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APPROACHES TO MANAGING THE LIFE CYCLE COST

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Abstract

Top managers are deeply involved in the strategic decision making process that affects the future of their organization on long term. At a particular time they have to decide what type of equipment they should commission into service so as to keep up with the progress of the society, to make profit for their company or to add more value to their current operations. Since they no longer consider their decisions on the acquisition cost as being the main cost driver, they have become more and more interested in pointing out both the total cost of ownership and the main challenges they will have to face with so as to manage the total cost.

Key words: decision, value, system, ownership, challenge, cost driver

1. Introduction

Nowadays top managers have *"le savoir faire*" to make decisions based on needs assessments, costs forecasts, and risk management related to the commissioning of a new system into service. Therefore lots of studies have been conducted with the main purpose to identify methods and tools to manage the entire process "from cradle to grave" in terms of performance, cost and time.

2. Phases in the life cycle

Generally speaking, the life cycle begins with the concept, continues with establishing the operational requirements of the future system, the design stage and the final design, production, trials and homologation, its use within and post warranty period, upgrades and modernizations, and ends with its decommissioning from service and disposal. All these stages are integrated into a process that a manager should be able to coordinate over the time, monitor and measure its performance, and control its costs at all stages. Moreover, the cost of replacing the future equipment should be taken into account at the earliest stage as well as the cost associated with the decommissioning and the disposal in order not to be overlooked later on. This will make the life cycle cost management more visible and effective.

The concept "value for money" gives them the opportunity to acquire cutting - edge systems that bring added value to its operational objectives and support them to face up to any future challenge.

For a simplified approach of the process, the stages aforementioned can be re-grouped into phases more comprehensive which give a strategic view on the process, namely:

2.1 Acquisition phase

At the beginning of this phase the need for a new capability generates this process. This capability shall be seen as a sum of attributes to reach a scope, not a sum of means, because means are part of the capability. The reasoning behind it is that whereas the means are changing due to the evolution of technology, the capability could remain with the same attributes. A project team is assigned to develop the attributes into a concept, into operational requirements and technical performance criteria afterwards, and to estimate the milestones and the rough order of magnitude on the expenditures relating to the total cost of ownership. The final design gives the technical features needed to make that capability effective, to make it efficient means that there is more than one system likely to fill it.

Other particular facets are related to other kind of means needed to be taken into account to ensure the full success of the acquisition phase such as training, support, etc.

The systems needed are selected based on such criteria as their technical performance, acquisition costs/life cycle costs, their compliance with the environment standards and the work safety standards, and the costs with disposal, etc.

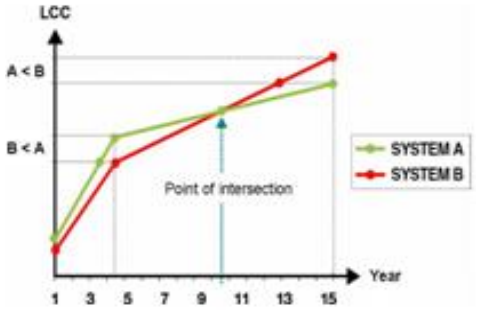

Fig. 1 LCC based selection of the system

2.2 In –Service phase

The main challenges are generated by the integration of the system with others being part of the same capability, by the need to dispose some sub-subsystems of before the lifespan of the system and their integration with the remaining sub- systems in the event that a new profile of the capability is required.

Logistics support shall be in place to ensure the performance of the system at any time.

2.3 Disposal

At the end of life cycle, the system is decommissioned and disposed of. This implies compliance with the environment standards in force as well as the ability to choose the right contractor to properly carry out this difficult task. Studies reflecting the impact of disposal on environment should be in place at that time as well as operating procedures spelling out how to mitigate the risks against the environment pollution.

As a result of disposal it may be possible to have some revenue in return for the scrap that will lead to significant economy of scale as well as expenditures to restore the initial environment conditions.

3 Life cycle cost analysis

3.1 Aims and objectives

There is so much uncertainty as to what type of system may be appropriate, and what concept might be required in practice. Therefore it is advisable to approach more than one solution when decided to buy a new system. The budget is the key factor that will later on put its footprint on the level of technology implemented and on the amount of research that can be supported to develop new technology.

Various methodologies can be applied to estimate future costs for planning purposes. The methods selected depend on the level of detail required, the availability of data, and time constraints. To identify the most adequate method, the analyst must have a comprehensive approach of the models and techniques and their applicability, and a clear and complete understanding of the operational requirements of the future system.

The features taking into account are related and not limited to the life cycle phases (concept, development, production, operation, support and salvage) and the information received form internal or external organizations (suppliers)

3.2 Program content, cost limitations, assumptions

The program starts by identifying the options available to meet the need, analyze these options and plan the activities for the next phases for the implementation of the most effective solution based on estimated costs in such areas as personnel, facilities, support equipment, spare parts, publications, training and training equipment, technical data, etc

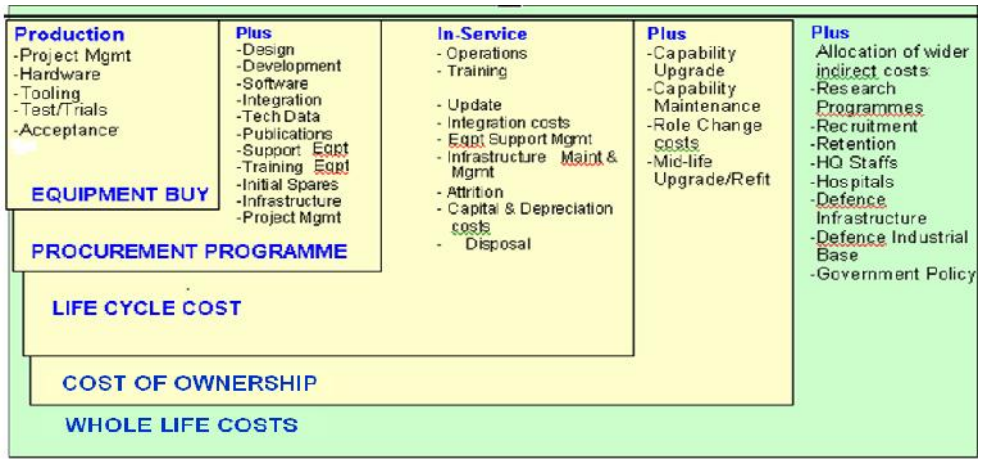

Fig. 2 Life Cycle Cost Boundary

At the earliest stage of the program, the main issues are the rough order of magnitude of projected life cycle costs, the technical solution within the concept, the risks emerging in any phase of the program, milestones, socio-economic factors, inflation rate/exchange rate, models for estimating costs. The program is to be tailored taking into account the development of the process through planning.

Throughout this program, LCC manager watches over the system's effectiveness by comparing the previously estimated figures of LCC with the real ones incurred to identify

trends and possible areas where there are problems, and to take corrective actions as required.

At the end of the life cycle, LCC is used to weigh up options to modify, rebuild or replace the system. In the end, the most cost-effective and operationally effective alternative is chosen.

3.3 Generic cost breakdown structure (GCBS)

GCBS is a tool which spells out the main cost drivers through the life cycle of the system and it is relevant to any product or project. GCBS shall be easy to develop, comprehensive, comparable, unambiguous, and flexible.

GCBS can be divided into:

i) Acquisition costs for, *inter alia*, procurement or development, initial logistic support, preparation, testing and acceptance, installation of the system, project cost, training;

ii) Operation costs :

- Operation costs for operating personnel, operating training, operating documentation, operational infrastructure and facilities, consumables, etc;
- Support costs for maintenance personnel, training and facilities, spare parts stocks, test & support costs, maintenance documentation, computer resources, infrastructure, upgrading and modification, etc;

iii) Disposal costs

As a cost element is always associated to a "resource" used by an "activity" applied to a "product", at the earliest stage of creating a GCBS it is recommended to identify all possible resources, activities and products. This is the purpose of the three following primary structures or lists:

- The product tree defines all core product elements over the lifespan of a system.
- The activity list defines all possible activities performed over the lifespan of a system.
- The resource list defines all possible resources used by activities.

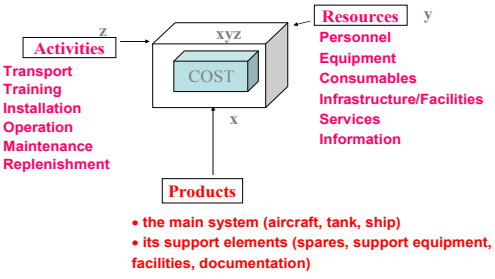

Fig. 3 Cost Breakdown Structure

GCBS is the basic framework on which a CBS is built taking into account the specifics of the project (develop a new system, purchase a system off the shelf, etc.) and the type of the system (naval weapon system, light armored vehicle, aircraft, etc).

3.4 Establish the data. populate the life cycle cost framework

3.4.1 Project initiation phase

The initiation phase identifies a gap in capability. This gap is detailed in some necessary documents and the planning will be initiated after its endorsement.

3.4.2 Project planning and development phase

This phase starts by identifying the options available to meet the need, analyze these options and plan the activities for the next phases. The comparison of the identified options will help to find one or two or three possible solutions that satisfy the need.

Life Cycle Costing is the method used to evaluate costs, to populate and develop the costs for each option. This may be the first estimate of Life Cycle Cost (LCC). The first estimate of LCC is based upon a deep understanding of the operational requirements and outlines a possible solution. This estimate is an indicator on the rough order of magnitude of total project cost and milestones.

At the turn of this initial estimation, a Program Planning Proposal (PPP) is conducted. PPP identifies resources required in broad terms and is similar to a pre-feasibility study.

A Project Development Study is carried out after PPP approval. This is a more detailed study and analyses the various options of meeting the need in more areas such as: capability, life cycle costs, personnel, technology and overall impact on business. Afterwards the second estimate of LCC is elaborated.

The second estimate of LCC is based on the general description of the end item sought, on production and construction experience, on the market conditions or on system concept or preliminary design and analysis of its cost and timelines. This second estimate of LCC might be adequate for taking the appropriate investment decision. This estimation is used to draw up the Program Development Proposal (PDP). The project definition phase begins after PDP approval.

3.4.3 Project definition phase

This phase implies a more detailed analysis of the most appropriate option, or maybe additional options are required. More options are weighed up to evaluate to what extent the operational requirements are met with regard to cost, milestones and performance. As this time the implementation phase is planned in detail. At the end of this analysis, the third estimation of LCC is prepared. It is based upon quality data (related to cost, timing and production or construction). This estimation should provide accurate financial and technical data related to fulfilling the operational requirements to get effective project approval. Additionally contingencies expenditures should be delineated to ensure the full transparency of costs ceiling throughout the implementation phase. The third evaluation of LCC is used to draw up the Program Change Proposal (PCP). The project implementation phase begins after PCP approval and it is the final phase before the acquisition of the system.

3.5 Conduct the cost analysis (CCA)

The purpose of conducting costs analyze is to evaluate and cut down the initial and through life cost. A number of LCC-studies can be performed in the bidding phase of the new equipment, namely:

i) Estimation of the total costs for new equipment;

ii) Comparison of Life Cycle Costs for different options to fulfill the operational requirements. Tenders are to be compared in the bidding phase. It is also possible that one bidder offers a number of options to fulfill the requirements. Bidders and tenders can be compared against each other on cost issues, when a common cost tree is used.

It is also possible to use LCC-analyses to calculate, evaluate and compare several support alternatives for the new equipment, i.e. the comparison of the concept of five levels of maintenance with the three levels'.

iii) Analysis the important factors of influence / cost-drivers to cut down the total life cycle costs.

iv) Sensitivity analyzes on most important factors of influence or uncertain cost elements to determine their impact on the total life cycle cost. The issue is how to deal with uncertainty in cost.

The Software Support Cost does not depend significantly on the size of the software, and the size of the user, but on the operational environment, the age and the contractual conditions.

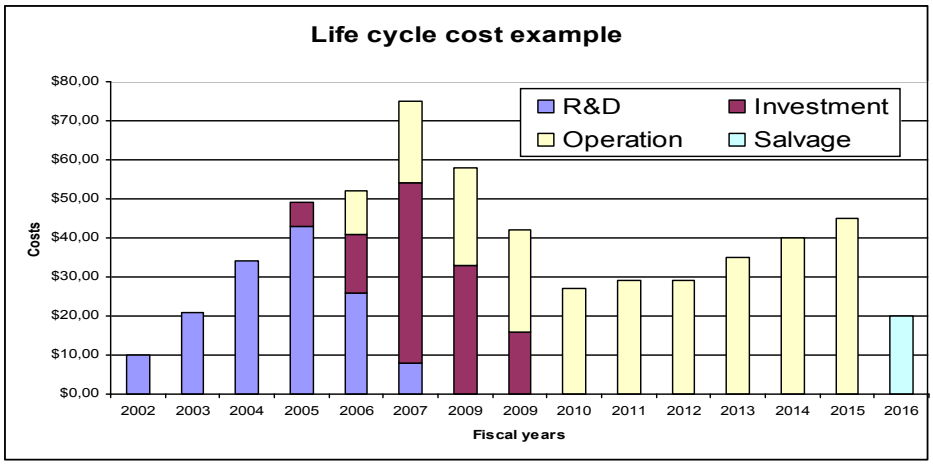

Fig. 4 Life cycle cost

4 Conclusions - Decisions

At the end of cost analyze the best solution has been identified and there is a clear picture on cost profile of when costs are expected to occur, based on work breakdown structure and the expected costs thereto.

Life cycle cost allows to the decisions makers to evaluate the future expenditures; to make comparison between alternative solutions; to manage the existing budgets; to make options for procurement; to evaluate the opportunities to cut down costs; to asses the affordability.

LCC is not an exact science, but an insight in the significant cost drivers, and an insight in the magnitude of the costs.

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