LIFE-CYCLE COSTING

USING ACTIVITY-BASED COSTING
AND MONTE CARLO METHODS TO
MANAGE FUTURE COSTS AND RISKS

Jan Emblemsvåg
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Jan Emblemsvåg
To my son Nikolai and my wife Navita
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PREFACE

If you think predicting the future is risky, try ignoring it.

*The Economist*

When I first thought about writing this book, I briefly searched the global online bookstores to find out what other books concerning Life-Cycle Costing (LCC) are available. I was stunned to learn that only a dozen books have been published concerning LCC. Those that are available are highly specialized, too, such as infrastructure construction.

How can it be that one of the few concepts that systematically tries to eliminate costs before they are incurred gets so little attention, while an enormous body of work concerns how to assess and cut costs after the costs are incurred? After all, what counts the most: being cost effective or knowing what prevented us from being cost effective in the past?

I believe one of the prime reasons for this lack of interest in LCC is that it has mainly been associated with engineering; life-cycle costs are the costs of some technical “stuff” sometime in the future that the engineers worry about. But who cares about a distant future when most decision-makers are either in a new position, retired, or even fired? In fact, according to *The Economist*, an average American CEO only has a position for 18 months before he or she is removed. Or equally common, who cares about the impact on other people’s budgets? Apparently, LCC concerns many issues that stretch beyond most organizational short-term needs, functional barriers, and present issues.

I believe that such fragmented thinking is becoming more and more a thing of the past. As product life cycles become increasingly shorter and product development become increasingly capital intensive, the point of decision-making and the point of measuring the effect of the decision-making are becoming increasingly closer, and the consequences of erroneous decisions are becoming increasingly grave. Also, more and more customers think beyond the purchase price; they want to know total costs. However, the best argument is that the very idea of LCC can be utilized in cost management and help turn cost management from hindsight to dealing with costs even before they are incurred. This is a much more effective approach than today’s cost cutting and it will produce results much more efficiently than the traditional LCC. Also, it will more easily
form the basis of systematic work toward gaining sustainable profitability for the long term.

Some would say that LCC is to help engineers “think like MBAs but act like engineers.” That is true and important, but I think of LCC in a broader sense. I believe the main purpose of LCC should be to help organizations apply knowledge about past performance and their gut feelings to future issues of costs and risks. This should be done not in the traditional sense of budgeting, but in meaningful predictions about future costs of products, processes, and organization, and their associated business risks.

In order to turn LCC from being an engineering tool hidden in the cubicles in an engineering department to a more useful and widely accepted engineering and management tool, some changes must be made. The purpose of this book is to present and illustrate one such approach that can bridge the gap between past and future costs, engineering and management decisions, and direct and overhead resource usage. To do that, I have taken two well-known concepts, Activity-Based Costing and LCC, and merged the best parts while adding the usage of Monte Carlo simulations, uncertainty, and some additional insight.

It should be noted that Activity-Based LCC is similar to the Activity-Based Cost and Environmental Management approach, but as the saying goes, the devil is in the details. The Activity-Based Cost and Environmental Management approach does not explicitly detail how to do cost forecasting, financial analysis, and so forth, issues that are pertinent to LCC. Also, it leaves the reader with little explicit support on assessing and managing risks. This book therefore concerns how to turn the Activity-Based Cost and Environmental Management approach into an LCC approach, which for simplicity is referred to as Activity-Based LCC.

The result is an approach that in my opinion is flexible, highly effective, and efficient for most cost management considerations (including LCC) and that can handle risk and uncertainty in a credible fashion. This is evident both from its theoretical foundations and also from the three case studies provided in the book. For those who are particularly interested in the theoretical foundations, I have provided references to every chapter in the back of the respective chapter.

The book is organized into nine chapters. In Chapter 1, you will find the basic premises for the book and the key characteristics of Activity-Based LCC. In Chapter 2, the basics of LCC are discussed. It starts out by discussing what a life cycle is, because that is not obvious and numerous definitions exist in the literature. Then cost as concept is defined and contrasted to expense and cash flow. This distinction is important to understand because LCC models can be cost, expense, and cash flow models, and it is important to understand which is which, and what to use when.
Due to the inherent uncertainty in LCC, it is important to discuss how to handle risk and uncertainty, and that is done in Chapter 3. Risk and uncertainty will be defined and discussed in sufficient detail for LCC purposes. Situations where an increase in uncertainty can reduce risks will be discussed and even shown in the case study in Chapter 8. This finding links directly to the Law of Incompatibility, which has important implications for all management efforts. Some of these implications are discussed throughout the book. Finally, a brief overview of a traditional risk management approach is provided. It is intended as a basic introduction for those who are not already fluent in risk management.

Chapter 4 is about Activity-Based Costing (ABC). ABC is an integral part of Activity-Based LCC, as the name indicates. ABC has several indispensable characteristics that are invaluable in cost management in general. Chapter 4 discusses the background of ABC, how it compares to traditional, volume-based costing systems, what the basic concepts behind ABC are, how it can be implemented, and so on. Like the two preceding chapters, Chapter 4 is intended as an introduction to some vital concepts that must be understood in order to understand Activity-Based LCC. Illustrative examples are also provided.

Then, in Chapter 5, the Activity-Based LCC approach is presented, which consists of 10 steps that are discussed in detail. The best way to learn the approach is, however, by carefully studying the case studies because they are organized according to the steps of Activity-Based LCC.

The first case study is found in Chapter 6, which is coauthored with Randi Carlsen. It concerns a tire disposal problem in the County of Ullensaker, north of Oslo, Norway. A do-nothing approach to the problem is unlikely to succeed in the long run because of the near proximity of Oslo Gardermoen International Airport. Thus, something must be done. In the case study, we look at the feasible options using both traditional LCC and Activity-Based LCC. Even in this simple case study, it is evident that Activity-Based LCC provides additional value by its superior tracing capabilities and flexible uncertainty handling.

The second case study, found in Chapter 7, concerns the operation of a Platform Supply Vessel (PSV) owned by Farstad Shipping ASA in Ålesund, Norway. Operating a PSV is not easy due to the very narrow margins, and an LCC model can be useful both in terms of providing decision support during bidding and cost forecasting. Chapter 7 also shows how to provide decision support in relation to choosing fuel and types of machinery, issues that have major structural impacts on costs. Here an Activity-Based LCC model shows how both issues can be handled effectively and efficiently.
In Chapter 8, the WagonHo!, Inc. case study is found, the most complex case study in the book. Its complexity derives from the facts that:

- It incorporates multiple products and cost objects.
- It includes credible overhead cost considerations.
- It includes the entire life cycle of the products.
- It includes both a cash flow analysis and a costing analysis.
- It shows how Monte Carlo simulations can effectively be used in terms of handling uncertainty as well as risks and in enhancing tracing.

This case study is, unlike the two other case studies, functional. That may be viewed as a limitation. However, given the complexity of similar real-world case studies, I am happy to use a simpler version because it is more than sufficient enough to illustrate the potential of Activity-Based LCC. For example, the case study clearly illustrates how Activity-Based LCC can handle multiple cost objects at the same time, how Activity-Based LCC handles overhead costs in a credible fashion, and that Activity-Based LCC is in fact a costing analysis and not just a cash flow analysis. Another advantage of this case study is that it is also used in Chapter 4 as an extensive example of an ABC implementation. By contrasting that implementation to the model in Chapter 8, readers can easily see both the differences and similarities between ABC and Activity-Based LCC.

In Chapter 9, some key concepts and findings are revisited. Whereas Chapter 1 focuses on the problems Activity-Based LCC must overcome and how they relate to traditional cost management approaches, including traditional LCC to a large extent. Chapter 9 focuses on the building blocks of Activity-Based LCC. The earlier chapter helps readers to understand what LCC ideally should be about and how Activity-Based LCC overcomes the problems of traditional approaches. Chapter 9 explains how Activity-Based LCC can be applied. Both Chapters 1 and 9 tell the same story, although they tell it differently. Finally, some future issues are discussed.

The book also includes two appendices. Appendix A contains a Monte Carlo example. This example is handy to read for those who do not quite understand the power of Monte Carlo methods. It clearly illustrates how Monte Carlo methods can be used for three purposes: (1) uncertainty and risk assessment/management, (2) the tracing of critical success factors, and (3) information management. Appendix B provides an overview of a ship component classification system, which is applicable to the case study in Chapter 7.

As outlined in the last chapter of the book, Activity-Based LCC opens up a completely different way of conducting cost management. Instead of depending on hindsight and chasing the deceptive accuracy of past figures to look forward
into the future, ask what causes costs and what are the risks? Everybody jokes about the hindsight of cost accounting. Why not do something about it?

Please note that the views presented in this book are solely those of the author and do not represent those of Det Norske Veritas (DNV) Consulting.

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