment such as phaco emulsification machines and ophthalmic lasers normally require considerable capital investment, a better understanding of the economic benefits is usually more crucial to justify the purchase. The basic economic concepts and typical economic analysis needed to justify procurement of ophthalmic equipment are discussed below. The various economics aspects are illustrated using the purchase of Eximer Laser for Lasik surgery procedure as a typical example since this represents the most expensive ophthalmic equipment at present.

Economic issues

Ophthalmic equipment is a major resource required for delivery of quality eye care at an appropriate cost. This resource should be selected carefully and once purchased it should be maintained and used efficiently in order to generate adequate return on the investment. Let us assume that the approximate capital investment required for introducing the Eximer Laser Lasik surgery procedure as Rs.2 crores. The typical economic issues that need to be addressed to adequately justify this investment are the following:

- Appropriate charges for the procedure
- Anticipated revenue per year
- Estimated expenses per year
- Volume required for break-even
- Estimated financial returns over multiyear period

A good estimation of Lasik procedure costs and the cost per procedure is essential for understanding the equipment economics and to initiate any cost containment efforts.

Procedure costs

Any procedure costs may be broadly classified under the following categories:

- Direct cost
- Indirect cost or overhead cost
- Fixed cost
- Variable cost

A cost element can be treated as a direct cost if the cost can be directly traced to the procedure. Salary of the staff performing the procedure, supplies used and equipment depreciation are examples of direct costs. Administrative staff salary, accounting, housekeeping, office supplies, etc are considered as indirect costs or overheads.

The cost elements are also classified differently based on the volume of procedures performed. The cost elements that do not vary normally with volume are treated as fixed costs and that vary with volume are considered as variable costs. Salary, rent, utilities and equipment depreciation are examples of fixed cost and consumables, drugs and surgical supplies are considered as variable costs. Fixed cost may have both direct and indirect cost elements whereas the variable cost normally may have both direct and indirect cost elements. Some cost may be fixed over a certain range of volume only. For example the salary may be fixed till a certain volume but additional staff may be needed to provide higher volume. Such costs are considered as semi-variable.

The typical fixed and variable costs or expenses for performing about 800 Lasik surgical procedures are given in table 1 and table 2

Table 1: Fixed expenses or costs

Cost	Rs.
Salary	4,20,000
Maintenance	17,00,000
Electricity	3,80,000
Rent	60,000
Overheads	24,000
Depreciation @20%	40,00,000
Interest @ 12%	24,00,000
Fixed cost per year	89,84,000

Table 2: Variable expenses or costs

Cost	Rs.
Mocrokeratome blade	1,000
Gas	170
Disposables	50
Medical supplies	50
Variable cost per procedure	1,320
Procedure per year	800
Variable cost per year	10,56,000

The equipment depreciation mentioned under fixed expenses corresponds to the reduction in equipment value with time. The following two methods are normally used for calculating the depreciation:

- Straight line method (SLM)
- Written down value (WDV)

In the straight line method an economic life is defined (usually 5 years) and the depreciation per year is calculated assuming zero value at the end of this period. The depreciation for Lasik equipment calculated as per this method is Rs.40 lakhs (Rs.200 lakhs 0.20)

In the written down value method the depreciation is calculated at allowable rate (normally 25%) for the first year and the value of the equipment is reduced by this depreciated amount. This reduced value is known as written down value or book value. The depreciation is higher in the yearly years and it reduces in the subsequent period. The written down value method is normally used by the tax auditors for income tax purposes. The depreciation values as per this method for five years as shown in (Table 3)

Procedure charges

The procedure charges may be determined based on the following two methods:

- Cost based pricing
- Competition based pricing

Table 3: Written down value depreciation

Year	Depreciation @25%, Rs.	Book value (WDV), Rs.
0		2,00,00,000
1	50,00,000	1,50,00,000
2	37,50,000	1,12,50,000
3	28,12,500	84,37,500
4	21,09,375	63,28,125
5	15,82,031	47,46,094

The detailed cost estimates provide a good basis for determining the appropriate charges for the procedure. The total cost is a sum of fixed and variable costs. The cost per procedure as per the expenses shown above in Tables x and x is about Rs. 11, 300. Usually a profit margin is added to the actual cost to arrive at the per procedure charge. Due to the difficulties in compiling the costs this method is not commonly used.

Most commonly the charges are fixed based on the prevailing market situation and what the market can bear (average going rate). The price sensitiveness or elasticity of the market needs to be assessed and

Table 4: Effective use of price elasticity

Details	Rs.	Rs.
Fixed expenses	89,84,000	89,84,000
Variable expenses	10,56,000	14,52,000
Total expenses	1,00,40,000	1,04,36,000
Procedure per year	800	1,100
Charges per procedure	12,000	11,000
Total revenue per year	96,00,000	1,21,00,000
Net surplus (-loss)	-4,40,000	16,64,000

it may be appropriate to offer lower charges in order to increase the volume of procedures. This may result in better returns than performing low volume at higher prices as shown in (Table 4) using the costs for the Lasik procedure.

Break-even volume

The revenues and expenses for performing 800 Lasik procedures and 1,035 procedures per year at Rs. 10, 000 per procedure are shown in (Table 5).

The volume at 1, 035 procedures per year results in no loss or profit. The volume represents the break-even volume for the Lasik equipment at the above procedure charge. The break-even volume (BEV) may be computed directly from the equation:

BEV = (Fixed cost)/ (Procedure charge- Variable cost per procedure).

Table 5: Break-even volume

Details	Rs.	Rs.
Fixed expenses	89,84,000	89,84,000
Variable expenses	10,56,000	13,56,200
Total expenses	1,00,40,000	1,03,50,200
Procedure per year	800	1,035
Charges per procedure	10,000	10,000
Total revenue per year	80,00,000	1,03,50,000
Net surplus (-loss)	-20,40,000	-200

The percentage of various cost sources at break-even volume are given in (Table 6).

Usually the depreciation and interest account for major portion of expenses (about 62% in this case for high value capital equipment)

Capital investment analysis

Capital investment decisions should be based on adequate return on investment (ROI) over a multiyear period. A number of sophisticated approaches can be used in this evaluation. Unsophisticated approaches include average rate of return, average payback period, actual payback period. Net present value, benefit/ cost ratio, and internal rate of return are sophisticated approaches. The net present value (NPV) using discounted cash flow (DCF) technique is a useful analysis tool used for this purpose. This method considers the time value of money and it provides a means to calculate the net present value of cash flows. An example net present value capital investment analysis for the Lasik equipment is shown in (Table 7).

Table 6: Percentage contribution of costs at break-even volume

Details	Rs.	%
Fixed expenses	25,84,000	25%
Variable expenses	13,66,200	13%
Depreciation	40,00,000	39%
Interest	24,00,000	23%
Total expenses	1,03,50,200	100%

This example assumes that 2 crores were invested initially from own funds, that is funds are not borrowed. It is necessary to show reasonable return for this investment. The above analysis calculates this return over a five year time period which is appropriate for this rapidly changing technology. Revenues and expenses are as per the projections shown. Cash inflow is the cash available at the end of each year shown. This value of cash is converted to Present Value (PV) using standard factors for 17% return investment (ROI). The net present value (sum of 5 year PV) is close to 2 crores indicating that if the projected volume of procedures at the above charges are performed it is possible to have about 17% return on the 2 crores investment. The normal expected ROI is about 20% or above. This may require either increasing the volume or the charges.

Table 7: Capital investment analysis

Cost details	Initial cost	Year 1	Year 2	Year 3	Year 4	Year 5
Initial cost						
Eximer laser	1,65,55,000					
Microkeratome	23,65,000					
Instrument sets	50,000					
Sterliser	2,25,000					
Topography m/c	9,46,000					
Total investment	**2,01,41,000**					
Operating expenses						
Salaries and benefits		4,20,000	4,20,000	4,20,000	4,20,000	4,20,000
Maintenance			17,00,000	17,00,000	17,00,000	17,00,000
Rent		60,000	60,000	60,000	60,000	60,000
Electricity		3,80,000	3,80,000	3,80,000	3,80,000	3,80,000
Overheads		24,000	24,000	24,000	24,000	24,000
Variable expenses		10,56,000	11,88,000	13,20,000	14,52,000	15,84,000
Depreciation		50,00,000	37,50,000	28,12,500	21,09,400	15,82,000
Expenses per year		**69,40,000**	**75,22,000**	**67,16,500**	**61,45,400**	**57,50,000**
Operating revenues						
Procedure per year		800	900	1,000	1,100	1,200
Charge per procedure		10,000	10,000	10,000	10,000	10,000
Revenue per year		**80,00,000**	**90,00,000**	**1,00,00,000**	**1,10,00,000**	**1,20,00,000**
Net surplus (-loss)		10,60,000	14,78,000	32,83,500	48,54,600	62,50,000
Cash inflow		60,60,000	52,28,000	60,96,000	69,64,000	78,32,000
PV factor @17%ROI		0.855	0.731	0.624	0.534	0.456
NPV	**20,097,040**	51,81,300	38,21,668	38,03,904	37,18,776	35,71,392

Suggested readings

1. *Prasanna Chandra., Finance Sense, Tata-McGrow Hill Publishing Company Limited, New Delhi, 1995*
2. *Subir Kumar Banerjee, Financial Management, S. Chand & Company Limited, New Delhi, 1997.*
3. *William J. Ward, Health Care Budgeting & Financial Management for Non-Financial Managers, Auburn House, Connecticut, USA, 1994.*
4. *James D. Suver, et al, Accounting for Healthcare Organizations, Healthcare Financial Management Association, Chicago, USA, 1997.*