Outsourcing Maintenance
A Question of Strategy

As organisations today strive to achieve minimum operating costs and lean operations in terms of manpower, the maintenance activity has become a target for outsourcing. With a growing shortage of skilled and experienced maintenance engineers, facilities management companies provide an attractive alternative to the traditional approach to maintaining assets. However, for many organisations, maintenance is close to the core of their operations and the decision to outsource is a difficult one. How, then, can an assessment be made on whether or not to outsource, and what are the key issues in the decision making process?

by Michael Levery

Background

In considering the issue of outsourcing maintenance, it is worth understanding how maintenance requirements have changed over the last 30 years, which has led many companies now to regard maintenance as a non-core activity.

Repair Focussed

Until the early 1970's, maintenance in the UK was essentially an in-house activity, and generally of a reactive nature. Most industrial and manufacturing plant was individually designed, with little if any standby facilities, and limited spares. It was imperative therefore that companies employed the full range of craft skills which provided an insurance policy against plant failure, ensuring that repairs were executed in the minimum possible time. Welders, fabricators, machinists, turners, lathe operators, fitters, lubricators, electricians and other trades, were capable of dealing with any eventuality, quite often having to make spare parts on demand when failures occurred.

It hadn't gone unnoticed, as high quality Japanese products hit the UK market in the 1960's, that Japan had moved from American style Preventative Maintenance techniques introduced in 1951 to Productive Maintenance, which recognised the importance of reliability, maintenance and economic efficiency in plant design. With technological development in the 1970's, and the move from individually designed production plant to more packaged plant processes, improving maintainability, it became clear to the Department of Trade and Industry that the traditional view of maintenance had to change.

Terotechnology

The DTI picked up on the theme of productive maintenance, to create terotechnology, in an attempt to raise the profile of maintenance at Board level. Terotechnology[6] was defined as

"A combination of management, financial, engineering and other practices applied to physical assets in pursuit of economic life cycle costs"

with the later addition:

"..... its practice is concerned with the specification and design for reliability and maintainability of plant, machinery, equipment, buildings and structures, with their installation and replacement, and with the feedback of information on design, performance and costs."

The fact that terotechnology is either unknown or rarely used in organisations today is testimony to the failure of this DTI initiative. Terotechnology principles are applied only in those industries where it is absolutely critical, for example for safety reasons in the nuclear and aircraft industries.

Totally Productive Maintenance

Meanwhile, the Japanese had moved on to develop Totally Productive Maintenance, the TQM bible of the maintenance activity. Devised by Seiichi Nakajima[2] at the Nishio pump factory of Aishen Seiki. TPM works to eliminate all obstacles to equipment effectiveness, covering the areas of downtime, speed losses and product defects. For the first time, maintenance was an issue on all levels in an organisation and across every function. Attempts to implement TPM in UK companies often foundered on the cultural issues of shared ownership and responsibility, as against functional responsibility and individual accountability, and generally failed to make an impact.

Various other maintenance initiatives were developed through the 1980's, including Reliability Centred Maintenance, which examined individual assets in their operational environment to determine best maintenance practice. Although this philosophy was highly successful in the aircraft industry, detailed analysis of this sort was inappropriate in many other industries.

Condition Monitoring using techniques such as oil analysis in gearboxes and vibration monitoring in rotating machinery to predict failure and deliver "just in time" maintenance, showed some initial success in identifying and predicting failures where companies had suffered major outages due to plant failure, but once stability was returned, it lost its appeal.

Why should it be so difficult for organisations to determine the right maintenance strategy for their operation, delivering real cost effectiveness? Is an integrated strategy through TPM the right way forward or is separation and buying in the service through outsourcing more appropriate? Is there a single tool which can identify the best way of carrying out maintenance?

Maintenance Challenge

Unfortunately maintenance is a complex and difficult subject, perceived as a cost rather than bringing added value to an operation. Why is it that organisations over-simplify maintenance requirements to fit in with organisational goals rather than based on the *needs* of the assets? It must first of all be recognised that no one maintenance solution will fit the needs of any asset throughout its life. Maintenance requirements continuously change due to wear and tear, technological developments, changing operational requirements, product quality and a host of other related topics; it truly is a moving feast.

Consider the model in Fig (1) which identifies the key stages in the life of an asset. Most organisations gear themselves up to dealing with the ongoing planned and repair maintenance without addressing how maintenance impacts on the other key stages of asset life.

Figure 1 Maintenance life cycle

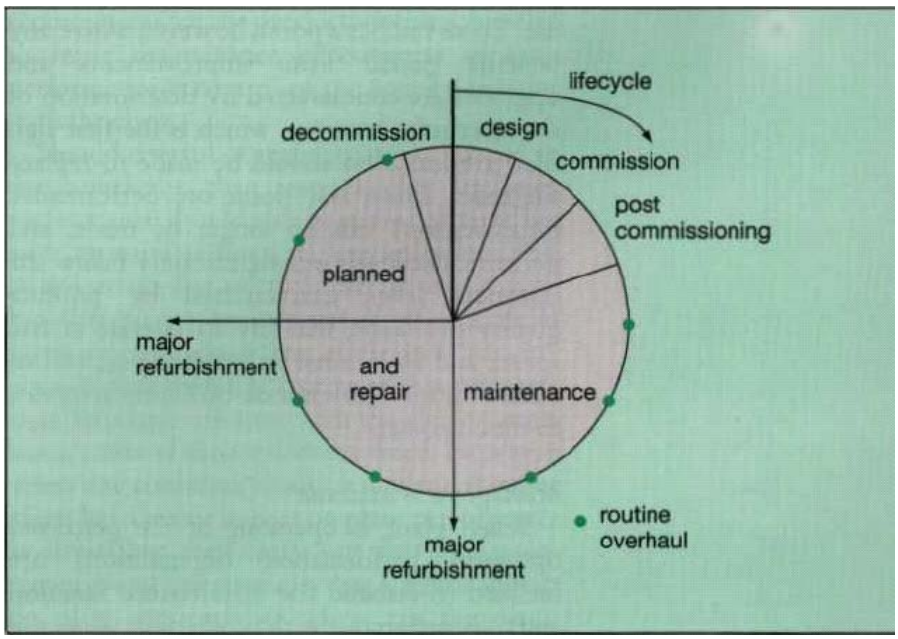
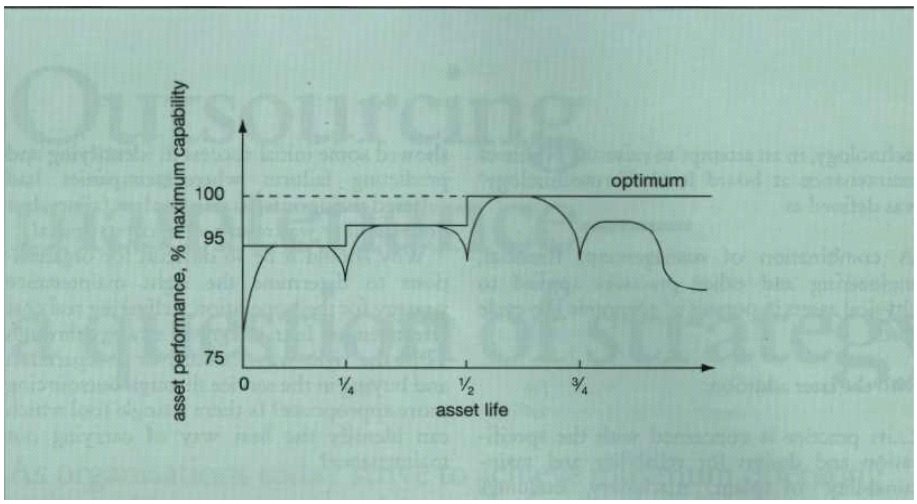


Figure 2 Asset life performance profile



Maintenance has a major part to play in the design, installation and commissioning of an asset, and is instrumental in driving post commissioning improvements. How many organisations initially get round to addressing their maintenance issues some time after handover when production problems become critical enough that urgent solutions are required?

Throughout the life of an asset, routine overhauls and major refurbishments are maintenance driven, but rarely built in as life cycle costs, requiring separate funding as the maintenance budget generally does not cater for these requirements. This typically leads to a life performance profile as demonstrated in Fig (2).

Post commissioning improvements will lead to achievement of optimum performance before there is a performance reduction leading up to the first major refurbishment. Following design improvements and technological upgrades, there is generally a raising of the asset's optimum performance level, and a similar profile is followed for the second phase of asset life. There reaches a point, however, where any benefits gained from improvements and upgrades are counteracted by deterioration of the asset infrastructure, which is the first sign that consideration should be made to replace the asset. From this point on, performance improvements can no longer be made, and performance levels out significantly below the optimum level, characterised by product quality problems, inability to operate at full speed, and an increase in breakdowns, and of course the inevitable knock on effects in service to the customer.

Management Attitude

When plant is operating at the perceived optimum performance, organisations are inclined to disband the maintenance function and fully integrate it with production, generally leading to a reactive strategy and failure to carry out timely routine overhauls and major refurbishments. Consequently, the react to failure philosophy becomes entrenched, and performance deteriorates. Organisations where assets perform well below optimum generally perceive maintenance as a problem best handled by experts and are inclined towards outsourcing the activity. This usually delivers immediate benefits, similar to that of condition monitoring, but over time the client questions the relationship with the contractor and where he is getting value for money from the maintenance service provided.

Having identified both the maintenance life cycle and performance profile for an asset, a maintenance strategy can now be developed to optimise performance, before consideration is given as to who actually does the maintenance work.

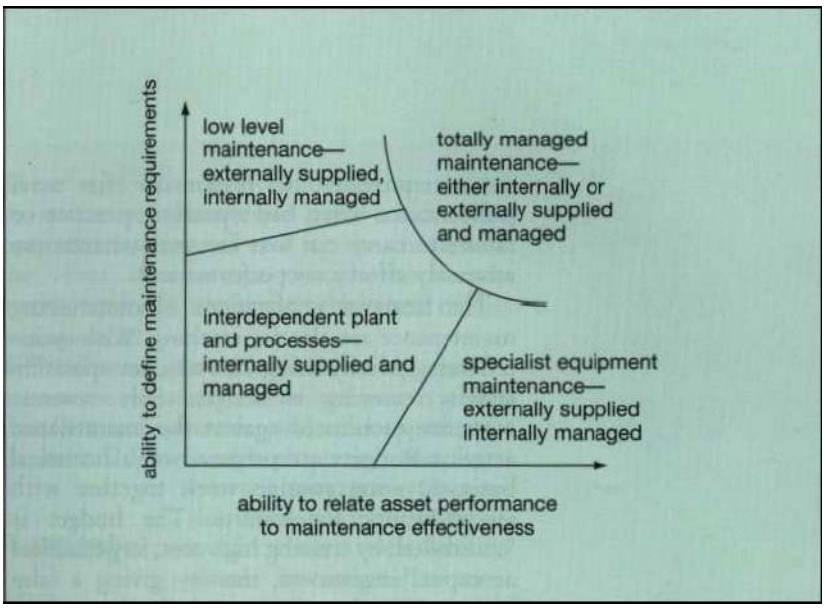
Maintenance Work and Who Does It!

The first task in determining who should carry out maintenance work is to group an organisation's assets into logical areas e.g.

Non-productive plant
- Office facilities
- Operational structures
- Plant services,
  e.g. steam, gas, water, air

Productive plant

Figure 3 Maintenance strategy/policy



Non-Productive Plant

The facilities management market in the UK is expected to grow to some $52 billion by the year 2000 according to research by Johnson Controls World Services[5] in 1995, as part of a $500 billion European wide outsourced market. The UK and the Netherlands lead the way in a European market valued at $260 billion in 1995. Building maintenance services account for over 10% of this market, yet twenty years ago this market didn't exist and maintenance of building assets was generally an in-house activity. However, this was one of the key areas of outsourcing for most organisations as it is a non-core activity and crucially, responsibility for performance of the building assets is handed over to the contractor. This latter point is often taken for granted, but is an important part of outsourcing thinking to be discussed in more detail later. Maintenance of office facilities incorporating the buildings themselves, lighting systems, and heating and ventilation systems is a prime candidate for outsourcing with a large number of companies supplying these services, and specification of requirements relatively straightforward.

The approach to maintaining operational structures, which consist of the buildings and civil structures around the process plant, could be the same as that of office facilities, but with limited maintenance requirements, a more piecemeal approach based on annual inspections to carry out remedial work is far more cost effective. Use of surveyors together with a negotiated contract with a building services supplier would adequately meet the need for plumbing, painting, joinery, electrical and civil/structural repair work.

Maintenance of on site plant services supplying the production process falls into the category of specialist equipment maintenance. It is inappropriate to maintain this type of equipment in-house despite the fact that failure of these types of processes can lead to loss of production. Specifications can be written which meet operational requirements covering volumes, availability and quality, enabling totally managed contracts to be established on a similar basis to that of building maintenance services. There are service companies in the marketplace which provide maintenance services on compressed air systems, bulk air supply systems, water and waste water supply and treatment, gas supply systems and steam services.

These three areas of office facilities, operational structures and plant services are not considered fundamental to production process. When examining the production plant maintenance work, however, the issues are varied and complex as this work is close to the core operation.

Productive Plant - Outsource or In-house?

Most organisations when maintaining their productive assets use a combination of in-house and contract maintenance. Contractors are used either for specialist maintenance where the expertise is not held in-house, or where routine, repetitive maintenance work is carried out. In-house is where the process knowledge is maintained, such that problems are readily resolved because the inter-relationship between the processes in production plant are understood. At first it appears that outsourcing the maintenance function is relatively straightforward as all that is being lost is process knowledge, but the implications reach much further.

Fig (3) identifies the four different ways of carrying out maintenance. For three of these areas the client is in control of the activity, namely in-house, low level and specialist. When outsourcing maintenance is considered, then it is important to determine where responsibility lies for the performance of the assets. The client must not only be able to define the maintenance requirements for the productive assets, but also be able to relate maintenance effectiveness to asset performance if control of the activity remains with the client

Should control of maintenance be passed to the contractor, then responsibility for asset performance should also be passed on together with appropriate financial responsibilities. It is at this point that parallels can be drawn with building maintenance as part of office facilities management, where the

contractor has full control over spending to ensure performance standards are met, with the client merely being a user of the services provided. However, when one considers production plant, then the client has a major impact on performance of the plant as invariably they carry out first line maintenance, and operator care has a major impact on plant serviceability. How can the maintenance provider be responsible for asset performance when bad operating practice or failure to carry out first line maintenance can adversely affect asset performance?

The financial implications of outsourcing maintenance are also far reaching. With maintenance generally being viewed as an operating activity carrying a budget, only revenue costs are monitored against the maintenance activity. Budgets are prepared on a historical basis, covering routine work together with an allowance for failures. The budget is "controlled" by treating high cost, large failures as capital investment, thereby giving a false picture of maintenance costs. In the case of building services maintenance, all financial control can lay with the contractor, but in the case of production plant, how much say can a contractor have in capital investment on the plant. It is vital that the full financial picture, revenue and capital, together with the financial roles and responsibilities is understood before consideration is given to outsourcing. Failure to invest is one of the major reasons for poor performance and high maintenance costs!

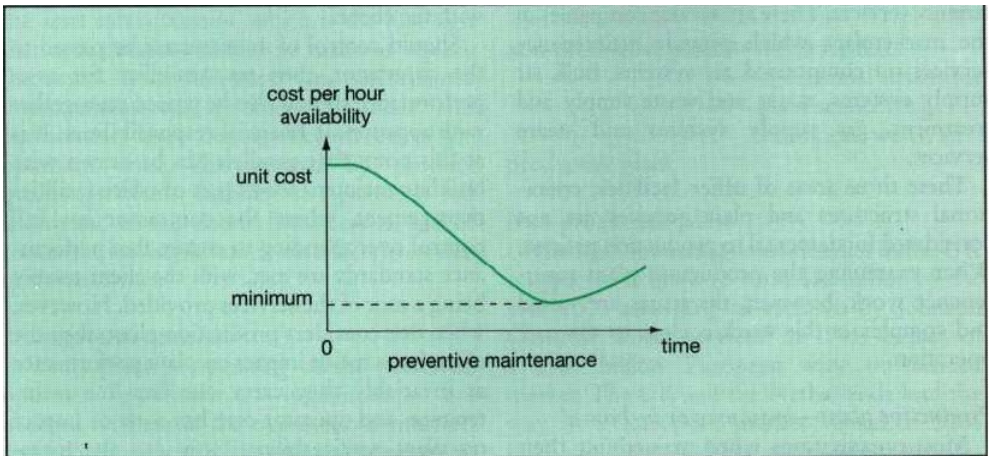
Performance Measures

What measures should be used when analysing maintenance performance? Quality, quantity and cost are measures which spring immediately to mind. Quality measures for maintenance usually relate to the response time to execute work requests together with time taken to return plant to service. Coupled with the timeliness for carrying out planned and preventative maintenance, quality measures reflect how well maintenance responds to the production function's needs. Quantity, or volume measures, indicate how hard the maintenance provider is working in delivering the maintenance service. Cost measures must examine both revenue and capital costs to ensure the benefits of capital expenditure are being reflected in reduced maintenance revenue costs. However, efficient maintenance is about making cost effective decisions every time work is carried out, and an overall effectiveness measure is needed. In Fig (4) maintenance effectiveness can be defined as

"the appropriate combination of preventative and repair work to deliver the lowest units costs in terms of operating cost/hour divided by plant availability".

Too little preventative maintenance delivers a breakdown philosophy, with high unit costs. As more preventative maintenance is carried out, the optimum point is reached before the effect of overmaintaining with its associated labour costs and reduced availability once again causes unit costs to rise. The optimum balance of preventative and repair work changes throughout the life of an asset, and to achieve this, a balanced approach in the application of maintenance techniques should be adopted. In the case of critical process plant with no standby, RCM and condition monitoring would be appropriate, right through to a breakdown philosophy for low cost low risk items where it is cheaper to replace than refurbish. There should be a review of the maintenance strategy when major changes of operational philosophy due to, for example, capital investment or
plant refurbishment taking place to ensure that the minimum unit cost is continuously being sought. Identifying the appropriate effectiveness measure will ensure lowest unit costs are met.

Figure 4 Preventive maintenance cost profile



Before considering maintenance for outsourcing, the current maintenance performance in terms of quality, quantity, cost and effectiveness must be understood and quantified to form a benchmark against which the future service can be measured.

Co-operative Relationships

The continuing low profile of maintenance as a profession has also led to a skill shortage, and organisations with operational problems have been unable to attract high calibre maintenance experts to resolve their issues. Facilities management companies are seen as centres of excellence providing an attractive alternative to the traditional in-house approach. But if you don't understand the subject, are concerned about loss of control, are aware that needs and requirements will change, and are worried about the financial implications, what do you do?

The client must have the confidence that the contractor is working in his best interests— not an easy concept to grasp

Most organisations would turn to an independent maintenance expert to write a specification for their maintenance requirement for contractors to tender against. They will be specific in terms of the immediate maintenance requirements and what is expected of the contractor with regard to quality, quantity and cost measures, but specifications cannot cover the changing needs of the plant, financial responsibilities and maintenance effectiveness. If outsourcing is the only option open to the client, and the contractor is to take full responsibility for the maintenance activity, then the client/contractor relationship has to be built on mutual trust and understanding. Specificiations and tendering are not the order of the day in this working relationship. The client must have the confidence that the contractor is working in his best interests; not an easy concept to grasp in a business environment of driving down costs and overheads. Partnering contracts have been used over recent years between client and contractor to enable non-core activities to be outsourced, but in the case of maintenance, where there are significant interdependancies, a much fuller and deeper relationship requires developing. You cannot write a specification for this type of relationship, as the requirements of both the client and contractor continuously change. There must be incentives for the contractor to maximise effectiveness and achieve the optimum lowest unit cost for the client, and the client must accept that the contractor knows best and not dictate the terms of the arrangement.

To achieve this working relationship, specifications are replaced by a defined way in which the client and contractor will work together to the mutual benefit of both parties creating a win-win situation. Ownership is taken jointly of those areas where responsibility cannot be assigned to one party or the other. Typically this would cover financial issues, performance measures and investment decisions, and in the true spirit of co-operation, any criticism of one party by the other is taken constructively to further develop the understanding. Most important of all, the relationship must be on a long term basis which will create the proper environment for developing co-operation and trust.

The Initiative Market

The area where outsourcing has taken place recently has been a reflection on how closely linked the maintenance activity is to the operational user. In the case of Railtrack,[4] who formed twelve regional infrastructure maintenance companies before selling to civil engineering groups such as Amey, Amec, Balfour Beatty, Jarvis, Tarmac and GEC Alsthom, responsibility for performance of the asset, the track itself, lies with the contracting companies, with performance measures based on track geometry and timeliness of track maintenance.

Rover Group[3] are testing the outsourcing concept with Drake and Skull Technical Services on a much more tentative basis at Swindon. Rover's four main sites at Longbridge, Solihull, Cowley and Swindon operate as independent business units, yet the treatment of the maintenance function is not consistent between the sites. Some see maintenance as part of a separate Manufacturing and Site Services function whereas others see the Maintenance/Site Services function as part of the manufacturing operation.

Although the five year facilities management contract is valued at £2.78m per annum, Keith Day, Commodity Manager, with Rover Group Purchasing, says "If outsourcing

proves to be a business benefit to the Group, then there is no reason why Longbridge won't do it. However, they've still got to be convinced, and that will take another one or two years." Could it be that the difference in the philosophy of where maintenance fits in the organisation is the reason why Swindon is following the outsourcing route and Longbridge not?

One thing that both Railtrack and Rover have in common, however, is the recognition that successfully outsourced maintenance activities can only be delivered through strong partnering arrangements and co-operative relationships.

Conclusion

Dr Michael Cross in his 1988 paper[1] "Raising the Value of Maintenance in the Corporate Environment", concluded that

> "There remains an urgent need for the strategic importance of maintenance to be recognised".

Sadly, there is less understanding of maintenance today in the corporate world than there was in the late eighties. Technological development has brought increased reliability engendering a reactive maintenance strategy in most organisations. However, when things go wrong technological development has brought increased sophistication requiring multiskilled engineers to solve process problems.

The corporate profile of maintenance continues to be raised only when major failures take place. Too many failures, and maintenance is considered to be out of control and external experts brought in to sort it out, yet when no failures are brought to corporate notice then maintenance is considered to be a peripheral activity and therefore not core to the organisation's needs. With today's focus on operating costs and reducing manpower numbers, this has further placed maintenance as a target for outsourcing, with facilities management companies looking to enter the plant maintenance market. However, with an inability to define requirements, no understanding of the relationship between capital and revenue expenditure, no appropriate performance measures or benchmarking in place, and a failure to determine responsibility for asset performance, there has been a noticeable hesitation by organisations to move to full outsourcing.

There is a market for outsourcing maintenance, but as part of a balanced approach to asset management, involving "in house" process knowledge, skilled labour supply for low level maintenance, specialist equipment maintenance and totally managed maintenance contracts. Experience shows that[1]

> "the extensive use of contractors has not yielded the cost or performance benefits sought", Cross (1988).

Success will only be achieved through establishing long-term co-operative relationships, not through specifying and tendering as experienced in the 1980s

This has largely been due to a lack of understanding of the maintenance activity, and outsourcing it for the wrong reasons. However, with skill shortages there is no choice for some organisations other than to consider outsourcing the whole of the maintenance activity, but success will only be achieved through establishing long term co-operative relationships, and not through specifying and tendering as experienced in the 1980's. Relationship management is therefore a key part of an organisation's maintenance strategy and it must be considered whether maintenance is carried out internally or externally.

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