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"USE OF EQUIPMENT REPLACEMENT ANALYSIS AT A TERTIARY CARE TEACHING HOSPITAL."

Management

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ABSTRACT

The efficiency of equipments in terms of productivity and quality of output decrease as they become old. The hospitals have to spend more money to keep it in shape and incur increasing repair and maintenance costs which in turn will increase the operating cost with no assurance regarding the retention of productivity and quality. Thus it becomes necessary to determine the age at which a replacement is more economical rather continue operations with increased cost. The article highlights on the replacement analysis carried out in a tertiary care teaching hospital.

KEYWORDS

Introduction:

The Indian medical equipment and devices market in India was estimated worth to be Rs 10,846 crore in 2007, a growth of over 17.5% estimated worth of Rs 9,230 crore in 2006. The market is projected to grow at a significant Compounded Annual Growth Rate (CAGR) of 14-16% in the next five years.[1] Imports make up over 60% of all devices by value and dominate the high end market with foreign devices seen as more effective and reliable.[2] Accelerated ageing population and increasing prevalence of chronic diseases are the key drivers that contribute towards the increase in total health expenditure in the medical devices in the region.[3] A clear cut national policy on acquisition, utilization and maintenance of medical equipment needs to be established in developing countries. For a comprehensive and more effective system in managing medical equipment a life cycle approach should be used.[4]

Effective management and efficient maintenance of healthcare equipment have deep economic consequences as these have an impact on all aspects of healthcare delivery. These are vital for smooth functioning of every healthcare facility from the primary healthcare facility to the most sophisticated hospital in every country. Available information indicates that a developing country will seldom have 50% of its equipment in usable condition.[5]

Besides maintenance there should be a policy for equipment replacement. After equipment has been used for sometime repair becomes uneconomical and a policy is required for its replacement. The old equipment may be used as a standby or given to teaching and research organizations or used as a source of spare parts for the repair of other equipment.[6]

There is a need for periodic evaluation of quality of performance of equipment in hospitals. It provides a satisfactory mechanism to assist the process of condemnation and replacement.[7]

Methodology:

A study was carried out to determine the feasibility of replacement of C- Arm STE-152 equipment. A retrospective study was carried out to obtain data pertaining to equipment, installation, warranty and maintenance details. Replacement analysis was carried out by three approaches.

A) ASHE (American Society of Healthcare Engineers) Depreciation method.
B) Maximum Expenditure Limits method. (MEL)
C) Total Average Costs.

A) ASHE Depreciation Method:

The depreciated value for biomedical equipments was calculated as per ASHE guidelines (American Society of Healthcare Engineers)

Depreciated value = Purchase value – A

$$A = \frac{\text{Purchase value x Equipment in usage}}{\text{Lifespan of the equipment.}}$$

If the maintenance and repair costs are more than depreciated value, it is considered Beyond Economic Repair and recommended for condemnation.

The second method of arriving at the certification of "Beyond Economic Repair" is given below.

B. Maximum Expenditure Limits method.

1. Establish Maximum Expenditure Limits (MEL). It should be established to ensure that it is more economic and operations effective to perform corrective maintenance than to replacement.
2. The computation of MEL is done by multiplying the MEL factor with current replacement cost.
3. The following can be used to determine if an item of equipment is economically repairable.

- Determine equipment use to date, projected life expectancy and equipment replacement cost.
- Determine life remaining on equipment.

Life remaining (L/R) = Life Expectancy (L/E) – Equipment Usage.

- Determine the percentage of useful life remaining for the equipment.

$$\frac{L/R}{L/E.} = \% \text{ of Useful life remaining}$$

- Determine the MEL factor:
  Hospital furniture – 80%.
  Basic electrical material - 80%.
  Basic mechanical material - 80%.
  Basic electronic material - 60%.

MEL = MEL factor x % Useful life remaining x Replacement cost.

If cost of the maintenance exceeds MEL it would be considered not economically repairable.[8]

C. Total Average Costs.

Replacement Analysis based on total Average Costs:

The total average costs (TAC) = [C- S(t) + U(t)] / t.
Where

C = Capital cost of the equipment.
S (t) = Resale value of the equipment at time't'.
U (t) = Operating cost up to 't'years.
t = number of time units (age).

Replacement of the equipment must be considered after't' years, if the

(t-1) years cost is greater than the weighted average cost up to 't' years.[9]

Results & Discussion:

1. Name: C-Arm.
2. Year of purchase: 2002.
3. Warranty – 1 year.
4. Purchase cost of the equipment: 18 lakhs.
5. Year of Installation: 2002.
6. User Department: Urology Operation Theater.
7. Life span of the equipment : 8 years
8. Yearly Maintenance cost of the equipment including spares. 3% of Original equipment cost (54000).
9. Present replacement cost of the equipment: 18 lakhs.

Insert table1:

A. Depreciation method: The depreciated value of the equipment was arrived at based on ASHE guidelines. The maintenance cost of the equipment does not exceed the depreciated value throughout the life span of the equipment. Replacement can be considered feasible after completion of life span of the equipment (2010).

Insert table2:

B. Maximum Expenditure Limits: MEL factor for C- Arm was assigned 80% as the equipment make up is predominantly mechanical material (The electronic component is ignored). The product of MEL factor, percentage of useful life remaining and the replacement cost of the equipment (Current replacement cost: 18, 00,000) does not exceed the maintenance costs throughout the life span of the equipment. Therefore replacement can be considered feasible after completion of life span of the equipment (2010).

C. Total Average Costs:

Reasons for selecting "Straight line method of calculating depreciation over Declining Balance Method":

In Declining balance method higher depreciation is allocated in initial years when machine is most efficient compared to later years. Also it balances the expense of depreciation and repair charges together as repairs are lowest in initial years and highest in later years. The Equipment maintenance in the hospital has been outsourced and the hospital is paying fixed amount of maintenance (3% of Original equipment costs including spares irrespective of the nature of maintenance) which is constant throughout the life span of the equipment. Therefore straight line method was selected as there is no need to balance the expense of depreciation with repair cost due to fixed amount of maintenance being paid to the biomedical department every year.

The total average costs (496285.7) in the year 2009 does not exceed the projected total average costs for the year 2009 (497250) with margin of difference being narrow (964.2 Rs). The hospital management can consider planning of replacement in 2009 and the equipment can be replaced after completion of its life span (2010).

Conclusion:

Replacement analysis based on the above mentioned approaches projected that the equipment C- Arm can be considered feasible to replace after completion of its life span. Hospitals are equipment intensive, labor intensive and information intensive organizations. Hospitals incur a higher capital & operating costs and the demand for expenses always seems to be far higher than the income generated. Efficient equipment maintenance program & timely replacement of equipment is the key for cost containment and also to ensure safe and quality care to the patients.

Table 1: Showing computation of Depreciated value based on the ASHE guidelines.

Years	A	Depreciated value	Maintenance
0.(2002)			
1.(2003)	225000	1575000	WARRANTY
2.(2004)	450000	1350000	54000
3.(2005)	675000	1125000	54000
4.(2006)	900000	900000	54000
5.(2007)	1125000	675000	54000
6.(2008)	1350000	450000	54000
7.(2009)	1575000	225000	54000
8.(2010)	1800000	0	54000

*** A** = Purchase value x Equipment in usage
Lifespan of the equipment.

* Depreciated value = Purchase Value – A.

Table 2: Showing computation of Maximum Expenditure Limits.

Years	Maintenance	%Useful life remaining	MEL
0.(2002)			
1.(2003)	WARRANTY	87.50%	1260000
2.(2004)	54000	75%	1080000
3.(2005)	54000	62.50%	900000
4.(2006)	54000	50%	720000
5.(2007)	54000	37.50%	540000
6.(2008)	54000	25%	360000
7.(2009)	54000	12.50%	180000
8.(2010)	54000	0	0

* % Useful life remaining = Life Remaining/ Life Expectancy.
* MEL = MEL factor X % Useful life remaining X Replacement cost

Table3: Showing computation of Operating Cost.

Years	Depreciation	Accumulated depreciation	Maintenance	Cumulative maintenance	Operating cost (Ut):
0.(2002)					
1.(2003)	225000	225000	Warranty	Warranty	225000
2.(2004)	225000	450000	54000	54000	504000
3.(2005)	225000	675000	54000	108000	783000
4.(2006)	225000	900000	54000	162000	1062000
5.(2007)	225000	1125000	54000	216000	1341000
6.(2008)	225000	1350000	54000	270000	1620000
7.(2009)	225000	1575000	54000	324000	1899000
8.(2010)	225000	1800000	54000	378000	2178000

* Operating Cost = Accumulated Depreciation + Cumulative Maintenance.

Table 4: Showing computation of Total Average Costs.

Years	Resale value (St)	C - St	[C - St + Ut]	**[C -St+ Ut] / t**
0.(2002)				
1.(2003)	1575000	225000	450000	450000
2.(2004)	1350000	450000	954000	477000
3.(2005)	1125000	675000	1458000	486000
4.(2006)	900000	900000	1962000	490500
5.(2007)	675000	1125000	2466000	493200
6.(2008)	450000	1350000	2970000	495000
7.(2009)	225000	1575000	3474000	496285.7
8.(2010)	0	1800000	3978000	497250

References:

1. Arora R. Medical equipment and devices market. Medical Buyer. 2008; 6 (16): 16.
2. Nair P. Medical device market in India. Modern Medicare. 2009; 5(4): 71.
3. Lau J. Medical device market – Mega trends in Asia. Asian hospital and Healthcare management. 2008; 16: 49.
4. World Health Organization. District Health Facilities – Guidelines for development and operations: 1st ed. New Delhi: AITBS Publishers. 2000:150.
5. Tabish SA. Hospital and Health Services Administration, Principles and Practice: 1st ed. New Delhi: Oxford University Press. 2005: 481.
6. Goel SL, Kumar R. Management of hospitals in 21st century: New Delhi: Deep and Deep publications. 2002; 2: 97.
7. Sarma RK, Sharma Y. Handbook on Hospital Administration: 1st Ed Jammu: Durga Printers. 2003: 456.
8. Mc Clain JP. Life Expectancy projection of biomedical equipments. A guide for medical equipment replacement program: American Society of Healthcare Engineers. 1995: 4-6.
9. Srinivasan AV. Managing a Modern Hospital: 1st ed. New Delhi: Response books. 2005: 241