Life Cycle Costing in Historical Perspecitve

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Introduction

Today's customers require products that are reliable and safely. Their decision to purchase is influenced by the product's initial cost (acquisition cost), operating cost and maintenance cost over its life (ownership cost). In order to achieve Customer Satisfaction, the challenge for suppliers is to design products that are reliable and cost competitive by optimizing acquisition and ownership costs. This optimization ideally should start at the product's inception and should be expanded to take into process account all the costs that will be incurred throughout its lifetime.[1] In all decisions made about a product's design and manufacture, Life Cycle Costing plays important role.

Life Cycle Costing was born at 1965 when the U. S. Logistics Management Institute first used the term *Life Cycle Costing* in a military-related document. And the U. S. Department of Defense published three guidebooks in the early 1970s. These Publications were thresholds of Life Cycle Costing. Since 1970s, many practices and theory of Life Cycle Costing have taken place and many publications on it have appeared.

This article surveys some publications which have been published on Life Cycle Costing in U.S. A., U. K. and Japan. Accordingiy, as the theory and applications of Life Cycle Costing in historical perspective are known, we can recognize the way of applying Life Cycle Costing to Life Cycle Cost Management. However, there are various meanings of Life Cycle Costing as follows:

Life cycle costing (LCC) is a method of expenditure evaluation which recognizes the sum total of all costs associated with the expenditure during the time it is in use. It is an evaluation technique, an input for decision making. Life cycle costing is a tool which synthesizes data and contributes to making a logical decision, but it is not an end in itself.[2)]

Life-cycle costing (LCC) analysis is a method of economic evaluation of alternatives which considers all relevant costs (and benefits) associated with each alternative activity or project over its life. LCC analysis is primarily suited for the economic comparison of alternatives. Its emphasis is on determining how to allocate a given budget among competing projects so as to maximize the overall net return from that budget.[3)]

Life-cycle cost refers to all costs associated with the system as applied to the defined life cycle. The life cycle forms the basis for life-cycle costing. In general, life-cycle cost includes research and development cost, production and construction cost, operation and support cost, retirement and disposal cost. Life-cycle cost is determined by identifying the applicable functions in each phase of the life-cycle, costing these functions, applying the appropriate costs by function on a year-to-year schedule, and ultimately accumulating the costs for the entire span of the life cycle. Life-cycle cost includes all producer, supplier, customer (user), maintainer, and related costs. Thus, the emphasis should relate primarily to those costs that can be directly attributed to a given system or product. Further, there needs to be an improvement in the traceability of costs back to the actual causes for such.[4)]

Life cycle costing (LCC) is a method of calculating the total cost of ownership over the life span of the asset. Initial cost and all subsequent expected costs of significance are included in the calculations as well as disposal value and any other quantifiable benefits to be derived.[5]

Life cycle costing is the process of economic analysis to assess the total cost of acquisition and ownership of a product. This analysis provides important inputs in the decision making process in the product design, development and use. Product suppliers can optimize their designs by evaluation of alternatives and by performing trade-off studies. They can evaluate various operating and maintenance strategies (to assist product users) to optimize life cycle cost (LCC). The life cycle cost analysis can also be effectively applied to evaluate the costs associated with a specific activity, for example effects of different maintenance concepts/approaches, to cover a specific part of a product, or to cover only (a) selected phase (s) of a product's life cycle.[6]

Life cycle costing requires that future costs have to be calculated by taking into consideration the time value of money. In life cycle costing, the future costs such as operation and maintenance have to be converted to their appropriate values before adding them to the item's procurement cost. There are a number of formulas developed in economics to convert money from one point of time to another. In life cycle costing studies such formulas are indispensable.[7]

Experience has shown that a major portion of the projected life-cycle cost for a given product and system stems from the consequences of decisions made during early planning as part of system conceptual design. These decisions deal with system operational requirements, performance and effectiveness factors, the maintenance concept, the system design configuration, number of items to be produced, utilization factors, logistic support, and so on.[8)]

As we can understand in the preceding definitions, Life Cycle Costing has various structures and many functions. In recent years, Life Cycle Costing is an important element during product design and development in many sectors of industry. Furthermore, Life Cycle Costing is expected as an Approach to Life Cycle Cost Management.

1. Development of Life Cycle Costing in U. S. A.—An Approach to Government Procurement Management : User's Perspective—

As the U. S. Department of Defense and other federal agencies seek to lower costs in a time of tight or reduced budgets, Life Cycle Costing (LCC) has become an important government procurement strategy. Large organizations and government departments have introduced LCC in their new procurement and development programs. In this framework, LCC is a procurement method that takes into account the total cost of product development, procurement, and ownership, recognizing that purchase price may be less significant than subsequent ownership costs. Life Cycle Costing refers to an analysis technique which encompasses the total cost of a system over a specified period in its life-time. Its costs include the following : research and development, testing and evaluation costs, acquisition costs ; and operation and support costs. The objective of Life Cycle Costing is to minimise the total cost of ownership of Government.[9)]

1.1 Life Cycle Costing of United States Logistics Management Institute

The term *Life Cycle Costing* was first used in a military-related document which was prepared by the U. S. Logistics Management Institute for the Assistant Secretary of Defense for Installations and Logistics.[10] This document describes LCC as follows:

In the truest sense, the life cycle cost of military equipment is the total cost incurred by the Government from the moment the investigation of its generating idea elicits manpower usage within or without the Government until every piece of the equipment is eliminated from the military logistics system. The term thus embraces all costs associated with feasibility studies, research, development, design and production, and all support, training and operating costs generated by acquisition of ohe equipment.

We have concluded that techniques are either available or capable of development for predicting and measuring logistics costs within tolerances which should permit their use in bid evaluation. We have further concluded that their utility and economic feasibility should be tested in actual competitive proccurement.

Logistics cost categories separate into two basic functional groups. One group of costs is of a source selection nature, including buying and bidder qualification activities, and the second is of a support nature, relating to introducing the equipment to the field and operating and supporting it. Of the two groups, the support cost categories are the most importnt.[11]

1.2 Life Cycle Costing of U. S. Department of Defense

The U. S. Department of Defense published guidelines in the early 1970s: *Life Cycle Costing Procurement Guide (interim ; LCC-1), Life*

Cycle Costing in Equipment Procurement-Casebook (LCC-2) and *Life Cycle Costing Guide for System Acquisitions (interim : LCC-3).*

LCC-1 defines that Life Cycle Costing (LCC) is an acquisition or procurement technique which considers operating, maintenance, and other costs of ownership as well as acquisition price, in the award of contracts for hardware and related support. The objective of this technique is to insure that the hardware procured will result in the lowest overall ownership cost to the Government during the life of the hardware.[12)]

LCC-3 defines that Life Cycle Cost (LCC) of a system is the total cost to the Government of acquisition and ownership of that system over its full life. It includes the cost of development, acquisition, operation, support and where applicable, disposal. However, in certain applications of this Guide, such as LCC estimation for purposes of contractual commitments, source selection and choices among design alternatives, LCC is generally used to examine only relevant costs.[13)]

1.3 Framework for Life Cycle Cost Management—An Approach to Life Cycle Cost Management : User's and Producer's Perspectives—

Here, we describe four conceptual frameworks for Life Cycle Cost Management.

(A) The U. S. Department of Defense—User's Perspective—

The U. S. Department of Defense has introduced many management concepts and contracting techniques in the pursuit of low life cycle cost. These diverse set of cuncepts and techniques are used in the Framework for Life Cycle Cost Management and in a systematic way to achieve low life cycle cost. The framework is composed of activity elements that directly influence the total life cycle cost of a system and the phased acquisition process keyed to four decision milestones. Figure 1 presents these elements in the framework and when, in the process, each elements are implemented.[14)]

(B) Susman's Product Life Cycle Management —Producer's Perspective—

Susman extends life cycle costing to Product Life Cycle Management. His framework integrates two perspectives on product life cycle with

Figure 1 : The Framework for Life Cycle Cost Containment

Activity	Mission Area Analysis	Milestone 0 Concept Exploration	Milestone I Demonstration & Validation	Milestone II Full-Scale Development	Milestone III Production & Deployment
Affordability	△	▲	▲	▲	▲
Life Cycle-Cost Estimate			▲	▲	▲
Costing			△	△	△
Design to Cost		△	▲	▲	▲
Value Engineering				▲	▲
Value Engineering Incentives				▲	▲
Reliability Improvement Warranties					▲
Acquisition Strategy		▲	▲	▲	▲
Procurement Planning	▲	▲	▲	▲	▲
Program Management		▲	▲	▲	▲
Product Planning	△	△	▲	▲	▲
Integrated Logistics Support / Integrated Logistics Analysis	△	▲	▲	▲	▲
Reliability & Maintainability	▲	▲	▲	▲	▲
Quality Program		▲	▲	▲	▲
Standardization & Specifications Program		▲	▲	▲	▲
Parts Control		△	△	△	△
Configuration Management				▲	▲
Test & Evaluation		△	△	▲	▲
Manpower & Training		▲	▲	▲	▲
Specifications & Standards		▲	▲	▲	▲

Legend : ▲ = Mandatory Event
△ = Discretionary Event

revenue generation and cost reduction. Revenue generation has its roots in marketing and business strategy. Cost reduction has its roots in design engineering and project management. Therefore in his framework, producers are required to think the pursuit of product life cycle profits.[15)]

Figure 2 : Actions for Generating Revenue and Reducing Costs

Revenue generation

- □Product Improvement
  - Features
  - Performance
  - Durability
- □Maintainability
- □Serviceability
- □Customer service
  - Fast delivery
  - "Hotlines"
- □Product customization
- □Expanded product line
- □Product warranty
- □New uses, new users
- □Price increases
- □Advertising

Cost reduction

- □New processes
- □Cumulative volume
  - Experience curve
- □Average volume
- □Capacity utilization
- □Focused factories
  - Coordination costs
- □AMT
  - Less work process, rework, inventory, and floor space
- □Design for manufacturability
  - Less assembly time
  - Training costs
  - Warranty costs
  - Spare parts
- □Design for logistical support
- □Design for maintainability
- □Design for reliablility

(C) Shields and Young's Product Life Cycle Cost Management
—Producer's Perspective—

Shields and Young Model is named Product Life Cycle Cost Management. This Product Life Cycle Cost Management extends the Life Cycle Costing concept by considering the broader oraganizational context in which product life cycle costs are incurred and managed. And this model is composed of Life Cycle Costing, Product Life Cycle Management, Or-

Figure 3 : Cost Reduction Methods

Design and Manufacturing Methods
- Design to manufacture
- Group technology
  - —Standardizing and reducing the number of parts and part no's.
  - —Standardizing the manufacturing Process
  - —Manufacturing cells
  - —CAAP
- Design to cost
- Design for assembly
  - —Taguchi methods
  - —Boothroyd and Dewhurst's design for assembly
  - —Hitachi's assemblyability evaluation method
- Concurrent and simultaneous engineering
- Reliability engineering
- Value analysis and engineering
- Total quality control of design and development

Design and Manufacturing Organizational Structure
- Early manufacturing involvement
- Manufacturing sign-off
- Integrator
- Cross-functional team
- Concurrent engineering team
- Simultaneous engineering
- Product-process design department

Materials Sourcing
- Vendor selection
- Vendor certification
- Electronic data interchange
- Purchasing of materials
- TQC of incoming materials before arrival

Inventory Management
- Manufacturing Resource Planning (MRP)
- Just-in-Time (JIT)

Advanced Manufacturing Technology
- Computer-aided design (CAD)
- Robotics
- FMS
- CIM
- MRP

Capacity Utilization
- Optimized production technology
- Computer-integrated manufacturing
- Total preventive maintenance
- MRP

Manufacturing Costs
- Economies of scale
  - —Dedicated technology (transfer lines)
  - —Standard parts, process, and products
  - —High volume/experience curve

- Economic of scope
  - —Flexible technology
  - —Focused factories
  - —Elimination of changeovers

Activity and Cost Driver Analysis
- Elimination of non-value-adding activities
- Reduction of value-adding cost drivers (number and frequency)

Total Quality Control
- Statistical process control
- Cost of quality
- Quality circles

Customer Consumption Costs
- Design for maintainability
- Design for reliability
- Design for serviceability

Performance Measures of Continuous Improvement
- Constant flow of inventory
- Standing inventory
- Simplicity
- Quality
- Productivity
- Flexibility
- Time

Motivation
- Target costing
- Motivational standards
- Ratchet productivity standards
- Design target accountability
- Design productivity standards
- Management by objectives
- Employee ownership
- Employee training
- Suggestion box systems
- Performance contingent compensation
- Skill contingent compentation

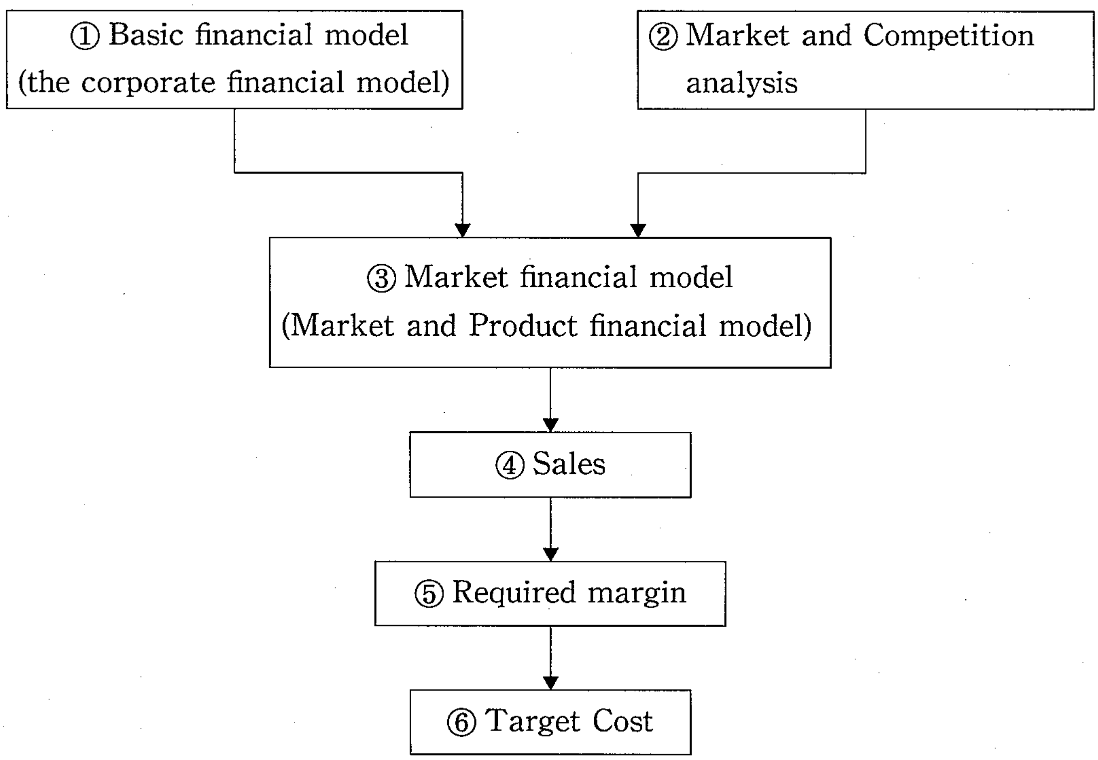
Accounting Control
- Budget planning and control
- Cost planning and estimation
- Actual cost accounting
- Standard cost accounting

ganizational structure and Cost reduction methods. In this framework, a key is to continuously reduce product costs. The most effective strategy for reducing a product's total LCC is to focus cost reduction efforts on those activities that occur costs. Figure 3 shows a list of cost reduction methods organized by several topical areas.[16)]

(D) CAM-I Life-Cycle Management Model—Producer's Perspective—

According to CAM-I, Life-Cycle Management focuses on those activities that occur prior to production to ensure the lowest total life-cycle cost. And Life-cycle costing is necessary to provide a better picture of long-term product profitability ; to show the effectiveness of life-cycle planning ; to quantify the cost impact of alternatives chosen during the engineering design phase ; and to assign the costs of technology to products that use the technology. And its Product Life-Cycle Model is shown in Figure 4. Integrating the corporate financial model with the market and competitor

Figure 4 : Position in Product Life-Cycle Model



analysis produces a market and product financial model, which yields sales, margin, and targat cost information. This model also focuses on product life-cycle cost.[17)]

2. Development of Life Cycle Costing in U. K. —An Approach to Capital Asset Management : User's Perspective ; Terotechnology and Life Cycle Costing—

In the U. K., Terotechnology evolved in the early 1970s. The first definition of Terotechnology and Life Cycle Cost is addressed in the British Standards as Terotechnology. The British Standard BS : 3811, "Maintenance Management Terms in Terotechnology", BSI, London, 1984 deffnes terotecnology as : "A combination of management, financial, engineering, and other practices applied to physical assets in pursuit of economic life-cycle costs." Accordingly, in the U. K., Life Cycle Costing was given new emphasis when the terotechnology approach to physical asset management was introduced.

In 1970s, Life-cycle costing is a concept which brings together a number of techniques—engineering, accounting, mathematical, and statistical—to take account of all the significant net expenditures arising during the ownership of an asset. Life-cycle costing is concerned with quantifying options to ascertain the optimum choice of assets and asset configuration. The techniques employed in life-cycle costing, including forecasting, cost-benefit analysis, preparation of cash flows, discounting, sensitivity analysis, cost estimating, probability theory, and others are not new. Many of these techniques are already used in capital investment appraisal. The fundamental aim of life-cycle management of physical assets is to optimize the life-cycle cost of owning and using physical assets. The life-cycle cost is the total cost of a physical asset throughout its life.[18]

The application of terotechnology and life-cycle costing to the management of physical assets can be seen as a totally integrated system of life-cycle management. The aim of the system is the pursuit of economic life-cycle costs in order to increase profitability and industrial efficiency.

Life Cycle Costing, together with a terotechnology approach, could provide a major decision-making and profit-improving for most industries.

Figure 5: Physical asset cost elements and interactions

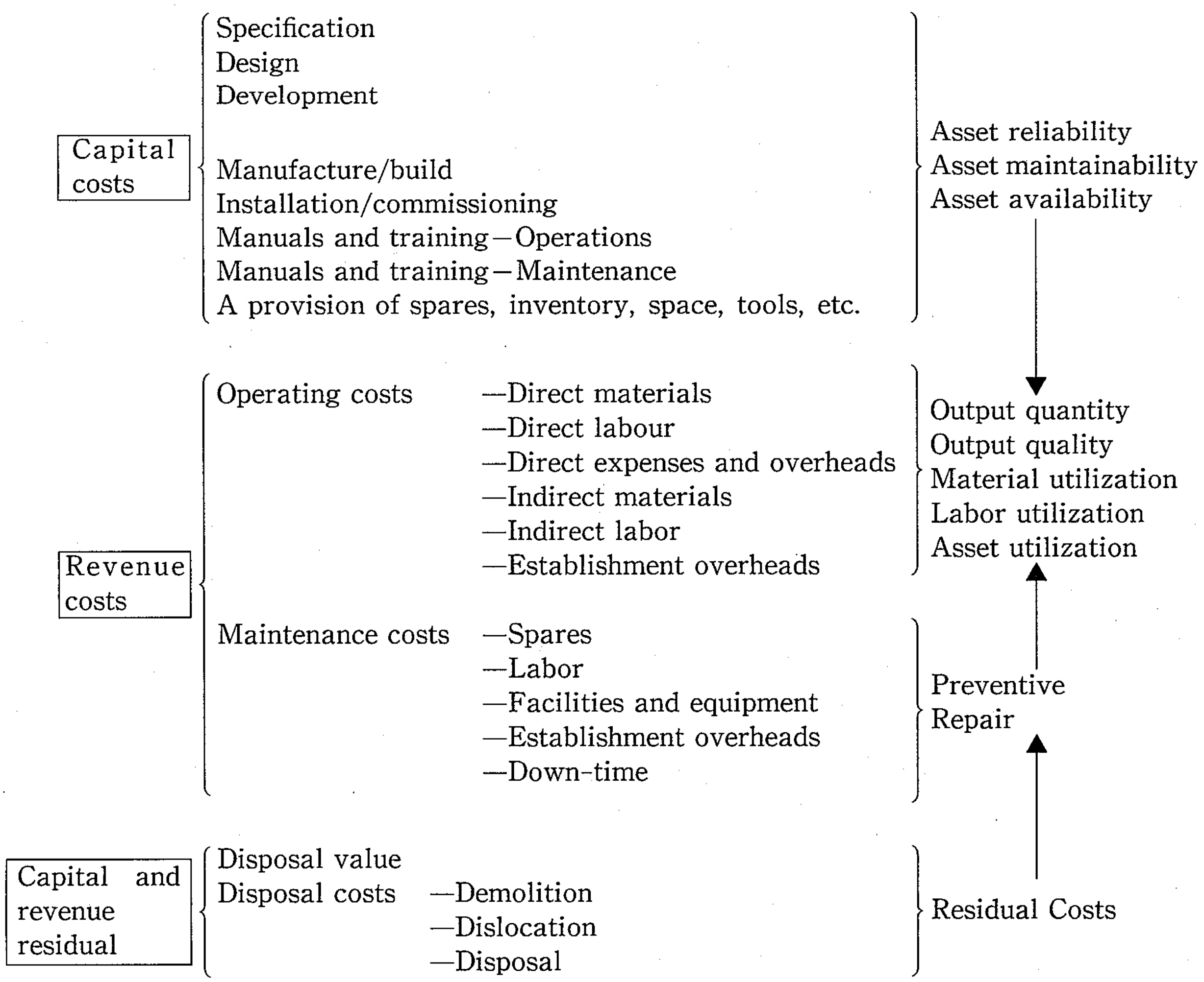


Figure 5 illustrates the relationship between specification, costs, and time to capital costs and revenue costs, the trade-off between costs and engineering features, and the oraganizational functions of an enterprise.[19]

Recently, Capital Asset Management is asserted and is defined that a co-ordinated management of the design, procurement, use and maintenance of a firm's fixed assets, in order to maximize the contributions to the firm's profit over the life-cycle of those assets. Capital Asset Management is life-cycle approach to maintenance management and is based on the idea of optimizing total maintenance costs over the equipment life-cycle. And most important rule is decisions to buy new or replacement plant should be based on a present-value life-cycle analysis of costs which should consider both maintenance and unavailability costs, these being estimated. Figure 6 shows total life cycle costs.[20]

Figure : 6 Factors in the build-up of total life costs

Total Life Cycle Costs			
Capital	Operational	Maintenance	Production and quality losees
Design	Labour — Plant operation	Labour	Due to plant non-availability
Development	Labour — Engineering	Material	Due to plant malfunction
Plant purchase	Energy — Oil	Spare part holding costs (stores)	
Installation	Energy — Gas	Engineering support cost (workshops)	
Commissioning	Energy — Electricity	Contractors	
Training of plant staff	Steam	Overheads (planners supervisors, engineers)	
Manuals and documentation	Water		
Tools and facilities for maintenance			
Initial spares holding			

3. Development of Life Cycle Costing in Japan —an Approach to Total Productive Maintenance (TPM): Coexistence of User's Perspective and Producer's Perspective—

In 1969, Nippondenso Co., Ltd., part of the Toyota group and one of the largest manufacturers of automobile electrical parts, developed Total Productive Maintenance (abbreviated TPM)—or PM with all employees participating through small-group activities. Its goal is to maximize equipment effectiveness at minimum life-cycle costs. TPM needs relevant cost infromation for its implementation. The life-cycle costs consist of (1) the initial investment, including research and development costs; (2) running costs, including maitenance costs; (3) logistic costs, including trainning costs; and (4) divestment.

"Total" has three meanings in TPM. First, it means the total system of PM, second, it means realizing total or overall equipment effectiveness at minimum life-cycle costs, third, "total" means the total participation of all company people, from the president to workers on the plant floor, in TPM activities. TRM's unique feature is its motivational management through small-group activities.[21)]

Furthermore, in Japan, Life cycle costing is a method used for calculating the costs of products or equipment over their entire life. This method is used for warious management purposes, such as for capital budgeting decisions, or when trying to produce quality products at a lower total life cvcle cost. These costs fall into two broad categories: manufacturing costs and user costs. On the manufacturing side, life cycle costs include all the costs that the producer will incur over the product's life cycle. On the user side, it includes all the costs that the user will incur to obtain, use, and dispose of the asset.

The Japanese Defense Ministry and Japanese defense contractors have maintained a close relationship with the U. S. Department of Defense. As a result, when Japanese companies manufacture defense products for Japanese Defense Forces, they must follow the American life cycle costing paractices. For example, the defense products manufacturing divisions at kawasaki Heavy Industries, Mitsubishi Heavy Industries, and Ishikawajima Harima Heavy Industries have been using life cycle costing in the same manner as American companies for many years.

Figure 7 shows the degree of satisfaction (by industry) with the use of life cycle costing. This survey was conducted by JIPM in 1983. Questionnaires were sent to its 523 member firms. Of these, 222 were engineering and machinery companies, of which 20 replied (9 percent response). The overall response rate was 29 percent.[22)]

Figure : 7 Degree of Satisfaction with Life Cycle Costing by Industry

	Producer	User	Type of users				
Questions			Engine	Chemical	Machinery	Steel	Metals
Interest in LCC	51%	51%	36%	50%	54%	61%	44%
Organization for LCC	19%	15%	8%	14%	19%	17%	18%
Use of LCC	22%	22%	17%	20%	24%	27%	20%
Level of satisfaction	29%	28%	20%	26%	31%	33%	26%
No. of plants	20	151	9	71	42	16	11

Recently, Life Cycle Costing is being accepted in Japanese business practice. Here, Life Cycle Costing case in a firm, EBARA Corporation case, is shown. As Figure 8 shows, Life cycle costing may be more effective as an engineering tool.

Figure : 8 EBARA Corporation ; Comparison of Life Cycle Cost

〈Yen〉

	New Hzfree Type Pump Unit	Fs Trpe Pump Unit
Name of Pump	80MMLF010 × 3 units	125 × 100 fs4kc518 × 2 units
1) Unit Production Costs	2,870,000	3,250,000
2) Construction Costs	697,000	990,000
3) Maintenance Costs	1,794,000	2,580,000
4) Running costs	7,217,100	7,786,000
Life Cycle Cost	**12,578,100**	**14,606,800**

(The Paper Presented at The 4th Maintenance Seminar : Life Cycle Cost, By EBARA, Tokyo University, Japan, February 22, 1999.)

4. New Development of Life Cycle Costing—An Approach to Environmental Cost Management : Environmental and Societal Perspectives—

As the preceding argument implies, Life Cycle Costing, at first, focuses on maintenance, operations, and procurement cost and is thought of as a tool for helping we choose between competing expenditures. However the biggest limitation of Life Cycle Costing is its inability to identify all our potential cost. For example, classical Life Cycle Costing does not recognize social cost which is an important factor to make decision making more rational. Full Cost Accounting attempts to reconcile some of the weakness of Life Cycle Costing.[23] U. S. EPA's Pollution Prevention Benefits Manual describes this approach. The manual identifies four levels or types cost, usual costs, hidden costs, liability costs, and less tangible costs. Research on Life Cycle Costing is required to include these costs.[24]

4.1 Full Cost Accounting
—Life Cycle Costing Approach to Solid Waste Management—

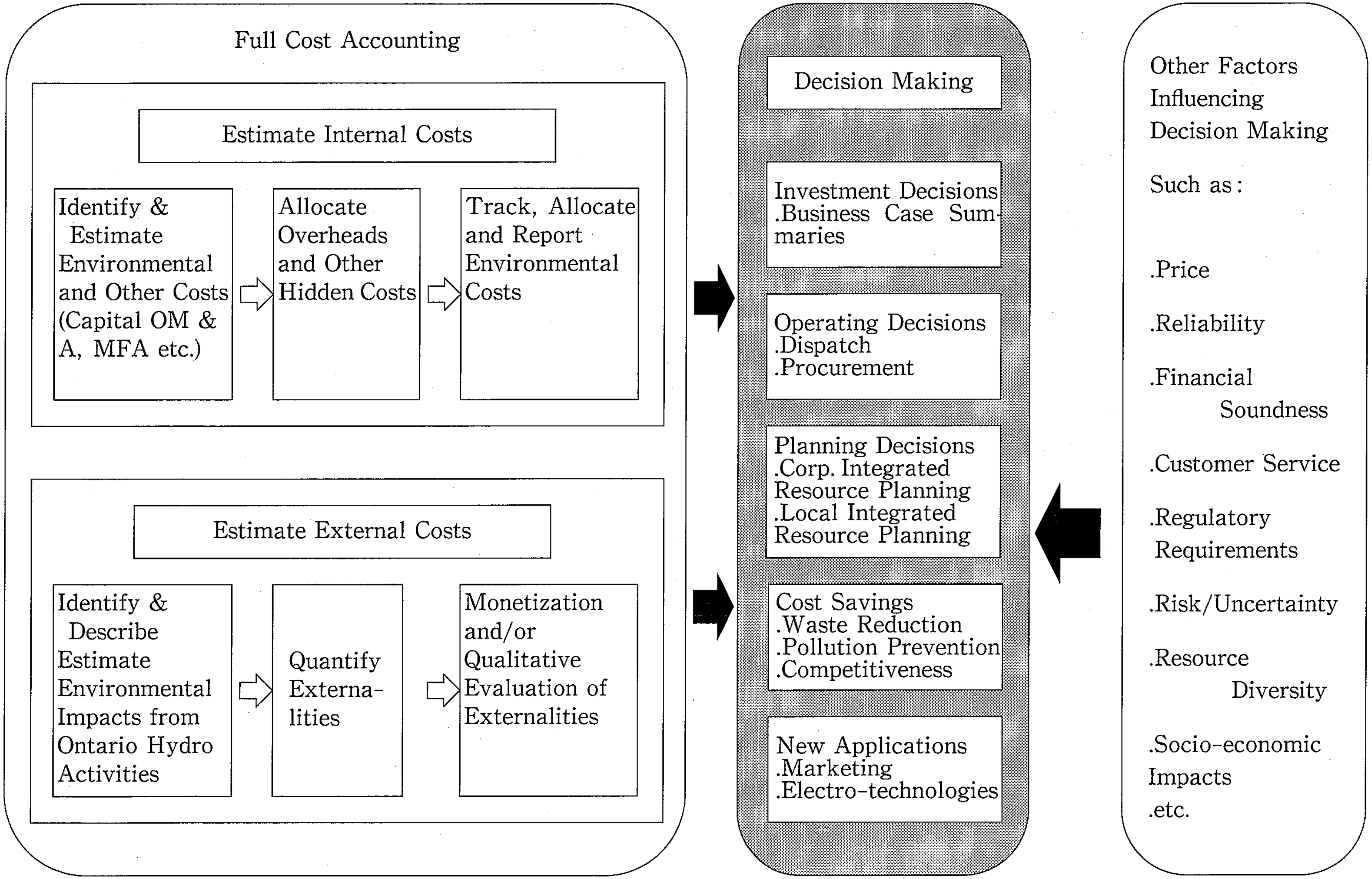
Full Cost Accounting (FCA) is a systematic approach for identifying, summing, and reporting the actual costs of solid waste management, taking into account past and future outlays, oversight and support service (overhead) costs, and operating costs.

Recently, the costs used in FCA are Up-front costs, Operating costs, Back-end costs. These three categories together cover the life cycle of Municipal Solid Waste (MSW) activities from cradle (up-front costs) to grave (back-end costs). The other categories of costs are Remediation costs at inactive sites, Contingent costs, Environmental costs and Social costs.[25)]

Next, Ontario Hydro, the biggest power utility in North America in terms of installed generating capacity, has considered concepts of life cycle costing in developing its strategy for FCA. For internal costs, Ontario Hydro considers the full fuel cycle, inventorying energy requirements and generation of wastes/pollution. For external costs, involving the consideration of damages to human health and the environment, Ontario Hydro aims to consider the full life cycle but expects to emphasize at a minimum the stages of the life cycle over which Ontario Hydro has direct control and responsibility : design, construction, operation and maintenance, and decommissioning/disposal.[26)]

Full Cost Accounting (FCA) integrates the environmental impacts of an organization's activities into business decision-making. For an organization like Ontario Hydro, FCA can help in understanding the potential environmental costs and liabilities associated with its activities and in

Figure 9 : Use of Full Cost Accounting in Decision Making at Ontario Hydro



reducing the costs of those liabilities, today and in the future.[27)]

4.2 Total Cost Assessment
—Life Cycle Costing Approach to Pollution Prevention Management—

The environmental perspective must be a part of design, procurement, production and marketing decisions. The disadvantage for environmentally related projects is that management's standard project evaluation techniques shortchange them. Pollution prevention projects must compete with other projects for scarce capital resources. Environmental projects suffered from a systematic bias in capital allocation decisions.

U. S. A. New Jersey Department of Environmental Protection addresses an approach in the capital budgeting area that is called Total Cost Assessment. Total Cost Assessment can serve as a valuable tool for more precise estimates of the real economic return on projects. This approach considers a broader range of cost and savings. The four cost categories area are Direct Costs, Indirect Hidden Costs, Liability Costs and Less Tangible Benefits.

Defition of Total Cost Assessment ; A comprehensive financial analysis of the lifecycle costs and savings of a pollution prevention project. A TCA approach includes : a) internal allocation of environmental costs to product lines or processes through full cost accounting, b) inclution in a project financial analysis of direct and indirect costs, short and long term costs, liability costs and less tangible benefits of an investment, c) evaluation of project costs and savings over a long term horizon, e. g. 10-15, d) use measures of profitability which capture the long-term profitability of the project, e. g. NPV and IRR.[28)]

4.3 International Development of Life Cycle Costing
—An Approach to international Standard—

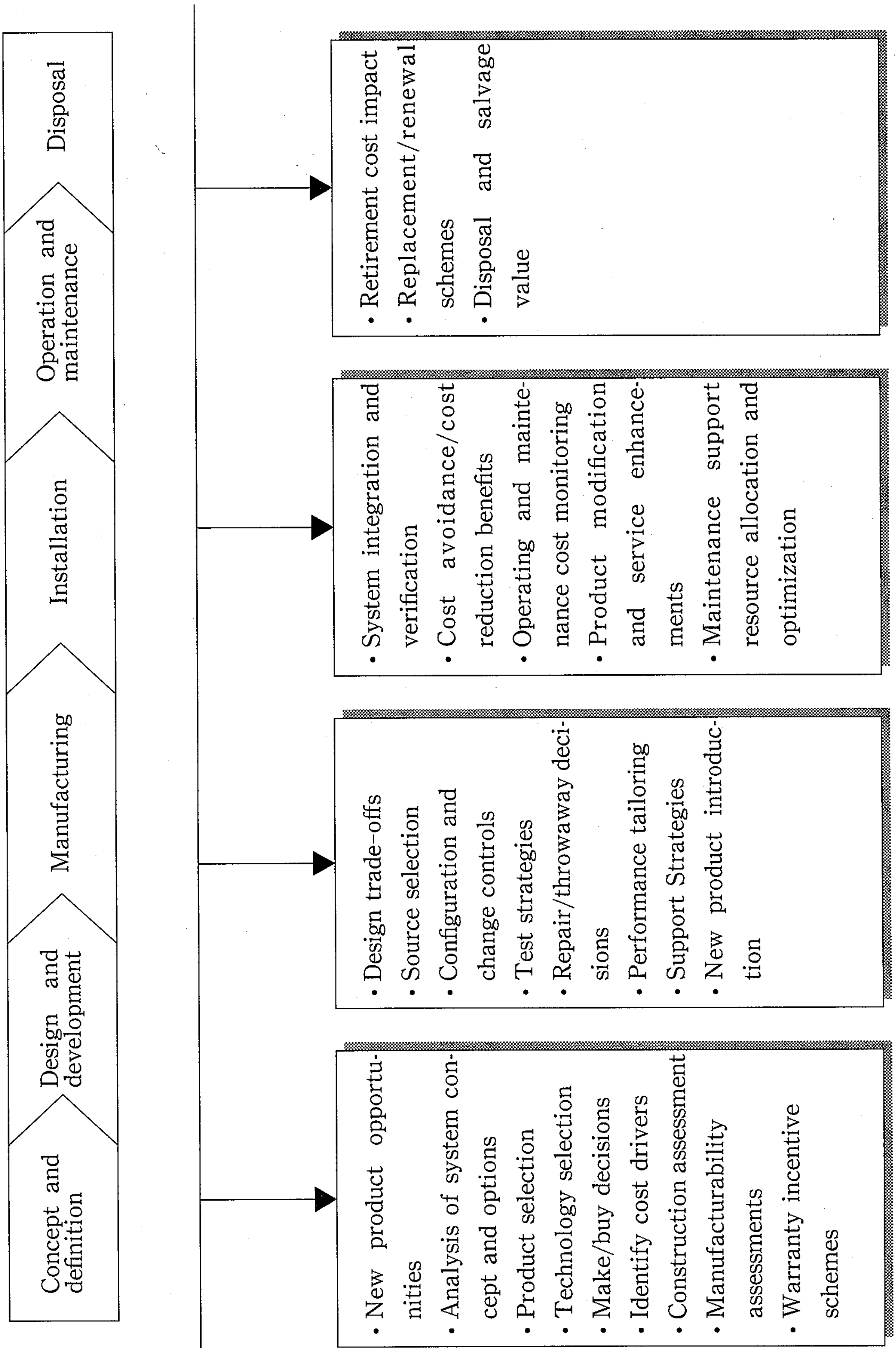
The International Electrotechnical Commission (IEC), a worldwide organization for standardization comprising all national electrotechnical committes (IEC National Committes), has published document to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. International Standard IEC 300-3 has been prepared by IEC technical committee 56 : Dependability. This Standard applys to ISO 8402. And this section of IEC 300-3 provides a general introduction to the concept of life cycle costing. Definition of life cycle costing is that life cycle costing is the process of economic analysis to assess the life cycle cost of a product over its life cycle or a portion of thereof.

Although the life cycle costs consist of many contributing elements, this standard particularly highlights the costs with dependability of the product.

Dependability of a product is a collective term which is used to descrive the product's avalilability performance and its influencing factors, such as reliability performance, maintainability performance and impact on the LCC. Reliability, maintainability and other dependability management considerations should be an integral part of the design process and LCC evaluations. Costs associated with product safety, reliability, maintainability and maintenance support performance, which are not that apparent, but need to be accounted for in life cycle cost models.

Figure 10 shows the life cycle phases of a product, together with some of the topics that should be addressed by a life cycle conting study.[29]

Figure 10 : Sample applications of LCC



Conclution

In the preceding discussion, we can understand the development of the relationship of Life Cycle costing and Life Cycle Cost Management. The major point of this article is that : When many systems have been planned, produced, and operated, costs have been introduced as an economic factor but they have been viewed in a fragmented manner. The costs assocciated with activities such as research, design, production, use and support, maintenance, disposal must be viewed on an integarated basis. A major impediment for Life Cycle Costing is more oriented to the "short term" in our current "thought processes". To be successful in this area requires that we must be a commitment to "Life Cycle Thinking" from producer, user, consumer and societal perspective.[30)]

Furthermore, transfer of Life Cycle Costing from U. S. A. to the other countries is summarized in Figure 11. Our historical perspective on Life Cycle Costing is summarized in Figure 12. A study on Lebenszykluskostenrechnung in Germany will be discussed in future.

（本稿は，平成12年度松山大学特別研究助成金による研究成果である。）

Figure 11 : Transfer of Life Cycle Costing

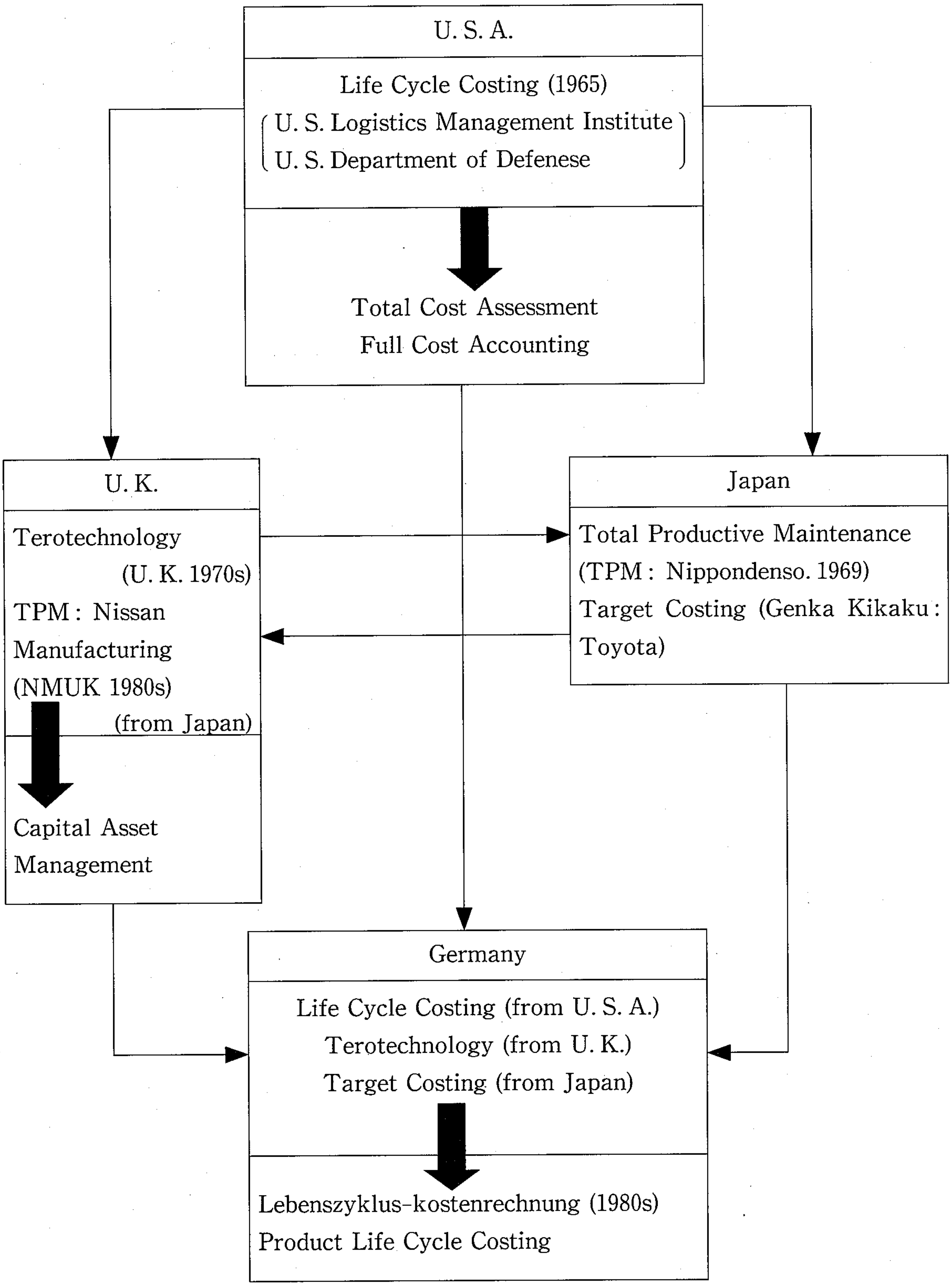
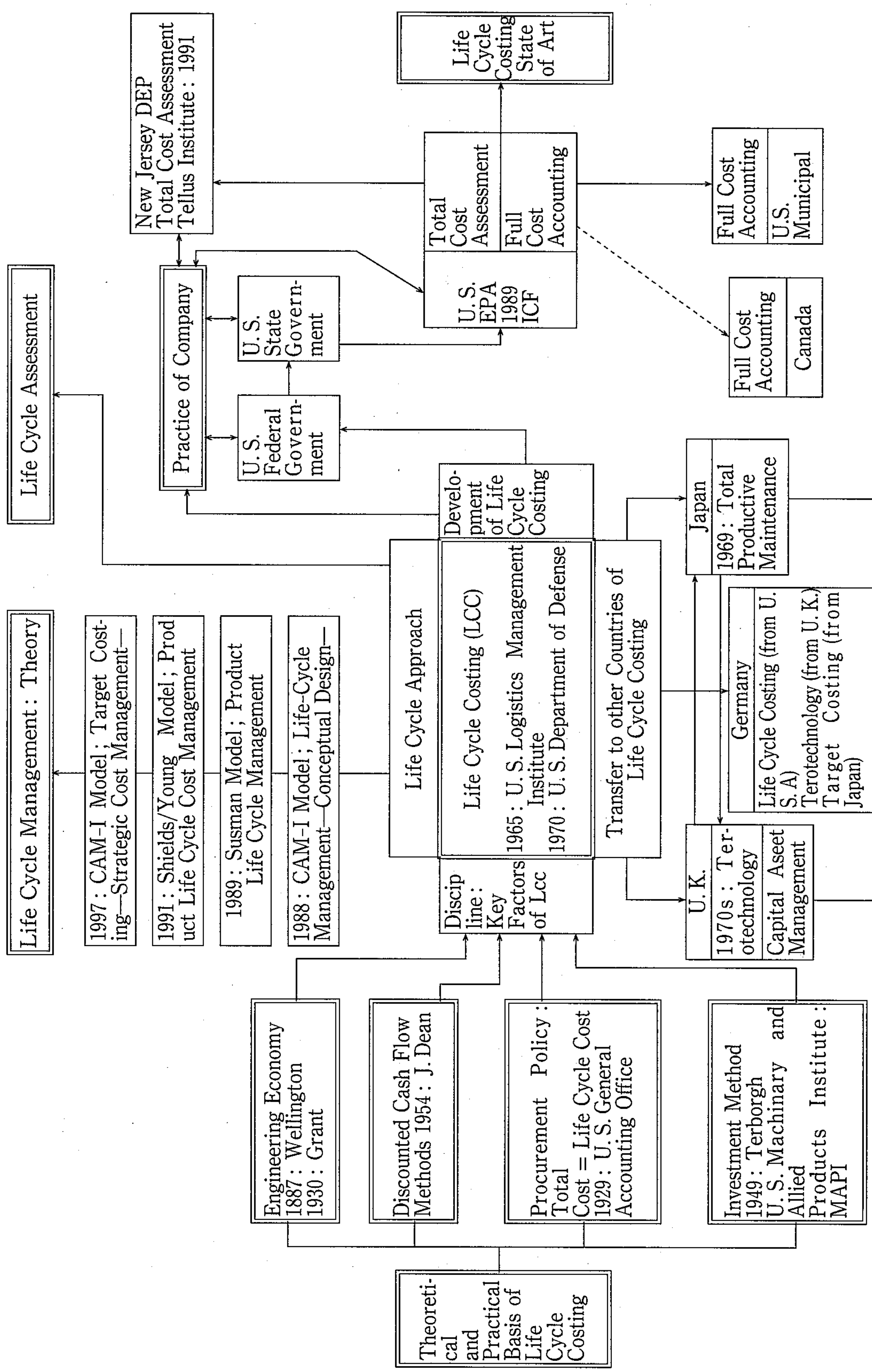


Figure 12: A Study of Life Cycle Costing: A Historical Perspective



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