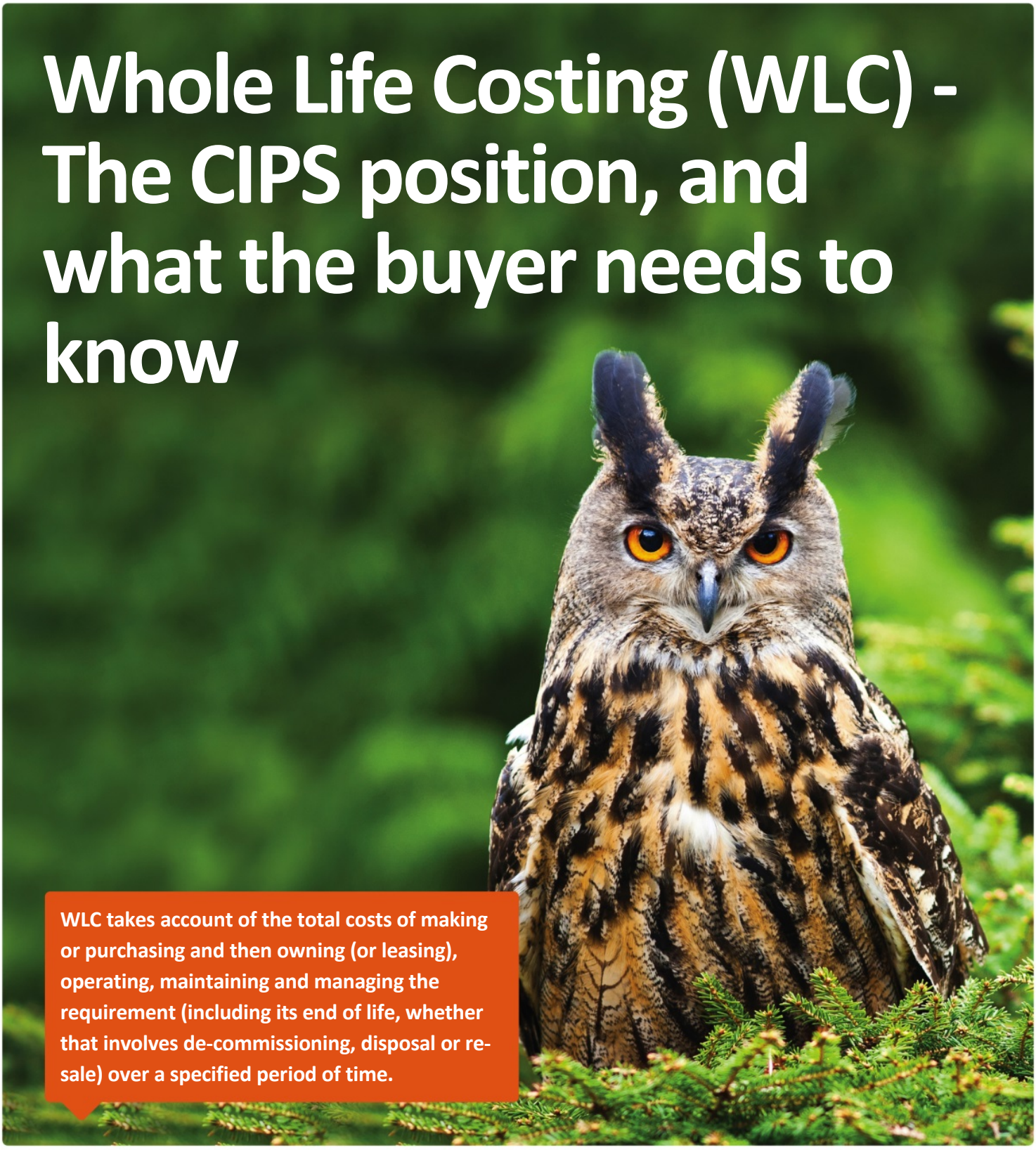
Whole Life Costing (WLC) - The CIPS position, and what the buyer needs to know



WLC takes account of the total costs of making or purchasing and then owning (or leasing), operating, maintaining and managing the requirement (including its end of life, whether that involves de-commissioning, disposal or re-sale) over a specified period of time.

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1. Whole Life Costing - The CIPS Position

This guide, one of a series, sets out to present, in an integrated fashion, the principles and practice of Whole Life Costing (WLC), together with CIPS views on the subject. CIPS is expressing beliefs on WLC as it is a best practice tool for evaluating options for any substantial procurement. These views and beliefs are listed below, and are highlighted and expanded at appropriate points within the text:

- CIPS believes Whole Life Costing to be synonymous with Life Cycle Costing.
- CIPS considers that all purchasing and supply management professionals (P&SM) should be competent in the theory and application of WLC.
- CIPS advocates the use of WLC in making 'make or buy' decisions, also when establishing which source of supply offers the best value for money.
- CIPS takes the view that P&SM professionals should take the lead in the WLC process, involving other colleagues on a cross-functional basis as appropriate.
- CIPS believes that P&SM professionals should be prepared to involve key suppliers in the implementation of WLC.
- CIPS believes that P&SM professionals are under an obligation to ensure that high value/high risk purchasing decisions are not made on the basis of price alone.
- CIPS takes the view that there is no single approach to WLC.
- CIPS takes the view that WLC tools used by an organisation will vary according to circumstances and individual requirements.
- CIPS recommends that, when making WLC calculations, expected usage life rather than expected physical life should be the preferred parameter.
- CIPS considers that the selection of an appropriate discount rate is critical.
- CIPS takes the view that while WLC is traditionally associated with high-value procurement decisions, there is no reason, in principle, why it should not also be applicable to relatively low-value purchases.
- CIPS accepts that financial criteria such as depreciation rates and resale values come into the equation and that therefore P&SM professionals should be prepared to seek assistance/advice from Finance.

2. Definitions

Whole Life Costing had been defined by the CUP (Central Unit on Purchasing, forerunner of the OGC – Office of Government Commerce) as: “…….a technique to establish the total cost of ownership. It is a structured approach which addresses all the elements of this cost and can be used to produce a spend profile of the product over its anticipated lifespan. The results of a WLC analysis can be used to assist management in the decision-making process when there is a choice of product. The accuracy of WLC diminishes as it projects further into the future, so it is most useful as a comparative tool when long term assumptions apply to all the options and consequently have the same impact.”

Two other definitions from the CIM (Chartered Institute of Marketing) and CIMA (Chartered Institute of Management Accountants) respectively are as follows: “the practice of obtaining over their lifetime the best use of the physical assets at the lowest cost to the organisation. This is achieved through a combination of management, financial, engineering and other disciplines.”

and

"the term 'Life Cycle Cost' embraces all the costs associated with feasibility studies, research development, design and production, and all the support, training and operating costs generated by the acquisition, or a replacement of physical resources."

3. Whole Life Costing – Basic Principles and Analysis Of Costs

CIPS advocates the use of WLC, at least, when deciding whether a requirement should be 'made or bought' and also when determining the source which offers the best value for money. Current UK policy requires central government departments to base procurement decisions on whole life costs and not on initial price alone. Local authorities are encouraged to do the same as a manifestation of best practice under the Best Value regime.

The following three basic principles are fundamental to WLC:

1. An analysis of the cost structure - any such analysis should ensure that all the cost elements are readily identifiable
2. Cost estimating - having produced a cost structure, it is necessary to work out the costs for each category. Various techniques are available, one being the use of CERs (Cost Estimating Relationships)
3. Discounting – is "the application of a selected discount rate such that each future cost is adjusted to present time, ie the point at which the purchase decision is made".

Inflation – this is referred to here only to emphasise that it should not be confused with discounting. As long as inflation affects the various aspects of the purchasing decision more or less equally, it is usual to exclude it from a WLC analysis. WLC takes account of the total costs of making or purchasing and then owning (or leasing), operating, maintaining and managing the requirement (including its end of life, whether that involves de-commissioning, disposal or re-sale) over a specified period of time. These costs are assessed to provide a rational comparison of alternative means of meeting the requirement.

A concise categorisation has been proposed by John Ramsey in an article in Purchasing and Supply Management (the predecessor to Supply Management), entitled The Product Purchasing Life Cycle - Purchasing, Sourcing and Power. Essentially, three types of cost are identified which, together, make up the total cost of a purchase. These are:

- initial purchase price
- purchase administration costs
- development and maintenance costs

A more comprehensive breakdown however is as follows:

Pre-acquisition costs

For example:

- investigation of the market place
- specification and design
- budget allocation
- preparation and issuing of invitation to tenders
- cost of tender evaluation
- cost of letting contract
- preparation for receipt of the requirement

Acquisition costs

For example:

- purchase price

- delivery charge
- insurance and taxes
- installation and commissioning
- training and support
- internal costs associated with changing from the incumbent supplier (which should be identified prior to tenders being received)

Operating costs
For example:
- labour
- materials
- consumables
- energy supply and consumption
- contract and supplier management
- transaction costs
- environmental costs
- cost of change, for instance, a decision to use alternative materials

Maintenance costs
For example:
- specialist labour
- specialist tooling
- spare and replacement parts
- reduced output with age
- frequency of maintenance and recommended downtimes
- servicing and inspection regimes

Downtime costs
For example:
- lost profits
- extra costs of overtime or sub-contracting
- costs associated with breakdown of equipment
- claims resulting from non-performance

End of life costs
For example:
- safe disposal
- re-sale
- ongoing liabilities
- decommissioning
- removal for sale or scrap
- re-instatement of land or buildings for alternative use

There is no single approach to WLC.WLC tools employed by an organisation may vary according to the specific nature of the requirement. For instance, the tool used to determine the best value for money in a software procurement might be very different from that used to evaluate capital equipment. There are several 'tools' available involving spreadsheets and DCF (discounted cash flow) calculations. P&SM professionals can either purchase such a tool or develop their own. At its simplest level, a spreadsheet could be produced for the requirement

with all the elements of cost individually listed along the rows and the suppliers listed down the columns.

These costs can be as detailed as required but at the very least they should cover:

- acquisition and all its components (delivery costs, installation costs, commissioning costs, etc)
- operating costs and all its components such as energy, spares, costs of maintenance
- end of life costs such as de-commissioning and removal costs
- details of precisely when costs are incurred

CIPS suggests that the cost elements can be weighted according to the degree of impact/ importance to the organisation. These weightings should be reviewed on a case-by-case basis along with other variables such as lifespan or the discounting method used.

CIPS recommends that the expected usage life rather than the expected physical life of the asset should be employed in WLC. This is particularly important when undertaking Net Present Value (NPV) or discounted cash flow calculations. The selection of an appropriate discount rate is critical. CIPS suggests that, as a rule of thumb, the current long-term expected interest rate less the current long-term expected inflation rate should be the discounted rate employed.

Purchasing and supply chain professionals should take great care if considering moving away from this method of ascertaining the discounted rate.

4. The Product Life Cycle

This is a key concept in any WLC exercise. A suggested five-part cycle is as follows:

1) Design – involves the development and test marketing of a new product or service. This stage is associated with considerable R & D costs, marketing initiatives, and a degree of uncertainty as far as the market success of the new product is concerned
2) Introduction – characterised by full-scale marketing, low levels of sales/profits, vulnerability to competing comparable products already on the market
3) Growth – difficulties of stage 2 by now largely eliminated. Increasing number of distributors, product now established in the marketplace; considerable amount of manufacturing overtime
4) Maturity – sales volumes continuing to grow but at a decreasing rate, eventually levelling off. Profits reaching a plateau or declining slightly. Production facilities beginning to need refurbishment/repair. Sales inducements and/or discounts available to customers
5) Decline – sales reducing at 1% or more monthly, declining profits, product substitution by distributors, withdrawal of promotional support, manufacturing equipment sold.

Source: Integrating Product Life Cycle and Purchasing Strategies L Birou et al, International Journal of Purchasing Management January 1997 p 25.

5. How Should a WLC Analysis be Carried Out?

The information required to undertake WLC may not be readily available and research may be required involving for example, the supplier and other customers of the supplier, particularly for information about their experience of using the requirement in question. However, once such information is obtained it can be used in other WLC exercises for similar procurements.

The time and effort involved in data collection to make WLC effective and useful can be so considerable that it could be argued that WLC is most appropriate for high value and high risk

procurements. However, where such data is readily available, and WLC is, consequently, not highly resource consuming, there is no reason why it cannot be applied to lower value purchases as a means of determining the best value for money option.

CIPS suggests that Invitations To Tender (ITT) should include a template, or questionnaire, for suppliers to complete which shows the costs associated with the requirement for which they are submitting bids. This is good practice both for the negotiation stages and also for WLC.Cost information required should include a breakdown of overheads, margins, production and operating costs, energy consumption, maintenance costs, disposal costs etc. Suppliers may of course be unwilling to provide such information, especially if the buying organisation does not place regular business with them. Such information is usually more readily obtainable from suppliers with whom the buying organisation has a partnering style relationship.

Costing information can also be sought from existing customers of the supplier in question, by contacting them to obtain for example, details of running costs. Similarly, the actual costs incurred during the life of the requirement should be monitored and recorded to inform future purchasing decisions. This is particularly important in high-value procurements such as construction. CIPS advocates the development of a WLC database so that costing information can be reused as appropriate.

Depreciation and re-sale are particular issues that need to be addressed and as such P&SM professionals may require the expert guidance of colleagues in Finance. For example, similar solutions may not have similar depreciation curves although their re-sale value may be the same. Cost/time graphs can be drawn to illustrate when different costs impact over the life of the requirement. There are several different approaches and colleagues who are qualified accountants are best placed to provide guidance on the appropriate use and application of discounted cash flow techniques. Liaising with colleagues in Finance and Internal Audit, for example, may assist P&SM professionals employed in organisations with devolved budgets, to overcome the problem whereby different parts of the organisation are responsible for costs at different points in the life of the requirement.

In such circumstances there is sometimes a tendency for a budget centre to consider its own costs to the detriment of another budget centre rather than deciding on the best overall value for money for the organisation.

Other Issues to Consider

Two important areas are risk assessment and sensitivity analysis. CIPS suggests that the larger the commitment, the more sophisticated should be the analysis. Construction in particular requires close attention to exit strategies, including the costs of decommissioning at the end of the life of the building, and CIPS recommends that the life of the construction should be determined in terms of the purpose for which the construction is procured rather than how long the building is expected to remain standing.

CIPS suggests that WLC is also a useful tool for determining the most appropriate choice of business processes. An analysis of an existing business process using whole life costs in terms of staff time, processes and timescales in general can lead to the development of a more viable and more cost effective alternative. An example would be the replacement of a fuel expenses reimbursement system with the adoption of fuel cards.

The resultant value-added benefits such as improved management information and contented colleagues, not least cost savings, eg reduced fuel and better allocation of resources, can be

apportioned over the life of the new process, ie year on year savings resulting from the decision to adopt the new process. CIPS also suggests that when applying WLC to PFI (Private Finance Initiative) projects, or similar complex procurements, WLC should be employed in a more sophisticated manner than that used for capital purchases, for instance. This would require a review of the whole commercial deal including assessment of important 'soft' issues such as culture, dependability, ultimate aims and strategy.

6. What are the Benefits of Whole Life Costing?

There are four key benefits associated with WLC:

1. Evaluation of competing options – WLC is relevant to most equipment purchasing decisions, whether simple or complex. The technique is also applicable to leasing decision
2. Improved awareness of total costs – WLC has been shown to provide buyers and decision-makers with a better grasp of the factors governing cost and the resources required by associated with the purchase.
3. Better forecasting – WLC allows the full cost of a purchase over a period of time to be calculated with reasonable accuracy. This is obviously of considerable importance when major investment decisions need to be made.
4. Performance trade-offs against cost – using WLC it is relatively straightforward to assess the reliability characteristics of a piece of equipment in the context of its cost profile.

WLC is particularly important at the present time when the rate of technological change is continually increasing. Some products may become outdated within, say, a year or less of acquisition. Clearly this period of obsolescence will vary from one industry to another. In the field of IT it will be considerably shorter than in, say, the foundry industry. Wherever it is employed, however, the use of LCC ensures that the pitfalls of using initial cost as the only criterion are avoided.

7. What Are The Limitations of the WLC Approach?

Three main disadvantages may be identified:

1. Whilst it is usually straightforward to ascertain the initial cost of a product,WLC can, at least in theory, also identify and quantify subsequent ongoing costs. In practice this is often easier said than done, not least because as a product goes through its life cycle a whole range of cost considerations come into play, including initial product design, development costs, marketing, advertising, product redesign and product replacement.
2. In strategic purchasing decisions WLC suffers from the problems that in such cases future costs are in reality approximate, being as often as not based on projected sales figures which are frequently over-optimistic.
3. Using WLC techniques may involve considerable expenditure in terms of manpower. This can be the case even when computerised procedures are employed.

8 . BUYING CAPITAL EQUIPMENT

WLC is typically associated with the purchase of capital equipment. Such purchases usually feature some or all of the following;

- high initial cost
- they are frequently a one-off transaction, which is to say that no-one in the organisation has prior experience
- a lengthy and sometimes difficult negotiation process
- choice of supplier critical (a long term relationship with the supplier is often necessary to ensure continuity of maintenance)

- a high level of input from technical/engineering departments which can lead to problems of cooperation and liaison with the purchasing department
- complex contract documentation

Source: Purchasing Capital Equipment.GE Partridge.

In "Purchasing Management Handbook" (Farmer), as noted above, contracts for the purchase of capital equipment are invariably complex, and will of course vary in many points of detail according to individual circumstances. However, model forms are readily available, one of the most convenient being the various Conditions of Contract for Engineering Plant and Materials, in Buying Goods and Services by Allwright and Oliver. Additionally, a comprehensive range of contract documentation is available from the Institution of Civil Engineers.

A comprehensive checklist for such contracts might well include the following:

- definitions
- scope or work
- warranty /guarantee
- liability
- price/payment terms
- acceptance procedure
- testing
- delivery date
- arrangements for site meetings
- maintenance and spare
- liquidated damages
- site preparation
- services
- manuals and instructional literature.

Michael Mee, at a seminar entitled 'Emerging Trends in Purchasing Best Practice' produced a comprehensive categorisation of the costs and activities involved in the selection, specification, purchase and maintenance of items of capital equipment. Initial acquisition and purchase for instance is seen as comprising key areas such as: market research; equipment evaluation; supplier appraisal; and tendering. These areas are further subdivided as follows:

a) Market Research

- Catalogues
- Buyers Guide
- Commercial databases
- Trade exhibitions
- Technical journals
- Independent advice - peer groups for example
- Information from sales representatives

b) Equipment Evaluation

- Demonstrations on site
- Loans of sample equipment
- Analysis of end user preferences
- Durability
- Ergonomics
- Quietness/smoothness of operation

c) Supplier Appraisal
- Site visits
- References
- Examination of accounts
- Assessment of consequences of supplier failure
- Quality standards

d) Tendering and Analysis
- Specification draft
- Type of tender (open, restricted, negotiated)
- Tender analysis
- PTN (Post Tender Negotiation)
- Award of contract

9. Can Whole Life Costing be Applied to Buying Services?

WLC is traditionally associated with goods, equipment and capital projects rather than services. However, service delivery organisations exhibit life cycle characteristics and the potential for cost reduction not dissimilar to manufactured goods. As the graph below shows, products and service life cycle curves have similar profiles but with a time differential reflecting the delay between the time a product comes onto the market and the point at which the first request for the service is made.

PRTM Consultancy has developed a four-stage process maturity model for service providers. As such companies progress through stages 2 and 3 they become aware that there are two distinct levels of inventory and service reviews which need to be undertaken. The first level, common to the great majority of service providers, concentrates on consistently satisfying customer needs on a daily basis. The second level may be described as incorporating medium and long term planning as part of the service management process. Research carried out by PRTM has shown those service providers who successfully implement such a process tend to be characterised by a lower level of end-of-line obsolescence and better asset utilisation.

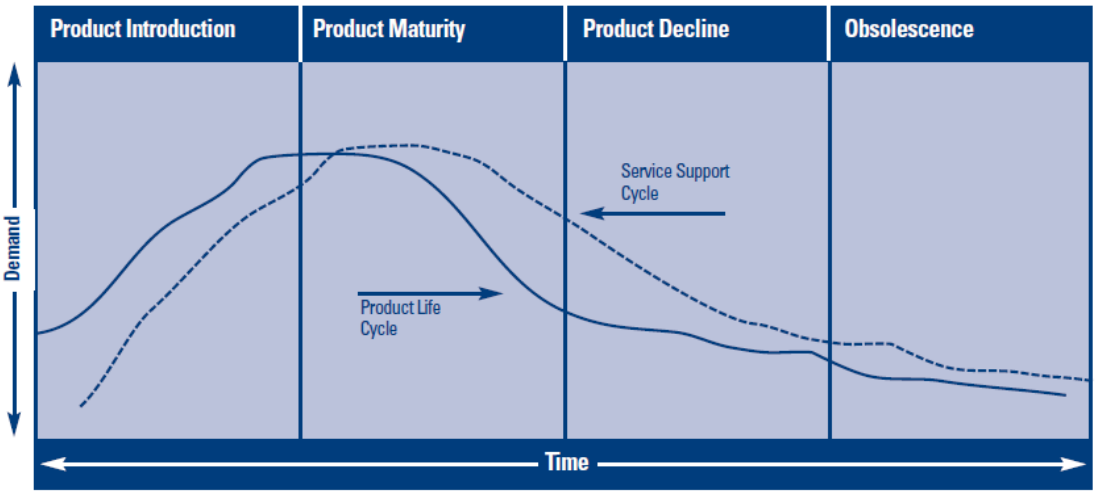
10. Life Cycle Analysis

Closely related to, and indeed an important facet of Life Cycle Costing, is Life Cycle Analysis (LCA) which recognises that all products have a recognised life span, which can be reproduced graphically by what is known as a Gopertz Curve. It is hardly necessary to add that this curve will vary from one product to another. For example, a high-fashion item will have a steep initial curve, followed by a somewhat less steep curve after the time for peak sales has passed.

LCA is a concept which has acquired prominence with the emergence of increasing concerns about the environment. It may be defined as 'providing a complete and objective picture of a product's impact on the environment'. It provides a complete evaluation of the emissions and wastes from sources and the production of raw materials and manufacturing processes right through to their eventual disposal. It is an analytical methodology and data collection process covering resource utilisation and waste products from cradle to grave.

The recognised stages in an LCA graph are clearly marked and will be well known to market strategists who may need to take measures from time to time to, for example, boost sales, or predict if and when a product redesign policy needs to be introduced. Clearly such

developments need to be closely followed by those responsible for purchasing strategies who need to know, for instance, what materials to order and when.



A suggested checklist of actions, which is appropriate for all buyers who are charged with minimising cost in their capital equipment purchasing, include the following;

- discuss with end users of the equipment what their precise needs are
- make maximum use of cross-functional teams, such teams to include suppliers, users and other relevant parties such as the finance department
- be involved as early as possible in any preliminary capital equipment purchase discussions. Buyers who are therefore involved will have the best chance of pinpointing opportunities for cost savings
- compile a detailed list of all the factors which are involved in a LCA
- establish a target price based on the financial and market information available relating to the item(s) of equipment under consideration.

LCA is being regarded by many companies (B&Q being a prime example) as a key criterion in their supplier evaluation process. These suppliers will often need to undertake an environment analysis of their own suppliers in turn. In this way the entire supply chain will be covered.

A useful alternative to a full LCA is to use the basic methodology to identify the key environmental impacts. Having identified these it is then possible to use a questionnaire approach to focus supplier evaluation on their efforts to address these priority environmental impacts. These will of course vary from one product to another. In the case of paper, for instance, the key environmental impacts have been identified as occurring during not only forest management, but also in the paper mill, particularly as far as emissions, energy usage, waste generation and effluent treatment are concerned.

Although the principle of Life Cycle Costing is relatively straightforward in that the cycle may be said to start with the purchase of the item of equipment and end with its eventual disposal, with Life Cycle Analysis it is often difficult to say where the cycle starts.

The impact of technology is redirecting the boundaries of life cycle costing, for example the impact of nanotechnology can improve the shelf life of perishable food products which contributes to the reduction of packaging. Forests will no longer need to but cut down to

provide paper pulp for packaging. Additionally the environmental and energy costs associated with manufacturing the packaging will be reduced.

11. What Role Does the Purchasing and Supply Management Professional Have to Play?

The CIPS position is that P&SM professionals should be competent in the theory and application of WLC. It can be a complex commercial process which, when used properly, can enable P&SM professionals to demonstrate a significant and visible contribution to their organisations' financial standing and thereby raise the profile of the profession.

CIPS believes that the P&SM professional should lead the WLC process and involve appropriate colleagues by means of a cross-functional team. Purchasing and supply chain professionals should openly share their WLC approach and invite others to contribute towards its development.

CIPS suggests that P&SM professionals should actively promote and educate colleagues in the concept of value generation for example, providing road shows or training seminars to demonstrate that price is just one element of cost. They should begin by marketing the concept to the Chief Executive Officer, Board of Management and internal audit with the aim of obtaining a top down visible policy, applicable to the whole organisation, on the use of WLC and other approaches to costing as appropriate to different categories of procurement.

Further, the P&SM professional should involve key suppliers in the WLC policy with a view to engaging them in the process and extracting relevant costing information from them in due course. This may lead to closer working relationships and, potentially, partnering style relationships in which suppliers can be developed for mutual benefit between both parties, e.g. the buying organisation and the supplier can work together to take cost out of a product, service or construction. CIPS believes it is not sufficient to simply persuade colleagues and others within supply chains as to the value of WLC, it is necessary to ensure its implementation and appropriate use within an organisation. It is a key responsibility of the P&SM professional to endeavour to prevent high value and high risk purchasing decisions being made on the basis of price alone.

12. A Case Study - Photocopiers

Often a machine, which at first sight seems to be the cheapest option, turns out to be far and away the most expensive when all cost factors are taken in account. In the book 'Purchasing and Supply Chain Management by Lysons and Farrington' (pp342-345), an example of a company which has the option of two makes of copier (a number of machines are being purchased) is given both designs having an anticipated life of 5 years and both of which fully meet operational requirements. Lysons gives full details of all the costs involved.

His analysis shows that when a full LCC is undertaken, the maintenance costs are far higher than the acquisition cost. In the case of the particular copiers under consideration, it is shown that the "Brand A" copiers although in total over £100,000 more expensive to buy, were approximately £250,000 cheaper to own when considered in terms of a Life Cycle Analysis over 5 years. Furthermore, the Brand A copiers being a higher quality machine with better reliability characteristics than Brand B were found to be on average 9% more available than Brand B, or, looked at in another way, copier B would be unavailable for twice as long as Brand A

(availability is defined as uptime over total time). The example clearly shows the importance of carrying out a careful analysis of all the costs involved when purchasing capital equipment.

13. Glossary

Absorption costing
A method of costing designed to ensure that total costs, fixed and variable, direct and overhead are recovered in the price of goods etc. ABC (Activity Based Costing). A cost attribution to cost units on the basis of benefit received from indirect activities such as order processing and setting up quality procedures.

Discounting
The longer the duration of a project the more likely it is that simple addition or subtraction of inward and outward cash flows will produce a skewed result as far as the assessment of its viability is concerned. The reason for this is that the sum of, say £10,000 at the commencement of the project is worth more than the same figure at the end of the project 4 years later when it will have acquired a value of perhaps £12,000. One way of expressing this is to say that £10,000 is the net present value of the £12,000 four years down the line. This process of converting future values back into NPV (Net Present Value) is known as discounting. (source: Gower Handbook of Project Management) IRR (Internal Rate of Return). A percentage discount used in capital investment projects; it brings the cost of a project and its future cash inflows into equality.

NPV (Net Present Value)
May be defined as the net present cost of the purchase or project and all future revenues flowing from it discounted back to the present time. Various allowances may need to be taken into account, such as the value of the purchase or project at the end of its useful life.

ROCE (Return on Capital Employed)
The fundamental ratio for determination of success of an enterprise or project represented by the formula

$$R\% = \frac{Pr \times 100}{Cap}$$

- Where R% is percentage return generated by the capital employed
- Pr is profit generated before tax
- Cap is average capital employed

Target costing
A product cost estimate derived from a competitive market price. Used to reduce costs through continuous improvement and replacement of technologies and processes.

Terotechnology
A combination of management, financial, engineering, building and other practices in pursuit of economic life cycle costs. Its practice is concerned with the specification and design for reliability and maintainability of machinery and equipment.

Total Acquisition Costs
The total of all costs in acquiring goods or services from the inception of the demand for them until their safe and satisfactory delivery at the point required.

Total Cost of Ownership
The purchase price of a product and its transportation cost plus indirect handling inspection quality, re-work maintenance, and all other follow on costs associated with the purchase including costs of disposal.

Value analysis
A systematic interdisciplinary examination of design and other factors affecting the cost of a product or service in order to devise a means of achieving the specified purpose most economically at the required standard of quality and reliability.

14. References and Websites

a) Book titles relating to Whole Life Costing/ Capital Projects

Whole Life-Cycle Costing: Risk and Risk Responses
A Boussabaine and R Kirkham
Blackwell, 2004
ISBN: 1405107863

Capital Equipment Buying
R Newman and R Simkins
1998
ISBN: 0814403697

How to Procure Capital Equipment (a title in the CIPS 'How To' series)

Additionally, most purchasing textbooks contain chapters or sections on whole life costing techniques

b) Websites
Among the more important are:

- .ogc.gov.
- .sustainable-development.gov.
- .eci-online.
- .esemag.
- .forumforthefuture.org.
- .dti.gov.
- .hm-treasury.gov.

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