Contracting out maintenance and a plan for future research

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Contracting out maintenance and a plan for future research

Contracting out
maintenance and
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Introduction

Contracting out or outsourcing of business activities has been a well established practice for quite some time. As the complexity of the products and production processes increased, the strategy of managing a production process from basic rough material resource to sophisticated products became a less viable option. The need to concentrate on the core production process in order to maximize the talents that exist within an organization and to make use of other complementary talents from other organizations has led to supply-chain production structures. This so-called horizontal contracting out phenomenon has been, and still is, the focal point of attention in the scientific logistics management community. The contracts between business partners and the supply-chain management problems are far from simple, but at least they are concentrated on just a few well-defined characteristic parameters of the products that are being exchanged and the length of the supply chain. In recent years, vertical contracting out has received increased attention in practice and in the scientific community. Vertical contracting concerns the outsourcing of activities that facilitate the production function within an organization. For example, financial administration (factoring), personnel management and maintenance are all facilitative functions that are candidates for contracting out.

In this paper we shall concentrate on exploring some viable options of contracting out of maintenance activities and on the consequences for the maintenance management function on the contractor's side. Since the research on which this paper is based is at an initial stage, the objective of this paper is to present a clear problem definition for research. First of all, we shall discuss the methodology used which led to the insights presented here. The first aspect of discussion is the motivation for vertical contracting out and how this motivation can be translated into suitable types of contracts for both contractors and their clients. Then, the different types of maintenance contracts will be discussed in view of the type of client-contractor relationship that has to be built and with respect to the maintenance management problems that have to be solved by both parties. In the last part of this paper we shall focus on

The author wishes to thank GTI GCO, HCG and STORK Industrial Services for their input to this research. The contractors operate mainly in the industrial sector and they are at home in a wide range of technologies and industrial sectors.

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defining research on the maintenance management problems of the contractor. Finally, a conclusion will be drawn on what relevant research issues need to be addressed to make contracting out of maintenance a solid and manageable process.

Research methodology

The findings on which this paper is based are a result of five MSc research projects carried out in actual contractor companies (GTI GCO and STORK Industrial Services) in co-operation with their clients. The objectives of these projects were:

- to determine performance indicators for a maintenance contractor[1];
- to identify what maintenance contracts could be offered to potential clients[2];
- in case more than one contract is feasible, to determine which contracts are most profitable, both for the client and the contractor, and to determine a path in which the client-contractor relationship could be developed further[3];
- to evaluate the contractor's control methods, available resources and organizational structure to meet (new) contract requirements[4,5].

In addition, several thorough discussions were held during the periods in which these projects were supervised with the contractors. Although the results of each research project are confidential and they therefore cannot be discussed here in detail, the overall research approach was design-oriented. In these projects the internal planning and control logic and the contract management function were analysed for improvement. Potential room for improvement was measured via performance indicators such as client satisfaction (technical system availability, budget compliance, etc.) and client potential (client motivation, client openness, available budget, etc.) as well as an analysis of current procedures with respect to inconsistencies and omissions. In each study it was concluded that current procedures and the organization had to be thoroughly enhanced. The results of these studies were:

- (1) a set of performance indicators categorized in combinations of management level and type of client-contractor relationship;
- (2) a framework for the operation of semi-autonomous task groups of maintenance workers with geographically dispersed clients;
- (3) guidelines for building semi-autonomous task groups and how they are managed;
- (4) a method to establish performance contracts (see also the section on types of maintenance contacts);
- (5) a procedure to analyse potential clients with respect to the best possible initial contract and to estimate the client's potential for growth in joint activities.

The outcome of the first three was generally approved by management, but testing was not possible at that time, because of the time constraints attached to an MSc project of eight months. The outcome of 4 and 5 reached testing stage, i.e. an initial performance contract was made for air-conditioning facilities in a clean room environment and a client intake procedure was applied for an existing client (in retrospect) and a new client.

The following discussion on contract management highlights the problems to be solved as they were identified during these MSc research projects. The research projects described above were case studies and therefore the remarks and ideas in this paper can be regarded as the results of a survey.

Motivation for outsourcing maintenance activities

For organizations which have an internal maintenance function, outsourcing of maintenance activities is common practice (see EUT maintenance model[6]). Statistics will be collected on maintenance activities if either: the available maintenance capacity is insufficient to meet peak demand (short-term contracting out); or the expected volume is too small and the randomness of the maintenance related to a particular skill too large to justify at least one professional on standby (strategic contracting out).

Owing to the economical depression of the late 1980s many companies were triggered to reconsider their outsourcing strategy. This resulted into what is called “concentration on the core activities”[7]. In particular management focused on the possibilities for vertical contracting out. Now, sufficient motivation exists to reconsider the justification of having a complete internal maintenance function. The key considerations for management to contract out maintenance activities are:

- Small maintenance departments cannot operate economically, i.e. the scale of operation is too small.
- Technological advancements, increased safety and environmental legislation in production processes necessitate an ever increasing need to train the maintenance workforce. Thus, maintenance is getting more costly and requires more management attention.
- An increase in operational flexibility may be achieved via contracting out[8]. The speed at which markets change is growing, creating a necessity for companies to change their mode of operation accordingly. More specialized contractors are able to change more quickly than large internal departments. The basic idea behind this assumption is that the complexity of changing an organization is much smaller if more professional and talented contractors can operate more or less independently on a narrower scope. Instead of managing a process of change for all company activities in detail, a client can now concentrate on updating the contract with a contractor. The contractor is responsible for the management of his own processes.

- Depending on the type of contract, financial flexibility of a client company can be increased. A contractor can offer a wide range of options all of which are based on financial constructs such as taking over client technical systems (TSs), exchanging shares of ownership, payment of contractor services depending on the client's primary output, etc.

It goes without saying that a contractor is motivated to offer maintenance services because it is his primary source of income. But new opportunities may arise if he is able to sell added value by taking over parts of clients' business risks and other (financial) burdens. In this way a contractor can diversify his "product" range and may be able to achieve a higher profit.

At this stage, research is needed to predict how the maintenance contracting market will evolve, in particular with respect to new types of maintenance contracts. Some major contractors in The Netherlands have high expectations of the potential of new contract types that exceed simple body shopping.

Contracting out

Contracting out of maintenance in general

Traditionally, the area of contracting out has received much attention from accounting and legal experts (e.g.[9]) and occasionally from specialized application areas such as the outsourcing of information system services[10]. Although the financial and legal aspects are outside the scope of this paper, a few general remarks will be summarized here.

The complexity and therefore the risks of a contract largely depend on three aspects:

- (1) the possibility of defining the service formally (what product is to be offered);
- (2) the possibility of defining the legal consequences of non-compliance with the promised service (legal liability);
- (3) the degree to which mutual trust can be built for all those aspects which are not covered by a formal contract[11].

Types of maintenance contracts

In the first paragraph we stated that maintenance contractors are very interested in developing new types of contracts promising a higher profitability for the contractor and an increased flexibility and lower maintenance costs for their clients. In this section we shall discuss the main types of contract a contractor can offer. The terminology used to identify these types of contract may be different from the jargon individual contractor companies use to promote their contract offerings. However, despite different naming conventions, so far no essential differences in opinion have been found which could obstruct the general categorization of contract types.

In Figure 1 three distinct contract types are shown. We shall discuss all three of them subsequently.

Figure 1.
Three basic types of
maintenance contract

Work package contract. A work package contract represents the most basic type of contract. Clients perform all planning and control logic themselves, i.e. clients tell the contractors when they have to do what maintenance activities. The complexity in this relationship remains entirely on the client's side. The contract is rather simple because it states what activities have to be carried out and when. Usually, payment of contractor services is based on unit rate or lump sum. On a client's request for work, the contractor checks the current availability for the requested capacity and, if availability is sufficient, will allocate the requested capacity. If, however, availability is insufficient, the client may be forced to reschedule the planned activities, or alternatively, may find a different contractor with comparable capabilities. In this situation, provided that a sufficient number of contractors with comparable capabilities exist, a maintenance client can afford a loose relationship with contractors and concentrate on the short-term selection of the most economical contractors. A close binding between contractor and client may not be needed. This contracting out policy only requires that maintenance activities are well defined, such as shutdown assistance, preventive maintenance, low urgency repairs, etc. The client has full control over the design of the maintenance concepts[8], planning and control and spare parts management. The contractor adds skilled manpower and/or tools to the client's maintenance process.

Performance contract. In a performance contract a contractor guarantees a certain availability of TSs owned by the client. The contractor receives payment via a budget provided by the client. The complexity of this type of contract can be large, because the responsibilities of all aspects concerning the modes of operation of the TSs by the client and the maintenance carried out by the contractor have to be explicitly separated between both parties. Preliminary studies in this field[2,4] demonstrate that defining all circumstances that influence the availability and utilization of TSs formally can be extremely time consuming and requires an almost perfect technological knowledge base in order to be complete. Any irregular aspect has to be formally taken up into the

contract. The budget a contractor receives has to be evaluated regularly together with the client to correct for unforeseen circumstances which caused maintenance cost increases which have to be paid by the client. In particular these unforeseen circumstances necessitate a formal meeting regularly between contractor and client to decide how matters will be solved. In addition, a contractor has to prove that he complies with the mutually agreed performance levels. This means that in order to be able to measure availability, several input and output streams of TSs have to be measured. Depending on the nature of these streams, more or less costly measuring devices have to be installed.

In general, we may conclude that a performance contract inflicts additional costs to maintain such a contract, because of the formal measurement of relevant physical properties related to the functioning of TSs and the arbitration that is required. Typically, contractors are in charge of the design of the maintenance concepts and the planning and control of the maintenance activities of the TSs that are contracted to them. The client concentrates on the definition of the performance statements associated with the TSs which have been contracted out. Sometimes contractors have to get approval for the maintenance concept they wish to use by the client. Given the level of effort that is required in most cases to establish a performance contract, and the level of mutual trust that has to be built over time, this type of contract is only feasible if both client and contractor work together for a longer period of time (at least 15 to 30 years).

Facilitator contract. In a facilitator contract the client is predominantly a user of TSs. The contractor is owner and maintainer of the TSs. Clients only pay for the time they wish to make use of the TSs and/or the number of products they are going to produce with the TS. The complexity of this contract compared with a performance contract is largely reduced because most of the management logic – i.e. purchasing of TSs, engineering of TSs, all functions listed in the EUT maintenance model except for the adaptation of use feedback and the operation intensity generated by clients – are all the responsibility of the contractor. Usually, clients have to agree with operating instructions provided by the contractor/owner of the TSs before they can make use of them. In turn the client only pays for the actual use of the TS. For many clients a facilitator contract provides an increase in financial flexibility. In practice, there are many examples of facilitator contracts. Perhaps a facilitator contract is better known by the term lease contract. Many manufacturers of professional office equipment such as photocopiers have a long tradition in offering lease contracts. Because of the general applicability of such TSs a lease contract may not require a long-term investment in building partnerships between contractor/owner and their clients. Both clients and contractors can change business partners quickly as they see fit. However, TSs owned by contractors which are constructed to suit the operating needs of a particular individual client, change the situation entirely. In this situation, the financial investment of a contractor can only be justified if the client agrees with a certain minimum period of use in which both parties are bound together by a facilitator contract.

Except for the full ownership of the TSs by the contractor, the primary difference with the other types of contracts is that the contractor accepts some risk that the client may go out of business prematurely. It goes without saying that the facilitator contract requires a maximum of mutual trust and openness with respect to sharing information and, possibly, making strategic business decisions jointly. A successful contractor must have an outstanding reputation as a reliable business partner with sufficient financial resources to back up risks involved with facilitator contracts.

The types of contract which have been discussed in the previous section are extremes on a more continuous scale. Contractors may develop different contract options for different sets of TSs, skills involved and the financial risks on the contractor's and client's side. In particular the facilitator contract offers sheer limitless possibilities in financial constructs to make this type of contract attractive to both sides.

Research areas

The contractor as the problem owner. Except for the work package type of maintenance contract, the contractor is the party which has to develop suitable offerings to attract potential clients. The performance of a contractor may depend for the most part on the scale of operation in comparison with other parties offering maintenance services. Formalizing the advantages of maintenance scale effects into maintenance contract offerings can only be carried out by the contractors themselves. Therefore, we shall concentrate for the remainder of this paper on the research issues on the contractor's side.

Contracting out maintenance: a market in transition. Apart from the competition of other contractors offering similar types of contract, most competition can be expected from internal maintenance departments in client companies. Nowadays, it is common practice for a contractor to take over all of, or at least a substantial part of, the client's internal maintenance department. In doing so a contractor quickly gets the resources potentially to benefit from scaled up operation. But, on the down side, with each maintenance department, new and different work ethics, operational procedures, information systems, etc. are internalized as well. Streamlining these originally different maintenance organizations into a well-co-ordinated company represents a problem area in its own right. However, as the contractor market matures the number of maintenance department take-overs may decrease. Until then, benefiting from operating on a larger scale will be difficult to achieve.

Contractor's capabilities. One of the strategic issues which must be researched has to do with the determination of what capabilities the contractor must have in-house. Apart from the financial and legal aspects in a maintenance contract, the issue of internal capabilities boils down to the choice of a set of combinations of skills and types of TSs that set the outline for any type of contract. Skills should be interpreted in a broad sense, i.e. talent and knowledge to design and manage maintenance contracts are included. The choices to be made have a close correlation with the financial attractiveness of

certain types of client. In doing so, contractors in fact define the scale of operation by targeting only their definition of the maintenance market. We will refer to this process of selecting clients as portfolio management of contracts.

Portfolio management of contracts. Depending on the types of contract that are offered, portfolio management may involve decision making on a strategic level (facilitator contracts) and on lower management levels, such as operational management levels for work package contracts. For work package type of contracts, portfolio management depends very much on the actual availability of skills. Essentially, portfolio management comes down to workload levelling. From a scientific point of view, performance and facilitator contracts are much more interesting. Even after consulting a potential client, insufficient information may prevent the making of decisions. Moreover, it is unclear how a client should be analysed in order to select a suitable type of maintenance contract and what risks are involved. In addition, if eventually a contract has been established, how can contracts be extended, or alternatively, how can they be terminated before severe losses are inflicted?

Contractor's management

In this section we shall concentrate on three dominating aspects of the contractor's management in relation to the issues presented in the previous sections and the findings of case studies carried out so far[1-5].

- (1) achieving scale of operation;
- (2) assessment of potential clients;
- (3) design of the contractor's maintenance function.

Achieving scale of operations. In the previous section it was suggested that achieving scale of operation is crucial in portfolio management. It should be emphasized that scale of operation is a relative parameter, i.e. at best the effectiveness and efficiency of a contractor's maintenance can only be compared with the effectiveness and efficiency of other alternatives (competitor contractors, the client maintenance department). Depending on the actual situations, maintenance management can benefit considerably from scale effects. For example, it is well known that in many maintenance situations failure-based maintenance rules may constitute a substantial part of the workload. Failures occur randomly and require a high degree of flexibility in case these failures require urgent repair. Real flexibility can only be achieved with some excess capacity, which is usually not a very economical option. If, however, one could operate on larger scale, i.e. "the law of large numbers" would suggest that the variation in workload requirements in relation to the mean workload (the variation coefficient) can improve. As a result, more flexibility is achieved without sacrificing the utilization rate of the available capacity. In the area of spare parts management beneficial effects can be achieved through operating on a larger scale as well. On a small scale, demand for spare parts may be variable, imposing high safety stocks. If, however, other clients with

identical TSs can be found to join their spare parts management, demand may be much less variable and easier and cheaper reordering policies can be used[12].

The examples shown here, although basically correct, oversimplify the problem of “up-scaling” operations. It may not be correct to assume automatically that the “up-scaling” benefits will always continue to increase. At some point, increasing scale may be counter-productive. Further research is necessary in order to determine suitable methods to predict the potential scale benefits in relation to a selected portfolio.

Assessment of potential clients. In order to achieve scale benefits a careful selection of potential clients is needed. The price of a contract and/or the profit a contractor can make depends on the contribution a client can make to the increase of scale on the contractor’s side. In short, the greater the contribution to the contractor’s scale of operation, the more likely it is that the contractor will be rewarded with a contract. To assess the client’s scale contribution, at least some detailed information on the maintenance demand, in terms of capacity requirements and spare parts demand per unit of time and the degree of predictability of both factors, is required by the contractor.

Apart from the lack of sound scale assessment methods outlined in the previous section, the openness by the client and the availability of relevant information may be limited as well, e.g. a potential client may have no formal maintenance history information or a sound maintenance concept for all important TSs may not yet have been designed.

A contractor has different options to respond to the unavailability of information. One option would be to offer a maintenance contract with a high price to compensate for (financial) risks. Another option would be to install proper data collection systems and, possibly, first design maintenance concepts for the potential clients via consultancy. The latter option will involve some kind of development of the client maintenance procedures and practice, in time, and also preparing suitable maintenance contracts as the client reaches certain milestones in maturity, e.g. at first only work package contracts handed out by the client may be acceptable for a contractor. Later, if proper maintenance concepts have been designed and installed, a more predictable maintenance demand may be a good reason to upgrade from a simple work package contract to a performance contract. Further research in this area is needed.

Conclusion

In this paper several interesting research issues have been discussed from an industrial engineering point of view. Since more and more clients are becoming interested in contracting out maintenance, contractors take great interest in solving current problem areas. It is clear that the issues of selecting suitable maintenance contracts, determination of contractor capabilities, contract portfolio management, the assessment of potential clients and scale effects and the design of a contractor’s maintenance function are all very much related to one another. It is also clear that different scientific disciplines such as

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management accounting, operations management, computer science and sociotechnology all need to be involved at different stages. Most of all, owing to the complexity with which these research aspects interact, there will need to be an active contribution by clients and contractors to serve as a test bed and platform for observation.

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