

LIFE CYCLE COSTING FOR VALUE ENHANCED HEALTHCARE

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ABSTRACT

The technique of life cycle costing (LCC) is an excellent aid in seeking more cost effective decisions. This paper discusses many opportunities to apply LCC to healthcare decision-making including: strategic business planning; deciding whether to renovate, build new or simply continue current use; seeking the optimum layout and functional plan; and making the best selection of engineering systems. A nursing tower example provides an in-depth look at the fundamentals of LCC. Sensitivity analysis and Monte Carlo risk simulation modeling are also illustrated. The paper concludes with suggesting the next steps toward application of LCC in the healthcare industry.

a general consensus that spending will continue to escalate at a rate that out paces the consumer price index. Payers will continue to restrict reimbursement rate increases and will be supported by employer and consumer groups.

"But, the healthcare business will continue to grow and a lot of money will be made by survivors," according to Forbes. Providers of healthcare services must deliver quality to retain patient volume, while containing costs to ensure viability. As such, tremendous pressure is now being placed on healthcare providers to lower operational and construction costs, while seeking quality care. More cost effective decision-making is needed and value specialists can help, if equipped with proper tools.

HEALTHCARE PRESSURES

The healthcare industry continues to experience consumer pressures to reduce operational costs while maintaining appropriate levels of patient care.

"The next 10 years promise turmoil in healthcare," according to an article in Forbes January 1996 magazine.¹ "Hospitals will close, doctors will quit their specialties, HMO's will merge, traditional health insurance will become virtually extinct."

Today's healthcare system is under increasing scrutiny regarding access, quality and cost. There is

LIFE CYCLE COSTING

LCC is a decision-making tool that can assist hospital administrators, architects, engineers, and value managers in selecting the best courses of action to optimize the total cost of ownership. Since healthcare staffing, as illustrated in figure 1, represents the largest single element of LCC, particular attention is required to improve efficiency both in hospital layout and use of the latest electronic communication technology.

LCC can be defined as "an economic assessment of competing design alternatives, considering all significant costs of ownership over the economic life of each alternative, expressed in equivalent dollars."² In 1972, the U.S. Dept. of Health, Education and Welfare summarized LCC as the "systematic con-

Hospital Expenses

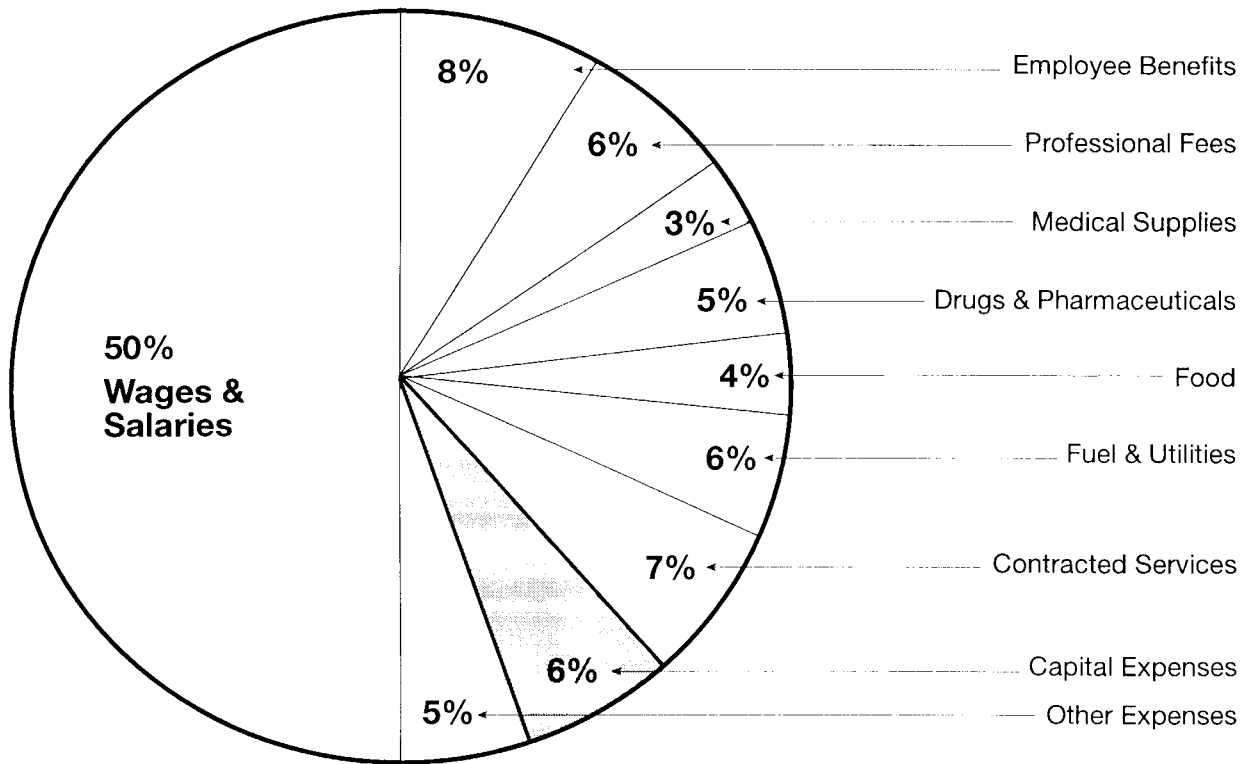


Figure 1 Total cost of ownership, typical hospital

sideration of cost, time and quality.” Numerous federal and state requirements exist for professionals to utilize LCC in design decision-making. The VE requirement as specified by the U.S. Federal Office of Management and Budget Circular A-131 requires items or processes be selected for “best value” as represented by the lowest total cost (LCC).” ASTM has established a number of standard practices for LCC.³

Unfortunately, too few practitioners utilize the powerful technique of LCC as part of their decision-making. The process of LCC is actually quite simple consisting of 4 steps:

1. **Identifying economic criteria**
Approach & Assumptions
Sources of Information
2. **Generating design alternatives**
Brainstorming
Creativity
3. **Evaluating life cycle costs and benefits**
LCC Analysis
Weighted Evaluation
4. **Selecting the design alternative**
Risk Assessment
Ranking

HEALTHCARE OPPORTUNITIES

The use of LCC to improve the cost effectiveness of healthcare applies at all levels of decision-making. It begins with such strategic business planning issues as whether to centralize or disperse speciality healthcare services in a geographic catchment area. Should “cottage style” primary care centers be located throughout the region or is it more life cycle cost effective to create a single large hospital complex? Should two competing hospitals each with 60% utilization rates be consolidated? And, what should a 30 year old hospital that is trying to compete in a decreasing inpatient-market do? Should they sell, renovate, consolidate, build new or simply remain status quo? “Among the HMOs, the ones that own their clinics and hospitals are suffering,” according to Forbes. “It is actually less expensive to purchase an incremental hour of a doctor’s time or a hospital visit than to own it.”

Once these strategic business planning decisions

are made, LCC can then be utilized to optimize the renovated or new design layouts for best staffing and functional efficiency. Should interstice space be provided for improved future flexibility and to minimize premature obsolescence? If so, on which floors and over what departments? Building systems selection is also an excellent use of LCC.

Which type of mechanical system will provide the best value to both the patient and healthcare provider for long term cost effectiveness? Other systems of particular interest for operational effectiveness include:

- Patient room lighting systems for comfort as well as energy efficiency
- Interior finishes for aesthetic appeal as well as long term low maintenance
- Communications systems for quick patient response and nurse staffing efficiency

EXAMPLE: NURSING TOWERS

To illustrate healthcare strategic business decision-making and the process of LCC itself, a nursing tower case study has been selected. A midwestern hospital association is interested in upgrading its nursing tower facilities because of decreasing utilization, pending obsolescence, rising energy and maintenance costs, and increasing staffing costs. Three alternatives are to be considered; 1. remain (do nothing), 2. renovate the existing facilities, and 3. build new nursing towers. Following is the “most likely” costs of these three alternatives as well as the estimated low and high values.

Alternative 1 - Continue Use of Nursing Towers

	<u>High</u>	<u>Low</u>	<u>Most Likely</u>
Replace air handling units within 4-8 years	\$2,500,000	\$1,500,000	\$2,000,000
Re-roof nursing towers within 10-14 years	\$800,000	\$ 400,000	\$ 600,000
Nursing tower value assumed in 25 years (salvage)	\$ 0%	\$ 0%	\$ 0%
Annual energy consumption	\$ 5.50/GSF	\$ 3.50/GSF	\$ 4.50/GSF

Maintenance/repair costs per year			
\$ 7.00/GSF	\$ 5.00/GSF		\$ 6.00/GSF

Nurse staffing annual costs			
\$ 40/GSF	\$ 35/GSF		\$37.50/GSF

Alternative 2 - Renovate Nursing Towers
(200,000 GSF)

Renovation construction cost			
\$ 80/GSF	\$ 35/GSF		\$ 50/GSF

Nursing tower value assumed in 25 years (salvage)			
\$ 40%	\$ 20%		\$ 30%

Estimated annual energy costs			
\$ 5.25/GSF	\$ 3.25/GSF		\$4.25/GSF

Maintenance/repair costs per year			
\$ 6.50/GSF	\$ 4.50/GSF		\$ 5.00/GSF

Nurse staffing annual costs			
\$ 38/GSF	\$ 33/GSF		\$ 35.50/GSF

Additional income over alternative 1			
\$ (5.00/GSF)	\$ (0.0/GSF)		\$ (2.50/GSF)

Alternative 3 - Build New Nursing Towers
(180,000 GSF)

Construct new nursing towers			
\$150/GSF	\$100/GSF		\$ 120/GSF

Demolish existing nursing towers			
\$ 6/GSF	\$ 4/GSF		\$ 5/GSF

Nursing tower value assumed in 25 years (salvage)			
\$ 80%	\$ 60%		\$ 70%

Estimated annual energy costs			
\$ 4.75/GSF	\$ 2.75/GSF		\$ 3.75/GSF

Maintenance/repair costs per year			
\$ 6.00/GSF	\$ 4.00/GSF		\$ 5.00/GSF

Nurse staffing annual costs			
\$ 35/GSF	\$ 30/GSF		\$32.50/GSF

Additional income per year over alternative 1			
\$(10./GSF)	\$(5/GSF)		\$(7.50/GSF)

The hospital administrator has requested the value manager to perform a life cycle cost analysis of these three situations using the present worth method

of analysis. The economic criteria for the analysis are:

- Project life cycle 25 years
- Discount rate 7%, compounded annually
- Monetary standard Constant dollars
- Cash flows End of the year
- Risk Assessment Sensitivity & Monte Carlo simulation
- Present time Date of occupancy
- Confidence level: 80%

Construction escalation to bid date:

- Nursing towers 6-10%

Differential escalation rates for operating costs are:

- Energy 0 to 2%/year
- Maintenance 0 to 1%/year
- Staffing 2 to 3%/year
- Income 1 to 5%/year

What is the life cycle cost of each of these alternatives? What is the best value option for the hospital administrator?

The microcomputer spreadsheet shown as Figure 2 combines all of the above information into an easy to read, organized set of information. Each of the columns present the three alternatives. Horizontally, the sheet is divided into three parts:

- Initial costs
- Replacement costs/salvage value
- Annual costs

The bottom of the sheet contains a summary of the total life cycle cost of each alternative, expressed in present worth dollars. The discounted payback period, in years, as well as the "annualized" total life cycle costs are also shown.

This analysis, based on the "most likely" estimates, indicates that alternative 3 (build new nursing towers) should be selected, but is this the right choice? If the administrator wants an 80% confidence in her decisions, what is the costs of each of the alternatives and is the 3rd alternative still the best choice?

To perform this calculation, I used an Excel spreadsheet add-on software package called, @RISK.⁴ Figure 3 illustrates the Monte Carlo simulation of results distributed by ascending order of probability. For example, since the hospital administrator wanted

an 80% confidence level, the life cycle cost of alternative 2 is \$138 million.

alternative 3, build new nursing towers, is the best choice even after considering the uncertainty of the estimates.

Figure 5 illustrates a “tornado diagram” for alternative 3 of the most sensitive variables in this LCC analysis. These include: added income, staffing costs, GSF, and maintenance costs.

With more time, the value manager should also explore “what ifs” relative these items such as, “what if there is no additional income as a result of building the new nursing towers.”

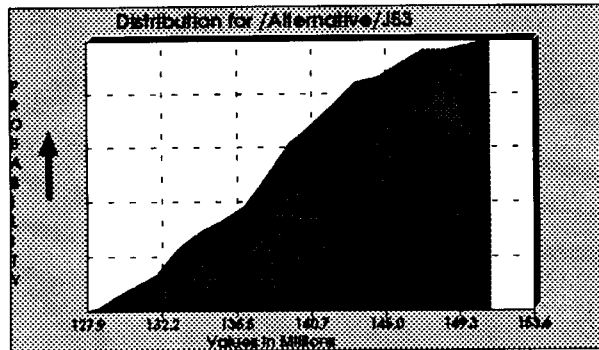
NEXT STEPS

For healthcare providers to benefit from more cost effective decision-making, they must insist on VM consultant use of LCC. On the other hand, VM consultants must be very proficient in the use of this technique to add value to the healthcare industry. The readers are directed to the bibliography for more information regarding the economic fundamentals, decision-making methodology, and sources of data to perform LCC. The changes which are occurring in the healthcare industry promise benefits to society including “a downsized, efficient, still high-quality health delivery system, just as the automobile manufacturers downsized their plants, improved the quality and improved the value,” according to Forbes.

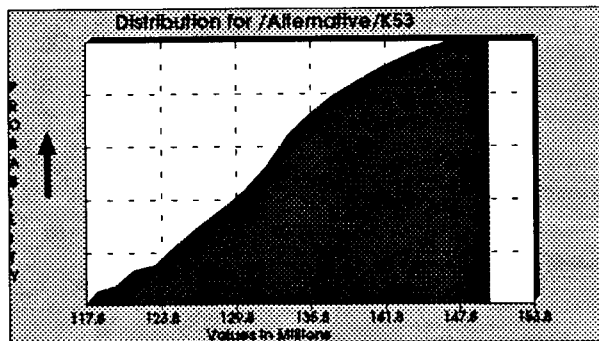
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3. ASTM E917-89 “Practice for Measuring Life Cycle Costs of Buildings and Building Systems.”
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Alternative 1



Alternative 2



Alternative 3

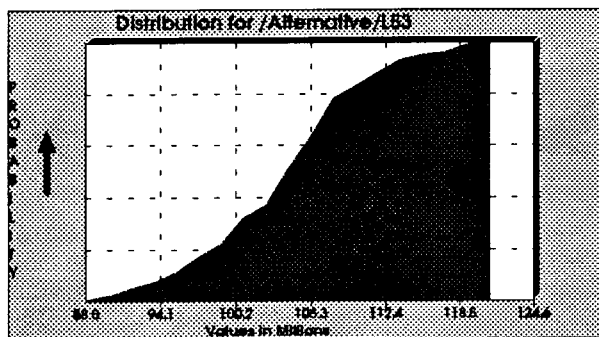
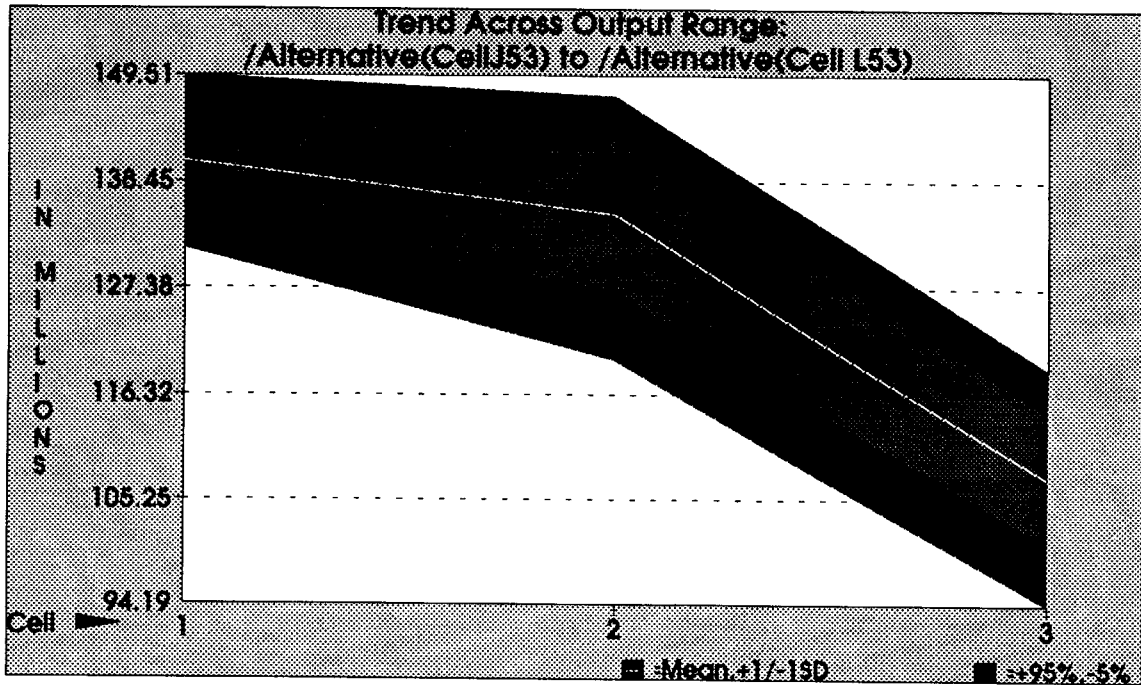


Figure 3

Figure 4 illustrates the comparison of all three alternatives based on the mean and bounded by +/-1 standard deviation, and by 5%/95% confidence levels. This chart graphically illustrates that, in fact

Summary Comparison: Alternatives 1, 2, 3

Figure 4



Sensitivity Analysis - Alternative 3

Figure 5

